Revised Final Remedial Investigation Work Plan

Yakima Mill Site (aka Boise Cascade Mill Site)

805 North 7th Street
Yakima, WA 98901

Agreed Order No. DE 13959
Facility Site ID 450
Cleanup Site ID 12095

Prepared for
OfficeMax Incorporated
LeeLynn, Inc. & Wiley Mt., Inc.
Yakima Resources, LLC
Dunollie Enterprises, LLC

January 2019

Version 1.0

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Certification

I hereby certify that this plan, document, or report was prepared by me or under my direct supervision and that I am a duly Licensed Professional Geologist/Hydrogeologist under the laws of the state of Washington.

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January 3, 2019

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Date

Acronyms

Acronym	Description
AOC	Area of Concern
AST	Above Ground Storage Tank
ASTM	American Society for Testing and Materials
bgs	Below Ground Surface
BTEX	Benzene, Toluene, Ethylbenzene, and Xylenes
CLARC	Cleanup Levels and Risk Calculation
COC	Contaminant of Concern
CSM	Conceptual Site Model
DEHP	bis(2-ethylhexyl)phthalate
DOE	Washington Department of Ecology (also Ecology)
EIM	Electronic Information Management
ESA	Environmental Site Assessment
FID	Flame Ionization Detector
GPS	Global Positioning System
HREC	Historical Recognized Environmental Condition
ICP	Investigation Contingency Plan
LEL	Lower Explosive Limit
LLM	Large Log Mill
MCL	EPA Maximum Contaminant Level
MSL	Mean Sea Level
MSW	Municipal Solid Waste
MTCA	Model Toxics Control Act
MW	Monitoring Well
NFA	No Further Action
PAHs	Polycyclic Aromatic Hydrocarbons
PCBs	Polychlorinated Biphenyls
PHASP	Project Health and Safety Plan
PID	Photoionization Detector
PPE	Personal Protective Equipment
ppm	Parts Per Million
PVC	Polyvinyl Chloride
QAPP	Quality Assurance Project Plan
REC	Recognized Environmental Condition
RI	Remedial Investigation
SAP	Sampling and Analysis Plan
SIM	Selected Ion Monitoring
SLM	Small Log Mill
SOP	Standard Operating Procedure

Acronym	Description
SVOCs	Semi-Volatile Organic Compounds
TCLP	Toxic Characteristic Leaching Procedure
TDS	Total Dissolved Solids
TOC	Total Organic Carbon
TP	Test Pit
TPH	Total Petroleum Hydrocarbons
UEL	Upper Explosive Limit
USGS	United States Geological Survey
UST	Underground Storage Tank
VC	Vinyl chloride
VOC	Volatile Organic Compound
WAC	Washington Administrative Code

1.0 Introduction

This Remedial Investigation (RI) Work Plan has been prepared on behalf of OfficeMax Incorporated, LeeLynn, Inc. & Wiley Mt., Inc., Yakima Resources, LLC, and Dunollie Enterprises, LLC (OfficeMax/Owners) by Barr Engineering Co. (Barr) and Fulcrum Environmental Consulting, Inc. (Fulcrum) to describe the RI activities that will be conducted at the Yakima Mill Site (also known as the Boise Cascade Mill Site), generally located at 805 North 7th Street, Yakima, WA, 98901 (Site; Figure 1).

Operations at the Yakima Mill Site date back to the early 1900s and are discussed in detail in Section 2.3 and in Appendix B1. It is believed that at least some of the Site was used for sawmill operations by Cascade Lumber Company as early as 1903. Cascade Lumber merged with Boise Payette Lumber Company to form Boise Cascade Corporation. In 2004, Boise Cascade Corporation sold all but one of the parcels on the Site to LeeLynn, Inc. and Wiley Mt., Inc., the current owners, and simultaneously leased the remaining parcel to Yakima Resources, LLC. Dunollie Enterprises, LLC has operated on the Site since the sale and lease in 2004. In 2004, Boise Cascade Corporation changed its corporate name to OfficeMax Incorporated. The saw mills ceased operations in 2005; the plywood plant ceased operations in 2006 and the log storage ceased in 2009.

Releases of hazardous substances, including petroleum products, have been documented in certain discrete locations (subsites) at the Site. A 2008 Phase II investigation identified petroleum constituents above Model Toxics Control Act (MTCA) cleanup levels in soil in a test pit placed east of the large log sawmill. The same investigation showed petroleum constituents above MTCA Method A cleanup levels in samples of soil collected near a former equipment fueling station east of the log yard shop and in soils in the northeast corner of the former plywood plant in the southern portion of the Site. A 2013 Phase II investigation also showed petroleum constituents in soil and groundwater above MTCA Method A cleanup levels near the northeast corner of the former plywood plant. These investigations also documented elevated methane concentrations in soil gas on the southern portion of the Site, south of the Columbia Basin Railroad (CBR) tracks that cross the Site in an east-west direction. Groundwater monitoring has shown concentrations of manganese, iron, and arsenic above the respective MTCA Method A cleanup levels or EPA secondary MCL in the shallow groundwater. Much of the northern portion of the Site has not been investigated thoroughly. Based on historic use, there may have been other releases at the Site.

Based on the results of the 2008 and 2013 investigations, the Washington State Department of Ecology (Ecology) determined that a release or threatened release of hazardous substances had occurred at the Site. OfficeMax/Owners were named potential liable persons and entered into an Agreed Order (AO; No DE 13959) with Ecology. The Yakima Mill Site is identified by Ecology as Facility Site ID 450 and Cleanup ID 12095.

Section VII of the AO (Work to Be Performed) requires OfficeMax/Owners to prepare an RI Work Plan, conduct the RI and prepare an RI Report, conduct a Feasibility Study (FS) and prepare a FS Report, and prepare a draft Cleanup Action Plan (DCAP), all in a manner that complies with MTCA. This RI Work Plan has been prepared to satisfy Part VII.A of the AO in accordance with Washington Administrative Code (WAC) 173-340-350 requirements.

A Draft RI Work Plan, including a Draft Sampling and Analysis Plan (SAP) and a Draft Quality Assurance Project Plan (QAPP), was submitted to Ecology on May 5, 2017. Comments from Ecology on the Draft RI Work Plan and the Draft SAP were received on July 27, 2017 and comments from Ecology on the Draft QAPP were received on August 7, 2017. OfficeMax/Owners provided preliminary responses to the Ecology comments in a letter dated September 20, 2017 and a meeting was held with Ecology representatives to discuss the responses to the comments on September 22, 2017. OfficeMax/Owners and Ecology held a series of conference calls to work through Ecology's comments. The agreed upon approach to resolving all of Ecology's comments was reflected in the Final RI Work Plan and supporting documents that were furnished to Ecology on December 21, 2017. Ecology's comments to the Draft RI Work Plan, SAP, and QAPP and OfficeMax/Owners' final responses to the comments developed in consultation with Ecology were provided in Appendix A to the December Final RI Work Plan.

Comments from Ecology on the December 2017 Final RI Work Plan, SAP, and QAPP were received by email on July 13, 2017 and by US mail on July 19, 2018. OfficeMax/Owners provided proposed responses to the Ecology comments on August 17, 2018. OfficeMax/Owners and Ecology held a series of conference calls to work through Ecology's comments. The agreed upon approach to resolving all of Ecology's comments was furnished to Ecology on September 17, 2018, and was reflected in the Revised Final RI Work Plan and supporting documents that were submitted to Ecology on September 17, 2018. Ecology's comments to the December 2017 Final RI Work Plan, SAP, and QAPP and OfficeMax/Owners' final responses to the comments developed in consultation with Ecology were provided in Appendix A to the September 2018 Revised Final RI Work Plan.

Comments from Ecology on the September 2018 Revised Final RI Work Plan, SAP, and QAPP were received by email on October 12, 2018 and by US mail on October 18, 2018. OfficeMax/Owners provided proposed responses to the Ecology comments on October 25, 2018. OfficeMax/Owners and Ecology held a series of conference calls and email exchanges to work through responses to Ecology's comments. The agreed upon approach to resolving all of Ecology's comments is reflected in this January 2019 Revised Final RI Work Plan and supporting documents. Ecology's comments to the September 2018 Revised Final RI Work Plan, SAP, and QAPP and OfficeMax/Owners' responses to the comments developed in consultation with Ecology are provided in Appendix A to this January 2019 Revised Final RI Work Plan.

The Site location and boundary are generally shown on Figure 1. The Site is further defined by the extent of contamination caused by releases of hazardous substances at the Site, which, based on facts known as of the effective date of the AO, is exclusive of any area 1) where municipal waste has come to be located or 2) which is affected by a release or threatened release of hazardous substances from the municipal solid waste.

A Sampling and Analysis Plan (SAP; Exhibit A), a Quality Assurance Project Plan (QAPP; Exhibit B), and a Project Health and Safety Plan (PHASP; Exhibit C) describing the RI organization, quality assurance/quality control protocols, investigation methods, sampling program, health and safety protocols and other details of the RI have been prepared and are exhibits to this Work Plan. The RI activities described in this Work Plan will be performed in accordance with the SAP, QAPP, and PHASP. These documents are being submitted to Ecology for review and approval.

1.1 Purpose

In accordance with their obligations under the AO, OfficeMax/Owners are conducting this RI to provide for the collection of sufficient information to determine the nature and extent of contamination that has resulted from the releases of hazardous substances, including petroleum products, at the Site. As set forth in WAC 173-340-350, the purpose of the RI/FS is to collect, develop, and evaluate sufficient information regarding the Site to select a cleanup action under WAC 173-340-360 through 173-340-390. The results of this and prior investigations and the extensive Site use information will be used to assess the potential risks to human health and the environment posed by identified releases at the Site, and where appropriate, to evaluate and develop remediation strategies.

1.2 Work Plan Organization

In addition to this Introduction, the RI Work Plan includes the following sections:

- Section 2: Site Description – describes the location, physical setting, and operational history at the Site.
- Section 3: Prior Investigations and Known Environmental Site Conditions – summarizes the scope and results from previous environmental investigations that have been conducted at the Site in chronological order and describes the current understanding of environmental site conditions based on the previous investigations and the operational history of the Site.
- Section 4: Preliminary Conceptual Site Model – presents the preliminary conceptual site model (CSM) for the Site including potential or known releases of hazardous substances, types of hazardous substances, potentially impacted media, and potential exposure pathways and receptors at the Site.
- Section 5: Data Gap Analysis – defines the process that was used to identify potentially significant data gaps in the CSM for the Site, identifies the existing data gaps and each identified AOC that will be investigated in the RI to fill the identified data gaps, and describes the approach that will be used to investigate each AOC in Stage 1 of the RI including COCs applicable to each AOC.
- Section 6: Remedial Investigation Activities – describes the soil, groundwater, surface water, pond bottom material, and soil gas sampling activities that will be completed in Stage 1 of the RI to close data gaps in soil, groundwater, surface water, pond bottom, and soil gas at the Site as described in Section 5, by referring to the details set forth in the SAP, QAPP, and PHASP in Exhibits A, B, and C to this Work Plan. A Stage 2 of the RI will be completed if needed to close any remaining data gaps consistent with the purpose of the RI described in Section 1.1.

- Section 7: Risk Screening Evaluation – describes the human health and ecological risk assessment methods and screening levels that will be used to interpret the information on the Site from previous investigations and this RI.
- Section 8: Reporting and Schedule – describes the RI Report that will be prepared per MTCA and AO requirements, the interim report and Stage 2 RI scope of work that will be prepared if necessary, and the schedule for completion of significant RI tasks in accordance with the AO.
- Section 9: References – provides a list of references cited in the Work Plan.
- Three Exhibits containing the Sampling and Analysis Plan (SAP), Quality Assurance Project Plan (QAPP) and the Project Health and Safety Plan (PHASP).
- Several appendices presenting information supporting the scope of the RI Work Plan and information provided at the direction of Ecology.

The following hierarchy of documents will be used on the project:

- The SAP will be the primary document for all field procedures.
- The QAPP will be the primary document for all laboratory procedures, data QA/QC, and data validation.

The RI Work Plan is intended to be an overview document with detail provided in the SAP and the QAPP.

2.0 Site Description

The Site is located in Yakima, Washington, west of Interstate 82 (Figure 1) in Range 19 Township 13 Sections 7 and 18. The Site, as generally shown in the Agreed Order, is approximately 171 acres in size and is comprised of 16 parcels (Figure 2). LeeLynn, Inc. and Wiley Mt., Inc. are the current owners of 15 of the 16 parcels (Parcel Nos.: 12001, 21003, 22411, 23421, 23427, 24001, 24402, 24419, 24420, 31453, 31539, 42001, 42401, 42404, and 43539) and OfficeMax Incorporated, successor to Boise Cascade Corporation, owns Parcel No. 41001.

Use of the term “Site” throughout this Revised Final RI Work Plan and supporting documents is meant to encompass the term “Site” (or “Facility”) as defined under MTCA, which includes "any building, structure, installation . . . ; or any site or area where a hazardous substance, other than a consumer product in consumer use, has been deposited, stored, disposed of, or placed, or otherwise come to be located." WAC 173-340-200.

The closed City of Yakima landfill (Landfill Site) is located south of the Site and is present on portions of parcels 42001 and 41001 (Figure 2). The Site is distinct and separate from the Landfill Site, recognized by Ecology as the Interstate 82 Exit 33A Yakima City Landfill, Facility Site ID 1927 and Cleanup Site ID 4618. The Landfill Site has been investigated under the Voluntary Cleanup Program by the City of Yakima and is being further investigated under an Agreed Order between the Washington Department of Ecology and the City of Yakima. The Landfill Site is not addressed by activities in this RI Work Plan.

2.1 Physical Setting

The physical setting of the Site in terms of climate, topography, regional geology, regional hydrogeology, and surface water is described in the following paragraphs.

2.1.1 Climate

The climate is semi-arid with cool winters and hot/dry summers. The average daily maximum temperature at the Site ranges from 36 to 88 degrees Fahrenheit and the average annual precipitation is 8.4 inches (NOAA, 2016).

2.1.2 Topography

Site topography is generally level and varies from approximately 1,080 feet mean sea level (MSL) in the northwestern portion of the Site to approximately 1,050 feet MSL in the southeastern corner (Figure 3).

2.1.3 Regional Geology

The Site is located in the Yakima valley. The regional geology consists of Miocene basalt flows of the Columbian River Basalt Group overlain by the Ellensburg Formation, which is overlain by mostly Holocene alluvial deposits resulting from the adjacent Yakima River. Geologic information for the Site comes from the *Geologic Map of the Yakima Quadrangle, Washington* (Bentley, 1983) and the logs from nearby wells.

The basalt is present at a depth of approximately 1,850 feet below ground surface (bgs), based on the drilling log from an onsite well completed in 1927. The Ellensburg formation (based on a drilling log located within ¼ mile of the Site) was observed as a clayey shale and sandstone, capped with a cemented gravel, beginning at a depth of 44 feet bgs (Landau, 1998).

The alluvial deposits are characterized as coarse grained sand, gravel, and cobbles, underlain in many places by silty sand, sandy silt, or clay (Landau, 2013). Fill at the Site generally overlays the native alluvial deposits and is described as imported rock, soil, and wood debris from former operations on the Site.

2.1.4 Regional Hydrogeology

The hydrogeologic units of the Yakima region can be split into the following two categories (Vaccaro, et al., 2009):

- Basin-Fill Units (including unconsolidated alluvial deposits and semi-consolidated to consolidated units of the Ellensburg Formation)
- Columbia River Basalt Group and interbedded units

The lithology and hydraulic characteristics of the basin-fill units are diverse and groundwater levels generally follow land surface contours. Groundwater generally flows towards the Yakima River in the shallow basin-fill units at the Site. The flow in the deeper units is controlled primarily by characteristics of the unit itself and the overlying units. Flowing artesian conditions exist in the Yakima basin where groundwater is present under confined conditions, described as “aerially extensive productive artesian zones.” There is evidence that the on-Site deep well was a flowing artesian well from a depth of about 700 feet bgs when it was constructed.

2.1.5 Surface Water

The Site is located to the west of the Yakima River, approximately 4,000 feet down-river from the confluence with the Naches River. The Site is approximately at river-mile (RM) 114.5. The United States Geological Survey (USGS; Vaccaro, 2011) completed an evaluation of exchanges between groundwater and surface water in the Yakima River in this reach of the river. The USGS evaluated data from four flow measurement surveys (July 1988, July 2004, September 2005, and March 2006) in the reach from RM 116.7 to RM 107.3. The results from the July 1988, July 2004, and September 2005 surveys indicate that the Yakima River was gaining a small amount of flow (less than 1 percent of the discharge at RM 107.3) between RM 116.7 and RM 107.3. The USGS noted that data from September 2005 showed the river losing a small amount of flow between RM 116.7 and RM 113.2 and gaining a small amount of flow between RM 113.2 and RM 107.3. The results from the March 2006 survey indicated that the Yakima River lost flow equal to approximately 11 percent of the discharge at RM 107.3 from RM 116.7 to RM 107.3. These differences in the river losing and gaining flow did not seem to be related to river stage. USGS did hypothesize that the differences in discharge measurements at the upstream and downstream locations on the reach may be less than the potential errors in the measurements. Given the potential uncertainties in the measurements described by the USGS, no firm conclusions should be drawn regarding the nature of the interaction between the river and groundwater in the river reach evaluated by the USGS (Vaccaro, 2011).

Available information including groundwater surface contours and geologic cross sections (see Figures 5 and 6) showing groundwater elevations near the river and river stage levels from Landau (2015) indicates that groundwater from the southwestern portion of the Mill Site flows through the Landfill Site and discharges to the Yakima River southeast of the Landfill Site. Available groundwater contours indicate that groundwater in the northeastern portion of the Mill Site flows toward the river and does not pass through the Landfill Site. Groundwater leaving the Mill Site will either enter the wetlands and ponds between the Site and the river, will enter the river (river gaining), or will flow parallel to the river and mix with river seepage (river losing), before likely entering the river further downstream. Whether the Yakima River is gaining or losing flow in the reach near the Site will be investigated in the RI using River stage gages and groundwater level measurements. Groundwater conditions across the Site will be evaluated during the course of performing the RI and will be described in the RI Report. Likewise, the relationship between groundwater and surface water on the Mill Site and, as appropriate and consistent with MTCA, east of the Mill Site, will be investigated in the RI.

A surface water ditch known as the “North First Lateral Drain” is located along a northeasterly arc south of the areas known as the pasture and the former wood waste landfill in the northern portion of the Site. The North First Lateral Drain enters the Mill Site near the intersection of North 4th Street and E “N” Street near the northwest boundary of the Site. The North First Lateral Drain runs as shown on Figure 3 and discharges into a siphon-type culvert beneath the gravel road near the north extent of the Mill Site. Water in this culvert outfalls into the former river water intake. Water in the river water intake and the North First Lateral Drain then flows over a small concrete dam/spillway (appearing to have existed for many years) and easterly, beneath Interstate 82, then southerly and parallel to the Interstate before reaching a pond east of the Interstate.

The North First Lateral Drain is the outfall of the Old Union Canal and the North First Lateral irrigation systems that serve an area of predominately residential properties between North 4th and North 6th Street, northeast of the Mill Site. The irrigation water for the Drain originates from the Naches River through the Old Union Canal. The North First Lateral Drain is present in aerial photographs by 1991 but likely dates to the late 1890s.

A second ditch is located on the Site, originating east of the north kiln pond area and extending in a northeast direction towards the river water intake and then turning south along the eastern boundary of the former north log deck towards the recycle pond. This ditch is referred to in mill records as the “spring diversion ditch” and it is hypothesized that it was constructed to drain a wet area that occurred in the mill area near the north log deck. This ditch enters a culvert located north of the recycle pond and extends east beneath Interstate 82. The location of the spring diversion ditch is shown on Figure 3. More detailed information about this ditch is in the History of Surface Water Features memorandum in Appendix B1.

The Fruitvale Wasteway enters the Mill Site from the west near the intersection of North 7th Street and East "H" Street. The Wasteway is in an underground culvert (except for one small section on the Site) and has a general alignment east-southeast across the Mill Site and Landfill Site, outletting into a small ponding area near the northeast corner of the former plywood log deck south of the CBR tracks. This is shown on Figure 3. The Wasteway continues in a culvert from this small ponding area beneath the asphalt roadway and south as a ditch along the western toe of the Interstate 82 embankment before entering a culvert and continuing to the east near the southeast corner of the Landfill Site. Markings on the shoulder of Interstate 82 indicate that two buried pipes are located beneath the Interstate in a northwesterly to southeasterly direction from near the southeast corner of the Landfill Site. These two culverts are connected to two flood gates on the west bank of the Yakima River, approximately 800 feet downstream of the Sunrise Rotary Park/McGuire Community Playground.

The Fruitvale Wasteway is the outfall of the Fruitvale irrigation system. The Old Union Canal irrigation system is also connected to the Fruitvale Wasteway. The Fruitvale irrigation system receives water from the Naches River through the Fruitvale Canal. The Fruitvale Wasteway has also been referred to as the PP&L Ditch, the Old Union Ditch, and the Irrigation Culvert. The orientation of the Fruitvale Wasteway across the Site has changed over time, but the outfall location has remained constant.

Surface water features on the Site included a number of "constructed ponds" (kiln, settling, recycling, equalization) that were used during portions of mill operations. Three of the ponds (north and south kiln ponds and the equalization pond) have been filled since mill operations ceased. While the recycle pond appears to have discharged off of the Site in the past, the discharge was reportedly stopped at least by 1997. There is no evidence that the settling pond ever discharged off Site. Water levels in the remaining ponds (recycle pond and settling pond) are likely expressions of the groundwater table. While the ponds are hydraulically connected to groundwater, there is no evidence showing that the ponds have adversely impacted groundwater quality, based on the results from the analysis of monitoring well samples collected immediately downgradient of these two ponds. The remaining ponds do not discharge to off-site surface water now. More detail on the history of the surface water features on the Site is provided in Section 2.3 and Appendix B1.

2.1.6 Site Geology and Hydrogeology

Near-surface unconsolidated materials at the Site consist of fill and native silt, sand, gravel, and cobbles. Fill is primarily composed of log yard materials, soil that was excavated to create large log ponds in the early years of Site operations and then used as backfill when the log ponds were filled (see description in Appendix B1), imported rock used to complete the filling of the north log pond prior to 1994, concrete debris, and perhaps some imported soil fill are present at the ground surface over much of the Site, with variable thicknesses depending on historical operations on the Site. Native soils consist of either the Ashue loam, Zillah silt loam, or Weirman fine sandy loam (USDA, 2016). Native soils are generally coarse-grained sand and gravel with lesser amounts of fine-grained silt and clay. Virtually all of the native soils on the Site have either been covered or otherwise disturbed by the 100+ year operating history at the Site.

Groundwater is first encountered within the unconsolidated materials at depths ranging from approximately 5 feet to 20 feet bgs, with the variation in depth attributable to the groundwater gradient to the southeast and to variability in Site topography. Groundwater monitoring completed at the Site since 1997 indicates that groundwater flow is from the west-northwest to the east-southeast toward the Yakima River with a gradient ranging between 0.003 and 0.007 feet/foot (Landau, 2015). Local variability in hydraulic conductivity may influence the localized groundwater flow pattern; however, coarse grained material is present throughout the Site, which likely minimizes the influence of localized variations in hydraulic conductivity on flow direction.

The near surface groundwater aquifer on the Site is not used for potable supply, or any other application and no drinking water supply wells are located in this aquifer on the Site or downgradient of the Site. It is considered unlikely that future drinking water supply wells in this aquifer will be located on the Site or in areas downgradient of the Site. The Site is not in a wellhead protection area. Private wells used for potable purposes are reportedly located in the neighborhood to the west of the Site. The depth and construction of these wells is unknown. The wells are located upgradient of the Site and are not likely to be affected by activities on the Site. The potential for connectivity between impacted groundwater on the Site and the potable wells west of the Site will be investigated in the RI. Groundwater likely enters a number of surface water features on the Site including the North First Lateral Drain near the north boundary of the Site, the spring diversion ditch in the center portion of the Site north of the CBR tracks and the two remaining former operational ponds on the Site.

Groundwater from the Site would most likely enter the North First Lateral Drain from the so-called "pasture area" in the far northwest corner of the Site and from the potential wood waste remnant area on the north boundary of the Site. The groundwater to surface water pathway will be applicable to groundwater on the eastern boundary of the Site entering the water features located east of Interstate 82 including the Yakima River.

2.2 Land Use

The Site is currently used for storage, vehicle and equipment maintenance, and log yard material recovery.

Covered and secure storage at the Site is limited to the former lumber shed. The shed consists of two areas, a private secured storage area for recreational vehicles, boats, and automobiles; and a second secured storage area currently leased to a federal agency for evidence storage. Covered and unsecured storage sheds are primarily used for vehicles and trailers.

Log yard materials on the Site have been excavated, loaded into dump trucks, washed and sorted on the Site, and then sold for a variety of uses. Water from the onsite deep well has been used for log yard material processing. Excess water from the log yard material processing was released to the ground near the spring diversion ditch, but water is no longer being used in the log yard material processing operations.

The Site is zoned for "Regional Development," which is a commercial and high density residential zoning designation. As described in the Yakima City Code, "The purpose of the regional development district is to provide high visibility from the interstate and state highways of the city of Yakima to provide regional commerce, office campus, recreation, large-scale retail, cultural, and large multiple mixed uses. This district is characterized by very intensive development and a variety of land uses including retail sales and service establishments, high-density residential development, financial institutions, professional office buildings, hotels, condominiums, and corporation headquarters."

A restrictive covenant has been recorded against the majority of the land at the Site. The covenant limits Site use to commercial or industrial activities and specifically excludes residential use. Accordingly, high-density residential development, which is allowed under the Regional Development zoning, is not allowed under the covenant.

Future use of the Site is expected to be consistent with current zoning and with the restrictive covenant (i.e., the Site is expected to be redeveloped for regional commercial, retail and service uses).

2.3 Site Operational History

Historical resources, public records, historical aerial photographs, previous reports, and local background information indicate that the Site operated as a sawmill and lumber manufacturing facility from the early 1900s until mill operations ceased in 2006 and all logs were removed by 2009. Sash and door manufacturing and fruit box manufacturing reportedly also occurred on the Site between 1909 and 1967. Records indicate that Boise Cascade operated two sawmills and a plywood plant, which included kiln buildings, a boiler house, large log deck areas, and other support buildings from when it assumed ownership in the 1950s until the facility was sold to the Owners in 2004. The Owners continued to operate the mill until the sawmills were closed in 2005 and the plywood plant was closed in 2006. Since then, the sale, salvage, and demolition of buildings and equipment, and the recovery and sale of log yard materials has been ongoing.

The history of mill operations with an emphasis on the surface water features used in operations is summarized in Appendix B1. This history was developed at the request of Ecology following their review of the May 2017 Draft RI Work Plan.

The original mill site was developed with Yakima River access for the delivery of logs originating from forests along the Yakima and Naches Rivers. Logs were floated down the rivers and directed through an intake into log ponds on the mill property. From the log ponds, the logs were pulled into the sawmill on a log way. Log ponds within the Site were used to manage log transportation and storage, resulting in the generation of log pond bottoms consisting of bark, sunken logs, and general deposition. Records indicate that sunken logs and other settled materials were removed from the log ponds about every three to five years.

Historical maps and aerial photographs from 1920, 1950, and 1952 show large ponds on the property, encompassing approximately 60 percent of the property north of the CBR tracks. Sanborn Fire Insurance

Maps indicate the presence of log ponds located in the north and east portions of the Site and south of the CBR tracks. The log pond north of the railroad is shown as separated by dikes or rail spurs. The log pond occupied the area of the Site north of the CBR tracks through at least 1956. Over time, delivery of logs using the river was replaced with delivery by rail and truck. From the 1940s until about 1994, the log ponds were used but gradually reduced in size in favor of log deck storage with the logs sprinkled with recycled water in the warm summer months to minimize the risk of fire and to prepare the logs for the sawmills. As reported in the URS 2003 Phase I ESA (URS, 2003), a 1969 memorandum from the Water Pollution Control Commission obtained during an Ecology file review states that the north log pond had been reduced from approximately 40 acres to approximately six acres.

A 1984 "Site Plan, Wood Products Complex" provides a layout of the log pond and waterways at the property. A log pond of five to six acres is shown near the center of the Site east of the sawmills receiving water from the river water intake through a ditch. Overflow from that log pond was released both north and south. The water released to the north flowed through a concrete pipe to the recycle pond and then was either used for log deck sprinkling or discharged to the east toward the Yakima River. Water released from the log pond to the south traveled through a buried concrete pipe to a pond with a log deck sprinkler pump that also intercepted the Fruitvale Wasteway. At that time, the Fruitvale Wasteway crossed the Site from west to east, both in open ditch and buried pipe and joined with other ditches near the southeast Site boundary along Interstate 82 before discharging to the east toward the Yakima River. As described previously, the Fruitvale Wasteway is now entirely in a culvert across the Site except at one short section.

Records show that the final approximately six-acre pond was closed in 1994. Per a 1997 Ecology memo, the pond was filled with rock and gravel. An interview of William Howard, the logging manager at the mill, verified that the small log pond formerly located east of the sawmills was filled in 1994, primarily with basalt rock quarried from an area near Naches (URS, 2003). It is considered likely that the other portions of the north pond were filled with materials that had been excavated to build the pond in the early years of mill operations.

Through a series of continual improvements, log deck sprinkler water that ran off the logs was collected and returned to the recycle pond and settling pond before being reused in the sprinkler system. In 1997 or before, release of water from the recycle pond into the Yakima River ceased and all sprinkler water was captured and recycled for onsite use, or was lost through infiltration to groundwater or evaporation. This system operated until log yard operations ceased in 2009. Since 2004, log yard material recovery has occurred. More details are in Appendix B1.

At the conclusion of mill operations in 2006, five small ponds were in use as a part of the mill's water reuse system. The five operational ponds were the south kiln pond, the north kiln pond, the recycle pond, the settling pond, and the equalization pond (adjacent to the plywood plant). The locations of these ponds are shown on Figure 3.

Historical records indicate that the south kiln pond functioned as a sediment trap that received wet scrubber water and periodic impervious surface wash down water. Scrubber water discharged to the south kiln pond originated as overflow from the exhaust scrubber on Boiler No. 5 in the boiler house. Boiler No. 5 was installed by Munstead-Woolford in the 1960s. Exhaust from the boiler was passed through a "scrubber water" spray system. The fan driven exhaust went up the exhaust stack and a series of water sprays was used to remove particulates from the exhaust. Spray water fell to the bottom of the stack and into a reservoir. A chain driven bar scrape moved material up an incline from the bottom of the reservoir and dumped the ash into a bin located adjacent to the scrubber. Water, containing some ash, overflowed from the scrubber equipment to the ground surface and flowed into a grated drain that carried the water to the north and into the south kiln pond. Ash in the scrubber water settled out in the south kiln pond.

While washing of impervious surfaces likely occurred, it was not a common practice. The facility consisted of buildings and asphalt, concrete, and gravel covered areas. The log yards were generally exposed logs and log yard material (mainly bark and chips) with working areas covered with rock, gravel, concrete, asphalt, and other materials. A street sweeper was used at the facility and generally focused on areas of tractor trailer traffic and other areas with heavy vehicle traffic. Application of water to other areas of the Site was principally for dust control purposes and not for washing down surfaces.

Records indicate that the north kiln pond received overflow water from the south kiln pond by a connecting culvert and also received steam condensate and condensate from the wood drying in the adjacent kilns.

The recycle pond was reportedly used in various ways during the history of operations. Documentation indicates that, at one time, the pond incorporated water from the river water intake, surface water return flow (excess sprinkling water and precipitation runoff) from the north log deck and water that traveled from the kiln ponds through a ditch. More recent documentation indicates that the recycle pond was primarily used for surface return flow from the north log deck sprinkling system with no kiln pond or river water intake inflow. While the recycle pond once discharged off the Site to the east, this discharge was reportedly stopped by at least 1997.

The settling pond was used as part of the log deck water sprinkling recycling system. There is no documentation that the settling pond discharged off the Site. Large pumps were used in the recycle and settling ponds to distribute water through above ground piping into the log deck sprinkling system to keep the logs wet in the warm summer months.

The equalization pond, located immediately south of the plywood plant, received steam condensate from the plywood plant, wash water from the plywood plant veneer dryers, blowdown water from the electrostatic precipitator, adhesive system wash water from the plywood plant, wash water from within the plywood plant, and stormwater from surrounding asphalt paved areas. Water from the equalization pond was discharged under permit to the City of Yakima's sanitary sewer system. Discharge water from the equalization pond to the City's sanitary sewer system was sampled on a quarterly basis with each sample consisting of a four sample composite from the outfall to the sewer (a concrete flume at the west end of the pond). Individual samples were analyzed for temperature, pH, and total suspended solids. The composite samples were analyzed for total suspended solids and five day biochemical oxygen demand by an accredited laboratory. Additional samples were analyzed for priority pollutants on a once per five-year permit cycle. Reports were provided to Ecology's Water Quality Program and are not available in Owners/ OfficeMax files.

A review of records indicates that a NPDES permit was first issued for the facility in or about 1983 by Ecology (permit WA-000141-4). With the renewal of the permit in 1997, state waste discharge permit ST-9204 was issued (effective December 1, 1997 to June 30, 2003). This permit contained four regulated discharges – two to the municipal sanitary sewer system (D001: Mill Site vehicle wash station/boiler blowdown and D002: outflow from the equalization pond) and two to infiltration (D003: Infiltration from the equalization pond and D004: Infiltration from the wet-log deck and the related north and south recycle ponds (aka recycle pond and settling pond, respectively, described in this RI Work Plan). Permit ST-9204 was canceled effective June 1, 2003, due to the delegation of the Federal Pretreatment Program to the City of Yakima. Permit ST-9230 was then issued for operations at the Site and was transferred by Boise Cascade to Frontier Resources, LLC on February 9, 2004, following sale of the facility. This permit was specific to the infiltration of the log deck sprinkling water and infiltration of water from the equalization pond and two "recycle ponds" (referred to in this RI Work Plan as the recycle pond and the settling pond). These were the D003 and D004 regulated discharges that were in permit ST-9204. Permit ST-9230 was closed in 2012.

Between approximately 1963 and 1970, municipal solid waste (MSW) was placed in the south log pond by the City of Yakima (Landau, 2013), on what is now referred to as the Landfill Site. The Landfill Site covers an area of approximately 33 acres (Figure 3). Following cessation of landfilling operations in 1970, the MSW was reportedly covered with a clay soil cap and the ground surface was raised with a mixture of fill soil and wood debris (Landau, 2015). The City of Yakima previously entered the Landfill Site into Ecology's Voluntary Cleanup Program to address environmental impacts resulting from the landfill and the Landfill Site will not be addressed by activities in this RI Work Plan.

A plywood plant was constructed at the Mill Site, south of the CBR tracks, in about 1960. In its review of the May 2017 Draft RI Work Plan, Ecology commented that "This Site was also used for manufacture of plywood; adhesives and solvents are used extensively in this process." Available information indicates that adhesives used in plywood manufacturing at the Site were limited to use of a phenol-formaldehyde, blood, and flour mixture in a formulation generally referred to as "phenol-formaldehyde adhesive." It is possible that the blood and flour were also used without the phenolic resin as a plywood adhesive. Use of phenol-formaldehyde adhesive and a blood/flour adhesive was limited to the plywood plant. No other engineered wood products (such as laminated beams, orientated strand board, particle board, etc.) were manufactured at the Site.

Records indicate that the materials used in the plywood plant adhesive(s) were limited to:

- Flour from ADM Milling Co.

- Type F Dried Blood from California Spray Dry Co.
- Sulfochem EHS (Sodium 2-Ethylhexyl Sulfate) from Chemron, a Lubrizol Company
- Caustic soda – 50% commercial grade from Dow Chemical Company
- GP 4445 Phenolic Plywood Resin (Formaldehyde) from Georgia-Pacific Resins, Inc.
- Spectra-Flo Red, a direct red dye, from ROTA PMC, Inc.

The phenolic plywood resin was reported to be less than 0.1% free formaldehyde. Material Safety Data Sheets (MSDSs) in use during 2005 for these materials are in Appendix C.

Solvents were not known to be used in the plywood manufacturing process including in the cleanup of spilled adhesive. During operations, adhesive spills were cleaned up using wood chips or clay absorbent (e.g., kitty litter) and then these materials were sent to the hog fuel pile for burning as allowed under the facility's air permit. Adhesive that dried or cured on the concrete surfaces could be removed only by physically chipping the adhesive off the concrete surface. Further, a limited literature review did not identify any solvents that would have been used to degrade the polymers created in the curing of the phenol-formaldehyde adhesive.

The Landau 2013 Phase I for the Site completed for the City of Yakima explains that a request was submitted to the Yakima Fire Department for records pertaining to fires, USTs, and hazardous materials storage, incidents, or spills at the subject and adjacent properties (see Landau 2013a, pg. 5-4). In response to this request, the Yakima Fire Department provided Landau with approximately 50 documents dating back to 2005. Records prior to 2005 were reportedly not available.

Landau describes the types of fires in the records provided by the Yakima Fire Department as follows:

- fires involving various types of equipment;
- a metal hopper fire;
- bark pile, mulch pile, wood chip, log pile, and log deck fires, including a large log deck fire in September 2009;
- fires at the plywood plant, SLM, boiler plant, and planer shed (planer shed fire in July 2010 that resulted in the loss of the building);
- a fire in a "pit adjacent to equipment and a concrete wall"

Landau did not identify any releases caused by the fires as a recognized environmental condition (REC) or an area of concern in the Landau 2013 Phase I ESA. However, data from the Stage 1 Remedial Investigation (e.g., high PAHs in the fire area[s]) may warrant sampling for additional fire-related contaminants in a Stage 2 Remedial Investigation.

3.0 Summary of Previous Investigations and Known Environmental Site Conditions

3.1 Previous Investigations

The Site has been the subject of numerous investigations that have involved site assessments and environmental sampling and analyses. Below is a summary of the investigations, underground storage tank (UST) removals (all known USTs have been removed from the Site) and other actions that have occurred on the Site. The focus of this section is on the results from previous investigations that indicated an exceedance of a MTCA cleanup level (Method A or B) and/or visible evidence of a potential release (i.e., visual staining in soils) and on results that were either non-detect or below the MTCA Method A or Method B cleanup levels. Figures are provided summarizing the results from the previous investigations that have been completed at the Site but are not intended to show every sample with every analytical result at every location. Releases of hazardous substances have been documented in certain discrete locations at the Site, which may be more properly referred to and managed as subsites or AOCs. The currently known environmental conditions on the Site are summarized in Section 3.2, based on the results of the previous investigations.

Unless otherwise noted, the investigation results described below were collected from the Site. To the extent that information collected as part of Landfill Site investigations is included, it is included for the limited purpose of preparing this RI Work Plan. As noted above, the Landfill Site is being addressed independently by the City of Yakima.

3.1.1 Underground Storage Tank Removal (PLSA, 1990)

In December 1989, one 20,000-gallon diesel UST, two 10,000-gallon diesel USTs, and one 10,000-gallon gasoline UST were removed by a licensed UST contractor. The locations of the USTs were not included in the report but were likely in the fueling area, between the former oil house and the above ground storage tank (AST) concrete pad, north of the CBR tracks (see Figure 20).

During the UST removals, soil was field screened for volatile organic compounds (VOCs) and soil with elevated headspace readings was excavated until there was no evidence of contamination based on field screening. Six soil samples were collected from the base of three of the UST excavations. Water samples were collected from two excavations where water was encountered. The report summarizing the removal of the USTs in 1989 states that water samples were collected from a depth of 15 feet from the excavations for tanks 3 and 4 and that the excavation for these two tanks extended to a depth of 17 feet (PLSA, 1990). The source of the water is not described; however, the report indicates that the water samples were collected from the excavation and not from a monitoring well. The excavation for tanks 1 and 2 extended to a depth of only 15 feet and no water was encountered.

Soil samples were analyzed for total petroleum hydrocarbons (TPH) and benzene, toluene, ethylbenzene, and xylene (BTEX) and the water samples were analyzed for TPH. All soil and groundwater sample results were below detection limits for all constituents.

Soil samples were analyzed for TPH using EPA SW-846 Modified Method 8015 with a detection limit of 10 mg/kg. Soil samples from below the gasoline tank were also analyzed for BTEX by EPA Method 8020 at a detection limit of 5 µg/kg. Analytical methods were consistent with Ecology regulations, Ecology guidance, and industry standards at the time of the investigation and provided detection limits below current cleanup levels in most cases. Groundwater samples were analyzed for TPH using EPA SW-846 modified Method 8015 with a detection limit of 10 mg/L. This detection limit is greater than the most restrictive MTCA Method A cleanup level (0.5 mg/L). The area of the USTs will be further investigated in the RI. The results from Barr's QA/QC review of the data collected in this investigation and a comparison between the detection limits used in this work and current MTCA Method A cleanup levels are in Appendix D1.

Contaminated soil was stockpiled on plastic sheeting for offsite disposal and the excavations were backfilled with clean soil. Approximately 2,000 cubic yards of soil was disposed of offsite on January 19, 1990 (Ecology, 2006). In 2006, a no further action (NFA) determination was made for the removal of the USTs and cleanup of the petroleum impacted soil at these four USTs and for an additional lubricating oil UST decommissioned in 1993 (CES, 1993; Ecology, 2006 – see 3.1.2).

3.1.2 Underground Storage Tank Removal (CES, 1993)

In November 1993, a 2,000-gallon lubricating oil UST located about 70 feet south of the small log sawmill was removed by a licensed UST contractor. The tank contained steam cylinder lubricating oil. It was reportedly installed in 1976 and was last used in 1986. The UST appeared to be in good condition and no evidence of a release (i.e., odors, sheen, etc.) was observed during removal. Three soil samples were collected from the base of the tank excavation and were analyzed for TPH (diesel, gasoline, heavy oil). All soil sample results were below detection limits for all constituents and the detection limits were all below current MTCA Method A unrestricted use cleanup levels. The results from Barr's QA/QC review of the data collected in this investigation and a comparison between the detection limits used in the analysis of the soil samples and current MTCA Method A cleanup levels are in Appendix D1.

This removal received a NFA determination as described above in Section 3.1.1.

3.1.3 Ethylene Glycol Release (CES, 1994)

During routine seasonal maintenance of the heating system in the spring/summer of 1993, a release of approximately 300-400 gallons of antifreeze (ethylene glycol) was discovered from corroded piping. After the release was discovered, the piping that ran from a small building that housed the heat exchanger to the small log sawmill was uncovered. The corroded piping and a previously unknown lubricating oil UST were also identified. This lubricating oil UST was located adjacent to the ethylene glycol piping and was removed as described in Section 3.1.2 above (CES, 1993) prior to investigating the ethylene glycol release.

In November 1993, four test pits were excavated to investigate the identified ethylene glycol release. Soil was screened at each location and no sheen or discoloration was observed. Soil samples were collected from each test pit and groundwater samples were collected from three test pits (utilities prevented one test pit from reaching groundwater). In addition, one surface water sample was collected from the adjacent log pond. Samples were analyzed for ethylene glycol. Ethylene glycol was not detected above the detection limit of 25 parts per million (ppm) in either the soil or water samples. The reporting limit for the soil samples is below the current MTCA cleanup level. The reporting limit for the groundwater sample is slightly greater (25 mg/L vs. 16 mg/L) than the present MTCA cleanup level. The results from Barr's QA/QC review of the data collected in this investigation and a comparison between the detection limits used in the analysis and current MTCA cleanup levels are in Appendix D1.

3.1.4 Phase I ESA (URS, 2003)

In 2003, on behalf of Boise Cascade Corporation, URS conducted a Phase I Environmental Site Assessment (ESA) of the Site and the Landfill Site in accordance with American Society for Testing and Materials (ASTM) Standard E 1527-00, "Standard Practice for Environmental Site Assessments: Phase I Environmental Site Assessment Process" to identify recognized environmental conditions (RECs). The Phase I ESA identified the Landfill Site and several areas on the Site as RECs. Other environmental conditions were also identified at the Site that URS concluded may or may not qualify as RECs. The environmental conditions identified during this 2003 Phase I ESA were considered as part of the 2013 Phase I ESA (Landau, 2013a) that is described in Section 3.1.8.

3.1.5 Closure of Wood Waste Landfill North of Site (2003-2005)

Boise Cascade operated a 5.7-acre wood waste landfill on the very northern portion of what was then the mill property. The landfill reportedly received wood waste, ash from the wood waste boiler, and other mill wastes. The landfill was never permitted. Use of the landfill ended in 1991. The landfill was closed by removing all wood waste and the property was sold for redevelopment.

The waste material was removed from the landfill in two stages. The first stage was completed in March-June 2003. Samples of native soil below the removed wastes were tested for petroleum hydrocarbons (gasoline, diesel, kerosene, heavy fuel oil, and lubricating oil), RCRA metals, polycyclic aromatic hydrocarbons (PAHs), and three phenolic compounds common to wood treating, although no wood treating had occurred at the mill. All constituents were either not detected or were below MTCA Method A soil cleanup levels. A closure letter for this portion of the cleanup was issued by the Yakima Health District, the jurisdictional authority, in September 2003 (Yakima Health District, 2003).

The second stage of wood waste removal occurred in late 2004. Samples of native soil from beneath the removed wood wastes were collected and again analyzed for petroleum hydrocarbons, RCRA metals, three phenolics, and PAHs. All samples were below applicable MTCA cleanup levels. Approval of site closure was received in June 2005 (Yakima Health District, 2005).

The results from the analysis of samples collected in 2003 and in 2004 are in Appendix E.

The Landau Phase I (Landau 2013a) and the Landau December 2, 2013 memo titled Background Information Acquisition and Review – Yakima Mill Site (Landau 2013c) identifies the possibility that a portion of the former wood waste landfill extends on to the northern portion of the Site.

3.1.6 Phase II ESA (Parametrix, 2008)

In 2008, Parametrix conducted a Phase II ESA for LeeLynn, Inc., & Wiley Mt., Inc. to evaluate environmental conditions at the Site. The Phase II ESA included sampling seven existing monitoring wells, (five on the Site and two on the Landfill Site), sampling surface water at the five former operational ponds, excavating 19 test pits, advancing nine soil borings, installing three soil gas probes to monitor for methane, and collecting nine surface soil samples. The sampling locations are shown on Figure 4 (soil) and Figure 5 (surface water and groundwater). Prior to the completion of borings or test pits, each area was evaluated by a private utility locating service. Geophysics were used to locate USTs that may have been remaining on the Site and none were found. A hazardous building materials survey was also conducted at the boiler house.

All soil samples collected from the soil borings, test pits, and surface soil sampling locations were analyzed for TPH. Many samples were also analyzed for VOCs, semi-volatile organic compounds (SVOCs), polychlorinated biphenyls (PCBs), and metals. Soil analytical results were compared to then current MTCA Method A, Method B, and Method C cleanup levels. Metal results were also compared to background concentrations for the Yakima Basin. The results from the analysis of the soil samples are shown on Figure 4 in terms of groups of potential contaminants and concentrations above and below current MTCA cleanup levels.

The results of this investigation were obtained by using analytical methods consistent with Ecology regulations, Ecology guidance, and industry standards at the time of the investigation and provided method reporting limits consistent with then current cleanup levels listed in the Parametrix Phase II report.

At the direction of Ecology following their review of the May 2017 Draft RI Work Plan, Barr completed a QA/QC review of the Parametrix data and prepared a comparison between the detection limits used in the investigation and current MTCA cleanup levels. This QA/QC review and the comparison between detection limits and current MTCA cleanup levels, which have been accepted by Ecology, are in Appendix D2. The detection limits for all soil analytes were typically below current MTCA cleanup levels with the exception of arsenic, which had a detection limit above the lowest MTCA cleanup level but below the commonly accepted background concentration, SVOCs in a few soil samples with elevated detection limits due to the need to dilute the samples to obtain valid results, and VOCs in one soil sample with elevated detection limits likely due to dilution. These elevated detection limits were greater than current MTCA cleanup levels. The detection limits for all groundwater analytes were at or below current MTCA cleanup levels with the exception of arsenic, several SVOCs and VOCs, and Aroclors. The following results were obtained from the analysis of the soil samples:

- *PCBs* – PCBs were not detected in any of the soil, groundwater, or surface water samples although detection limits for the water samples were above the lowest current MTCA cleanup level.
- *Metals* – The results from the comparison of soil metals results to MTCA cleanup levels is shown on Figure 4. Metals were not detected at concentrations above MTCA cleanup levels in any of the subsurface soil samples from the test pits and borings. Total chromium was detected in all surface

soil samples at concentrations below the MTCA Method A cleanup level for trivalent chromium. Five of the six surface samples were slightly above the MTCA Method A cleanup level for hexavalent chromium. However, laboratory analytical methods did not speciate between trivalent chromium and hexavalent chromium. Cadmium was detected slightly above the MTCA Method A cleanup level in one surface soil sample.

- *Visible petroleum impacts* – Visible evidence of petroleum impacts (staining and/or petroleum odor) was identified at a test pit completed east of the large log sawmill (TP-10 - Figure 4) and at another test pit, completed near the fuel dispenser west of the log yard shop (TP-12). Additional test pits were placed around these test pits (TP-18, 19, 20, around TP-10 and TP-21, 22 around TP-12). It was concluded that there was petroleum contamination (diesel and oil-range) in the soil near the water table within about a 60-foot radius of the test pit east of the large log sawmill (TP-10) and that petroleum soil contamination (diesel and gasoline-range) extended in an approximate 25-foot radius around the test pit west of the log yard shop fuel dispenser (TP-12). The specific source(s) of these impacts were not determined.

- *TPH* – TPH (primarily diesel and oil-range) exceeded MTCA Method A cleanup levels in seven of 31 subsurface soil samples collected from the borings and test pits and from one of nine surface soil samples. The comparison of the results to MTCA Method A cleanup levels is shown on Figure 4 and in Appendix D2. Gasoline range organics exceeded the MTCA Method A cleanup level in one test pit sample; benzene was not detected in this sample.

- *VOCs* – VOCs were below MTCA cleanup levels in all soil samples with the exception of a duplicate subsurface soil sample in which benzene was just above the detection limit but was not detected in the original sample and an assumed fly ash sample in which benzene was detected above the MTCA Method A cleanup level.

- *SVOCs* – PAHs were detected in two surface soil samples and in the fly ash sample above MTCA cleanup levels. No SVOCs (including PAHs) were detected at concentrations above MTCA cleanup levels in any of the subsurface soil samples collected from the test pits and soil borings or from the other surface soil samples although the detection limits in a few of the samples were elevated as described above.

Groundwater samples were collected from seven existing monitoring wells and analyzed for TPH (gasoline, diesel, and oil-range), VOCs, SVOCs, PCBs, and metals. Groundwater results were compared to MTCA Method A, Method B, and Method C cleanup levels and to the EPA’s Maximum Contaminant Levels (MCLs). The results from the comparison of the groundwater samples to current MTCA cleanup levels are shown on Figure 5 and in Appendix D2. PCBs were not detected in any of the samples although the detection limits were greater than the lowest current MTCA cleanup level. TPH and SVOCs were not detected in most samples and did not exceed then current MTCA cleanup levels in any of the samples although the detection limits of some SVOCs were greater than the lowest current MTCA cleanup levels as described above. Total iron and manganese concentrations exceeded the secondary MCLs in each well sample and dissolved iron and manganese exceeded the secondary MCLs in most of the well samples.

Parametrix pointed out that samples from upgradient wells MW-1 and MW-9A had high iron and manganese concentrations relative to the MCLs indicating that background groundwater is elevated with respect to these two metals. Dissolved iron and manganese concentrations were lower in samples from these two wells than from the other wells that were sampled. Secondary MCLs for iron and manganese are for aesthetics (taste and odor) and are not health risk based. Vinyl chloride (VC) concentrations exceeded the MTCA Method B carcinogenic cleanup level in groundwater samples from two wells (MW-7, MW-8) located on the Landfill Site. VC was not detected in any of the groundwater samples collected from monitoring wells located on the Site. Site groundwater is not used as a drinking water source nor is it contemplated for use as a drinking water source in the future. However, it is acknowledged that according to WAC 173-340-720(2), groundwater must be classified as potable unless the exceptions to potability can be demonstrated. It is further acknowledged that groundwater at the Site includes multiple separate aquifers, including near surface groundwater and deeper aquifers. The near surface aquifer will be evaluated during the RI because that is the aquifer most likely to be impacted by Mill Site conditions.

Surface water samples were collected from the five former operational ponds (equalization pond, recycle pond, settling pond, north kiln pond, and south kiln pond; Figure 3) within the Site. All samples were analyzed for TPH and metals. Selected samples were also analyzed for VOCs, SVOCs, and PCBs. Surface water results were compared to MTCA Method A, Method B, and Method C cleanup levels for surface water and groundwater and the EPA MCLs. Because MCLs do not apply to surface waters and the ponds do not serve as a drinking water source, the comparison to drinking water standards was performed for limited screening purposes only.

The comparison of the surface water sampling results to current MTCA cleanup levels is shown on Figure 5 and in Appendix D2. Concentrations were below surface water cleanup levels in all samples with the exception of one SVOC (bis(2-ethylhexyl)phthalate) (DEHP) in the sample from the south kiln pond. The DEHP concentration also exceeded the MCL. Phthalates are common lab contaminants and it is considered a possible false positive result although phthalates were not detected in the associated laboratory quality control samples. Ecology stated in comments to the May 2017 Draft RI Work Plan that phthalates are used in some adhesives, which could have been used in plywood manufacturing. Although historical Site records are not complete, there is no record that plywood adhesives containing phthalates were used at the facility (see section 2.3). TPH (diesel or oil-range) was detected above the MTCA Method A groundwater cleanup level in samples from four of the five ponds but silica gel cleanup was not used to remove organic-sourced hydrocarbons, potentially resulting in false positive values. Iron exceeded the secondary MCL in samples from all of the ponds and manganese exceeded the secondary MCL in all samples except the sample from the equalization pond. The pond bottom material or underlying soil was not sampled in the investigation. The equalization pond (located partially on the Landfill Site) and the north and south kiln ponds have been filled since the Parametrix Phase II was completed.

Methane surveys were conducted using five groundwater monitoring wells on the Site, two groundwater monitoring wells on the Landfill Site, and three new gas probes located on the Site. Three rounds of methane readings were collected in February and March 2008. Methane was detected in a gas probe located immediately north of the CBR tracks (GP-1) and in a gas probe on the east side of the plywood plant (GP-3). The detected methane concentrations exceeded the lower explosive limit (LEL) and often times exceeded the upper explosive limit (UEL) (5% and 15% by volume, respectively) at both locations. Methane was not detected at the other sampling locations on the Site.

3.1.7 Vinyl Chloride Groundwater Monitoring (Fulcrum, 2012)

In 2008 and 2009, Fulcrum completed an investigation of VC concentrations in samples from three monitoring wells (MW-7, MW-8, and MW-9A). The purpose of the investigation was to further evaluate conditions identified during the Parametrix 2008 investigation, which reported the presence of VC in samples from MW-7 and MW-8, located on the Landfill Site. MW-9A is located on the Mill Site approximately 500 feet upgradient of the Landfill Site. Groundwater samples collected during seven monitoring events in this investigation were below the MTCA Method A cleanup level for VC in all samples.

Fulcrum's samples were only analyzed for VC (by SIM) and not for other chlorinated VOCs. Very low vinyl chloride concentrations were detected in about one-half of the samples collected from wells MW-7 and MW-8 located downgradient of the Landfill Site. The highest detected concentration was 0.05 µg/L in a sample from well MW-7. The detection limit was 0.02 µg/L, which is below the lowest current MTCA cleanup level. No detectable vinyl chloride concentrations were measured in the seven samples collected from well MW-9A located on the Mill Site.

3.1.8 Phase I ESA (Landau, 2013a)

In 2013, Landau Associates conducted a Phase I ESA of the Site for the City of Yakima in accordance with ASTM E 1527-05, "Standard Practice for Environmental Site Assessments: Phase I Environmental Site Assessment Process." The purpose of the Phase I ESA was to identify RECs at the Site.

The Phase I ESA identified the following RECs:

- Poor housekeeping and chemical handling at the current Auto Maintenance Shop (former Natural Gas Boiler building)
- Staining and odors at the fueling area east of the current Auto Maintenance Shop
- Staining and drums of chemicals at the VAT Building
- Liquid with petroleum sheen and odor on the ground surface southeast of the former Plywood Barker Building at the Plywood Plant and staining on the floor of the building
- Two deep structures with liquid and petroleum staining on the walls in the northeast corner of the Plywood Plant
- Presence of MSW (at the Landfill Site) and the potential for methane generation near the Plywood Plant
- Presence of wood debris and the potential for methane generation

- Metals in groundwater
- Unknown fill in the log deck/pond areas
- Irrigation water ditch and former operational ponds

The following areas were not identified as RECs, but were considered potential environmental concerns:

- Former Wood Debris Landfill Remnant (possibility that a portion of the former wood waste landfill extends on to the northern portion of the Site)
- Former Log Yard Shop
- Former Fuel Dispensing Pumps and ASTs west of the Log Yard Shop
- Former Large Log Sawmill
- Former Small Log Sawmill
- Former Machine Shop
- Former Kiln Building
- Boiler House
- Former Boneyard
- Plywood Plant
- Triangular Parcel located north of the CBR railroad tracks, including the Former Oil House and Service Pit, Former Auto Repair Shop, Former Fuel Dispenser Pump Area, and Fuel ASTs

The former USTs on the Site were identified as a historical recognized environmental condition (HREC) but not as a REC.

3.1.9 Phase II Investigation (Landau, 2013b)

In 2013, Landau conducted a Phase II ESA for the City of Yakima to evaluate environmental conditions at the Plywood Plant and the so-called Triangular Parcel located north of the CBR tracks. The Phase II ESA included two stages of soil, groundwater, soil gas, and surface water sampling to define the extent and magnitude of identified releases in the study area. Investigation activities included sampling two existing monitoring wells, installing five new monitoring wells, advancing 53 soil borings, installing four temporary gas probes to monitor for methane, and collecting water samples from three areas of standing water. In addition, wood debris samples were collected to evaluate the potential for reuse. The sampling locations used in this investigation are shown on Figures 6 (soil), 7 (groundwater), and 8 (methane).

As directed by Ecology following Ecology's review of the May 2017 Draft RI Work Plan, Barr completed an EPA Level 2a QA/QC review of the soil and groundwater data collected in this investigation. This involved reviewing and confirming the QA/QC review that Landau completed as part of the 2015 investigation. The QA/QC review, including a comparison of detection limits used in the analyses with current MTCA cleanup levels, is in Appendix D3 and has been accepted by Ecology. The QA/QC review concluded that all data are valid as qualified in the data tables in Appendix D3. As described in Appendix D3, the PQLs for some analytes were above current MTCA cleanup levels. This occurred more frequently with the groundwater samples (primarily SVOCs and VOCs) than with the soil samples.

A total of 65 soil samples were collected from the soil borings and were analyzed for TPH (gasoline, diesel, and oil range), metals, and SVOCs including PAHs. Selected samples were also analyzed for VOCs, PCBs, and hexavalent chromium. The comparison of soil sample results to MTCA cleanup levels is shown on Figure 6 and in Appendix D3. Concentrations of all parameters were below the applicable MTCA cleanup levels in all soil samples, with the exception of TPH (diesel and/or oil range organics) at six locations in the vicinity of the plywood plant. These samples that exceeded MTCA cleanup levels for TPH were collected near the lathe pit within the plywood plant and in the barker building area. Evidence of free product was identified below a depth of 15 feet in two borings placed in the barker building area. Samples collected from borings completed in the former oil room and maintenance shop, the VAT building, the central portion of the plywood plant, and the equalization pond were all below MTCA cleanup levels. All of the soil samples collected from the Triangular Parcel (adjacent to the steam cleaner shed, fuel dispensers, ASTs, and oil house) were below MTCA cleanup levels for all parameters.

A total of 35 groundwater samples were collected from temporary, existing, and newly installed monitoring wells in this Phase II investigation. Groundwater samples were analyzed for TPH (gasoline, diesel, oil-range), VOCs, SVOCs (including PAHs), and metals. Selected samples were also analyzed for PCBs and hexavalent chromium. The comparison between the groundwater sample results and the current MTCA cleanup levels is shown on Figure 7 and in Appendix D3. SVOCs and PCBs did not exceed MTCA cleanup levels in any of the samples although the PQLs for some of the analytes were above the lowest MTCA cleanup levels. VC exceeded the MTCA Method B carcinogenic cleanup level in samples from two wells (MW-7, MW-8 – consistent with Parametrix results) on the Landfill Site but not from wells on the Site. Neither VC nor other chlorinated solvents were detected in any of the groundwater (or soil) samples collected in the vicinity of the plywood plant, with the exception of TCE, which was detected in samples from Wells MW-9A and MW-12 below the MTCA cleanup level. Well MW-9A is located upgradient of former operations at the Site and MW-12 is located east of the plywood plant, between the plywood plant and the barker building. As described previously, the detection limits for some of the groundwater VOC analytes were above the lowest applicable MTCA cleanup levels. Total iron, manganese, and arsenic concentrations exceeded their respective MTCA cleanup level or EPA secondary MCL in most groundwater samples. Approximately one-half of the groundwater samples had a pH less than the screening range of 6.5-8.5. TPH (diesel and/or oil-range) concentrations exceeded MTCA cleanup levels at seven of the 28 groundwater sampling locations near the plywood plant. These samples were collected from five borings around the lathe pit, one boring adjacent to the former barker building, and one from the equalization pond. TPH concentrations were below MTCA Method A cleanup levels in all seven of the groundwater samples collected on the Triangular Parcel (adjacent to the steam cleaning shed, fuel dispensers, ASTs, and oil house) and in the remaining 21 sampling locations in the vicinity of the plywood plant.

Methane surveys were conducted at four temporary sub-slab monitoring points (G-01, G-02, G-03, and G-04) beneath the southeast corner of the plywood plant. The locations of the methane sampling points and the highest measured methane reading at each sampling point are shown on Figure 8. The methane concentrations were greater than the LEL and UEL in samples from G-01, located in the southeastern portion of the plywood plant, approximately 150 feet from the current known extent of buried MSW at the Landfill Site. Methane concentrations at the other sampling locations were all either non-detect or below the LEL.

3.1.10 Background Information Acquisition and Review (Landau, 2013c)

Concurrent with their Phase I ESA, Landau prepared a technical memorandum that summarized the findings of the document review and the Phase I ESA and identified potential data gaps requiring further investigation. The following data gaps were identified:

- Former Wood Waste Landfill Remnant (possibility that a portion of the former wood waste landfill extends on to the northern portion of the Site)
- Former Log Yard Shop
- Former Fuel Dispensing Pumps and ASTs
- Former Large Log Sawmill
- Former Small Log Sawmill
- Former Machine Shop
- Former Log Ponds/Log Decks
- Former Kiln Building and Kiln Ponds
- Boiler House
- Former Boneyard
- Irrigation Ditch/Culvert (aka Fruitvale Wasteway)
- Recycle Pond
- Former Plywood Plant (oil room, lathe hydraulic oil room, lathe pit, sub-slab soil, equalization pond)
- Triangular Parcel (Oil House and Service Pit, Steam Cleaning Shed, Auto Repair Shop, Fuel Dispenser Pump)
- Groundwater
- Soil Gas/Methane

Some of the above data gaps were addressed in the Landau Phase II ESA of the Plywood Plant and the Triangular Parcel described in 3.1.9 (Landau, 2013b).

3.1.11 Arsenic Groundwater Monitoring (Fulcrum, 2014)

In 2012 and 2013, Fulcrum collected samples from existing monitoring wells to evaluate arsenic concentrations in the groundwater. Eight groundwater sampling events were conducted at MW-1, MW-5, MW-6, MW-7 (MW-7 is located on the Landfill Site), MW-9A, MW-10, MW-11, and MW-18. One groundwater sampling event was conducted at MW-12. Arsenic was detected in at least one sample from each of the monitoring wells, including upgradient wells MW-1 and MW-9A. Groundwater samples from MW-1, MW-7, MW-10, MW-11, MW-12, and MW-18 had arsenic concentrations that exceeded the MTCA Method A cleanup level of 5 µg/L.

3.1.12 Supplemental Remedial Investigation (Landau, 2015)

From September 2014 through June 2015, Landau conducted a supplemental Remedial Investigation for the City of Yakima to assess potential environmental impacts associated with the former City of Yakima landfill (Landfill Site). This investigation was a continuation of work by SLR International Corp. in 2009 and 2010. Although the objective of the supplemental remedial investigation was to assess environmental impacts associated with the landfill, soil, groundwater, and soil gas monitoring were completed on a portion of the Site as part of the supplemental investigation.

As directed by Ecology following Ecology’s review of the May 2017 Draft RI Work Plan, Barr completed an EPA Level 2a QA/QC review of the soil and groundwater data collected in this Supplemental RI. This QA/QC review involved a detailed review of the QA/QC review performed on the investigation data by Landau as part of the 2015 supplemental investigation. The results of Barr’s QA/QC review, including a comparison of investigation PQLs and current MTCA cleanup levels, is in Appendix D4 and has been accepted by Ecology. The QA/QC review concluded that the data are valid as qualified in Appendix D4. As described in Appendix D4, the PQLs for all soil analytes in the Landau 2015 supplemental investigation were less than the lowest applicable MTCA cleanup level, with the exception of two amines that had detection limits slightly greater than their cleanup level. The PQLs for several groundwater analytes (primarily SVOCs, VOC, and pesticides) were greater than the lowest applicable MTCA cleanup levels, primarily because SIM was not used to analyze the groundwater samples for SVOCs and VOCs.

Groundwater samples were collected from as many as 11 monitoring wells on the Site during six monitoring events between July 2013 and June 2015 and analyzed for metals (total and dissolved), TPH (gasoline, diesel, and oil-range), SVOCs including PAHs, fluoride, nitrate, nitrite, chloride, and sulfate. Samples from a subset of the wells were also analyzed for pesticides, PCBs, VOCs, alkalinity, bicarbonate, total organic carbon (TOC), total dissolved solids (TDS), and ammonia. These groundwater monitoring locations are shown on Figure 7.

The comparison between the groundwater sampling results and current MTCA cleanup levels is shown on Figure 7 and in Appendix D4. TPH (diesel and oil-range) and metals were the only constituents consistently detected in groundwater during this investigation. DEHP was detected at concentrations greater than the MTCA cleanup levels at MW-18 and FPP-MW-3. TCE concentrations in samples from MW-9A, upgradient of the plywood plant and other operations on the Site, were greater than the MTCA cleanup level. No other VOCs or SVOCs were detected at concentrations greater than the MTCA cleanup levels although the PQLs for some analytes were above the MTCA cleanup levels as described above.

TPH concentrations (diesel and oil range) were greater than MTCA Method A cleanup levels in samples from four of the six wells located near the plywood plant and barker building. TPH concentrations (diesel and/or oil range) were greater than MTCA Method A cleanup levels in samples from one of the two wells located on the Triangular Parcel north of the CBR tracks and downgradient of the fuel dispensers. TPH concentrations were below MTCA Method A cleanup levels in samples from three wells located north of the Landfill Site (downgradient/sidegradient of the Triangular Parcel and plywood plant/barker building). Gasoline range organics were not detected in any of the monitoring well samples collected on the Site. Many of the TPH sampling results showed significant variations in concentrations and in the laboratory description of diesel and oil range hydrocarbons from sampling event to sampling event. The extent of the elevated TPH concentrations did not extend to monitoring wells about 500 feet downgradient and within the Landfill Site.

Silica gel cleanup was observed to have a significant impact on the laboratory results for TPH (diesel and oil range organics) by reducing the suspended organics in the collected samples (i.e., samples with silica gel cleanup had lower concentrations than duplicate samples without cleanup). Previous sampling of groundwater reported total organic carbon as high as 430 mg/L at the Site.

Metal concentrations (iron, manganese, arsenic, and sodium) greater than the MTCA Method A or B cleanup levels for groundwater were measured in samples from 10 monitoring wells on the Site. Low pH and reducing conditions were measured in samples from the Site wells and the Landfill Site wells during this investigation. Landau hypothesized that area-wide reducing conditions resulting from the presence of wood debris and MSW contribute to the elevated dissolved metal concentrations in the groundwater.

Analyses for VC along with PCE, TCE, and DCE were included in Landau’s 2015 Supplemental RI, which included sampling of seven wells on the Mill Site over a period of four quarters of monitoring. VC, TCE, PCE, or DCE were not detected in any of these groundwater samples, including samples from wells MW-9A and MW-12. VC and other chlorinated solvents were also not detected in samples from wells MW-7 or MW-8 (on the Landfill Site) in Landau’s Supplemental RI.

Five soil samples were collected from two new monitoring wells and three new gas probes on the Site. These sampling locations are shown on Figure 6. The samples were analyzed for TPH (gasoline, diesel, and oil-range), metals, pesticides, fluoride, nitrate, nitrite, pH, PCBs, VOCs, and SVOCs including PAHs. The soil samples were analyzed for TPH (diesel and oil range) with and without silica gel cleanup. The comparison between sampling results and current MTCA cleanup levels or EPA secondary MCL is shown on Figure 6 and in Appendix D4. No TPH, fluoride, nitrate, nitrite, pH, PCBs, VOCs, or SVOCs including PAHs were detected above (or below in the case of pH) screening levels. No metals were detected above MTCA Method A or B standard cleanup levels in any of the samples. Two pesticides were detected at very low concentrations but above the screening level in one sample. The PQLs for all of these analyses were below the MTCA cleanup levels.

Samples were collected from 13 gas probes on the Site during the January and June 2015 monitoring events. These sampling locations and the methane results are shown on Figure 8. Methane concentrations exceeded the LEL in six gas probes located on the Site and within about 250 feet of buried MSW. Five out of the 26 samples also exceeded the UEL for methane.

3.1.13 Transportation Corridor Investigation (Landau, 2016)

In September and October 2016, Landau conducted a methane gas and geotechnical investigation for the City of Yakima within the proposed transportation corridor that would extend across the Site (Figures 3 and 9). The investigation included evaluating the extent of log yard materials, assessing the geotechnical properties of subsurface materials, sampling log yard materials, and installing/sampling landfill gas monitoring probes, all within the transportation corridor.

Approximately 30 test pits were placed on the portion of the roadway alignment that is on the Site. The test pits showed log yard materials (aka wood debris) from the ground surface or near the ground surface to the surface of the groundwater at a depth of about 18 feet along the road alignment south of the CBR right-of-way to the south Site boundary. Subsurface materials along the road alignment north of the railroad are a mixture of sand, gravel, and some buried log yard material from the ground surface to the groundwater surface. Petroleum odor and staining were reported at a shallow depth (1.5 to 2 feet bgs) at two of the test pits – one near the former log yard shop and the second near the former sawmills. No odor or visible evidence of petroleum contamination was identified in deeper samples at these two locations or at the water table in the test pit that could be extended to the water table. The second test pit met refusal at 2.75 feet bgs due to large boulders. A sample from each of these two test pits showing visible evidence of petroleum was analyzed for TPH (diesel and oil range organics). The sample collected near the log yard shop had a TPH (oil range) concentration of 14,000 mg/kg and the sample collected in the sawmill area had a TPH (oil range) concentration of 500 mg/kg. TPH (diesel) was not detected in either sample.

A total of seven soil gas probes were placed along the road alignment on the Site – three south of the CBR tracks and four north of the railroad. The locations of these gas probes are shown on Figure 9. The three southernmost probes (GP-11, GP-35, GP-37) encountered log yard materials and the four probes north of the railroad were in silt, sand, and gravel with cobbles. Methane concentrations ranged from about 10% to 20% in the four samples collected from two of the gas probes south of the railroad (GP-11, GP-35), from 1% to 4% in the third probe south of the railroad, and from 8% to 19% in the gas probe located just north of the railroad (GP-36). No methane was measured in the other three gas probes placed along the road alignment through the center of the Site.

3.1.14 2016 Site Reconnaissance (Barr/Fulcrum, 2016)

As described in Section 3.1.13, Landau performed a geotechnical and methane gas investigation for the City of Yakima at selected locations on the Site and the Landfill Site along the alignment of a proposed transportation corridor (Figures 3 and 9) in September-October 2016. Barr and/or Fulcrum staff members observed much of the work conducted by the City's consultant. The City's investigation consisted of making observations and collecting soil samples from test pits and installing/monitoring soil gas probes.

Observations made by Barr and/or Fulcrum staff members during the time on Site included the following:

- Test pits excavated near the western end of the proposed road alignment (i.e., near the western boundary of the Site) did not encounter any contaminated soils or log yard material. These observations are consistent with the available information indicating that no operations that would have the potential to cause impacts occurred in this portion of the Site.
- At least one test pit placed by Landau and located outside of the currently identified limits of the Landfill Site encountered MSW at the base of the test pit (approximately 15 feet below grade).
- Some mild staining was observed on portions of the former log yard shop slab.
- Some staining was observed on the slab of the former plywood plant in the former oil room area and near the locations of the press pits.
- Riser caps on some of the existing gas monitoring wells at the Site did not appear to be well sealed. Seals should be evaluated and repaired as necessary before these wells are used for soil gas sampling.
- The protective casing on monitoring well FPP-MW-2 is bent and partially crushed. Well MW-9 and gas probes GP-2 and GP-22 are also damaged. These wells and gas probes cannot be used for sampling in this RI.
- Diesel odor was noted in surficial soil at the location of the former diesel dispenser on the Triangular Parcel.

The former machine shop slab was inspected by Fulcrum in December 2016. Water piping and electrical conduit penetrations were observed; however, the pit in the northwest corner identified in the URS Phase I ESA (URS, 2003) could not be identified. There were no indications of staining and the slab appeared to be intact. Subsequent to the December 2016 Site reconnaissance, a concrete "pit" was identified on a concrete slab located northwest of the former machine shop. It is possible that this is the pit referred to in the URS 2003 Phase 1 ESA.

3.2 Known Environmental Site Conditions

3.2.1 Petroleum in Soils East of the Large Log Sawmill

As described in Section 3.1.6, TPH concentrations (diesel and motor oil) exceeded MTCA Method A cleanup levels in samples collected at 8 and 13 feet bgs at a test pit (TP-10) located near a "dry well" feature east of the large log mill. Field screening evidence of petroleum (odors, visible presence) was also identified in three "step-out" test pits placed to the east of TP-10. Based on the placement of the additional test pits, Parametrix concluded that petroleum contamination extends to the water table in an approximate radius of 60 feet around TP-10. The source(s) and extent of this petroleum contamination has not been determined.

3.2.2 Petroleum in Soils at Fueling Station West of Log Yard Shop

As described in Section 3.1.6, TPH concentrations (gasoline, diesel, oil) exceeded MTCA Method A cleanup levels in a sample collected at 13 feet bgs in a test pit (TP-12) near a former fueling station west of the former log yard shop. Based on the placement of additional test pits, Parametrix concluded that petroleum contamination at this location is limited in extent (likely less than a 25-foot radius from TP-12). The source(s) and the extent of this petroleum contamination has not been determined.

3.2.3 Petroleum, Cadmium, and Naphthalene in Shallow Soils in Log Yard Material Fill Area in Northern Portion of the Site

Parametrix found TPH (diesel and oil range) concentrations greater than MTCA Method A cleanup levels in shallow samples of log yard materials at two test pits (TP-16 and TP-17) placed in an area of log yard material fill in the northern portion of the Site (Parametrix 2008). Silica gel cleanup was not used to mitigate the influence of the log yard material on TPH concentrations in these samples. There was no field evidence of petroleum contamination in the samples. A surface sample from this area that was identified by Parametrix as fly ash contained cadmium, naphthalene, and benzene higher than MTCA Method A cleanup levels.

3.2.4 Former Operational Ponds

As described in Section 3.1.6, Parametrix found that TPH (diesel and/or oil) concentrations were above MTCA Method A cleanup levels in water samples from four of the five former operational ponds on the Site. The source of the TPH was speculated by Parametrix to be either surface runoff or settled solids at the bottom of the ponds. Silica gel cleanup was not used in the analysis of the samples so it is not possible to determine if the TPH was from petroleum or non-petroleum (e.g. wood debris) sources. Parametrix concluded that the TPH in the pond water was not affecting groundwater based on the groundwater monitoring results. The ponds have not been sampled for almost a decade so the current quality of the pond water is unknown. The settled solids at the bottom of the ponds have not been sampled. Three of the five former operational ponds (north and south kiln ponds and equalization pond) have been backfilled since the Parametrix water samples were collected.

3.2.5 Petroleum in Soil and Groundwater at Plywood Plant and Barker Building

Petroleum impacts as indicated by TPH concentrations (diesel and oil range) above MTCA Method A cleanup levels have been detected in soil and groundwater samples collected adjacent to and downgradient of the lathe pit at the plywood plant. The lathe pit is located in the northeast corner of the plywood plant and is west of the barker building. The bottom of the hydraulic lathe pit is approximately 15 feet bgs, which is near the water table.

Soil samples collected from 11-16 feet bgs in the groundwater smear zone had TPH concentrations (diesel and oil range) greater than MTCA Method A cleanup levels. Soil samples collected from 0-10 feet bgs in borings near the lathe pit were below MTCA Method A cleanup levels and had only minor field indications of petroleum impacts (odor or sheen) which suggests that soil impacts are primarily the result of release(s) from near the bottom lathe pit. The horizontal extent of soil with concentrations greater than MTCA cleanup levels is approximately 200 feet by 400 feet as shown on Figure 10.

Groundwater samples collected from soil borings and monitoring wells adjacent to and downgradient of the lathe pit had TPH concentrations (diesel and oil range) greater than MTCA Method A cleanup levels. Isocontours of diesel range and oil range concentrations from sampling events conducted between July 2013 and June 2015 are provided on Figure 11. The extent of groundwater with concentrations greater than MTCA Method A cleanup levels generally coincides with the extent of soil impacts in the groundwater smear zone; however, there is significant variability in groundwater concentrations between sampling events. The northern extent of the groundwater impacts and the potential contribution from upgradient sources (e.g. fuel distribution system) has not been defined.

A groundwater sample collected from a temporary well placed in a boring south of the plywood plant adjacent to the former equalization pond (FFP-B24) had an oil range organic concentration greater than the MTCA Method A cleanup level in the July/August 2013 sampling event. Subsequent samples collected from adjacent permanent monitoring well FPP-MW-3 were below MTCA Method A cleanup levels. Soil and groundwater quality adjacent to the former equalization pond is not related to soil and groundwater impacts in the vicinity of the lathe pit since the equalization pond is not downgradient of the lathe pit.

3.2.6 Reducing Conditions in Groundwater and Subsequent Elevated Iron, Manganese, and Arsenic Concentrations in Shallow Groundwater

Elevated iron, manganese, and arsenic concentrations have been measured at the monitoring wells on the Site and on the Landfill Site since groundwater monitoring began in the 1990s. The low pH in the groundwater and the presence of log yard materials on the Site (and MSW on the Landfill Site) have led to the conclusion that reducing conditions in the groundwater have likely resulted in the solubilization of naturally occurring iron, manganese, and arsenic into the groundwater. Limited data has been collected to understand the reason(s) for the elevated iron, manganese, and arsenic concentrations. Very limited groundwater data has been collected from upgradient portions of the Site to understand if the elevated concentrations are a regional or a Site issue.

3.2.7 Elevated Methane in Soil Gas

Methane concentrations above the LEL (with some above the UEL) have been measured on the southern portion of the Site (and on the Landfill Site). The source(s) of this methane (MSW, log yard materials, or petroleum degradation) has not been determined. Limited information indicates that methane is not an issue on the northern portion of the Site.

4.0 Preliminary Conceptual Site Model

The following preliminary Conceptual Site Model (CSM) was developed for the Site based on the definition in WAC 173-340-200, and on a review of previous investigations, historical operations, current conditions, and likely future uses. The setting of the Site is described in Section 2.0 and is not repeated here. Data gaps in the preliminary CSM are identified for further investigation in this RI and are described in Section 5.0. The preliminary CSM and the Site setting will be refined as further information is collected during completion of the RI and any subsequent Site investigations.

4.1 Hazardous Substances

Historical lumber mill operations and historical plywood/veneer products manufacturing have been identified as sources of hazardous substances on the Site. The types of hazardous substances potentially released at the Site include petroleum hydrocarbons (gasoline, diesel, oils), metals, VOCs, and PCBs. Methane has also been detected in soil gas at the Site but the source of this methane has not been determined. At Ecology's direction following Ecology's review of the May 2017 Draft RI Work Plan specific SVOCs (phthalates, naphthalene, carcinogenic PAHs, and pentachlorophenol) and a broad list of chlorinated herbicides and pesticides were added as COCs to some of the AOCs investigated in this RI.

Previous investigations (summarized in Sections 3.1 and 3.2) have identified petroleum hydrocarbons, metals, and VOCs in soil and groundwater at concentrations above MTCA Method A cleanup levels. A few SVOCs were also detected in soil at concentrations above MTCA Method A cleanup levels. Petroleum hydrocarbons were detected in surface water pond samples at concentrations above MTCA Method A cleanup levels. Methane has been detected in soil gas samples at concentrations above the LEL (and some above the UEL). The focus of the RI Work Plan is to define the magnitude and extent of the hazardous substances at the Site.

4.2 Impacted Media

Previous investigations indicate that soil, groundwater, soil gas, and surface water at the Site have been impacted by past operations at the Site and, in the case of soil gas, by possible impacts from MSW at the Landfill Site. A detailed description of known environmental Site conditions is in Section 3.2 and is not repeated here.

4.3 Potential Exposure Pathways

As defined in WAC 173-340-200, an exposure pathway means the path a hazardous substance takes or could take from a source to an exposed organism/receptor. "An exposure pathway describes the mechanism by which an individual or population is exposed or has the potential to be exposed to hazardous substances at or originating from a site. Each exposure pathway includes an actual or potential source or release from a source, an exposure point [i.e., the point of potential contact with a hazardous substance], and an exposure route [e.g., ingestion, inhalation, dermal contact]. If the exposure point differs from the source of the hazardous substance, the exposure pathway also includes a transport/exposure medium [e.g., groundwater, air].” WAC 173-340-200.

Based on the current understanding of Site conditions and current and potential future land use scenarios, the preliminary site conceptual model identifies the following potential complete exposure pathways:

- **Soil – direct contact pathway:** MTCA requires an evaluation of the soil-direct contact pathway at every site and a concurrent evaluation of ingestion and dermal absorption exposure routes at sites with mixtures of petroleum and hazardous substances. Because most of the Site is unpaved, this exposure pathway is considered complete for all potential hazardous substances at the Site including those shown in Tables 1 and 2

- **Soil leaching pathway (protection of groundwater):** Hazardous substances including those shown on Tables 1 and 2, have the potential to leach from soils and porous paved surfaces to groundwater. Because most of the Site is unpaved and the groundwater is relatively shallow, this exposure pathway is considered complete at the Site.

- **Soil vapor – receptor pathway:** Methane has been previously detected in soil gas samples collected at the Site at concentrations exceeding the LEL and UEL. In addition, it is possible that TPH, BTEX, VOCs, and SVOCs could contribute to this soil-vapor pathway due to their potential volatility. This exposure pathway is considered to be complete at the Site.

- **Groundwater ingestion and direct contact pathway:** According to MTCA, all groundwater is considered potable unless it is shown through a rigorous approach that it would not be suitable for drinking water. Groundwater at the Site has the potential to contain the hazardous substances listed in Tables 1 and 2. Consistent with MTCA, the drinking water ingestion and direct contact exposure pathways are both considered complete for the Site.

- **Groundwater-surface water pathway:** Groundwater at the Site has the potential to contain the hazardous substances in Tables 1 and 2. Groundwater at the Site has the potential to migrate and interact with surface waters of the Yakima River. The groundwater–surface water exposure pathway is therefore considered complete for the Site.

- **Groundwater-soil vapor-receptor pathway:** Groundwater at the Site has the potential to contain the hazardous substances listed in Tables 1 and 2. Many of these substances have the ability to volatilize directly from groundwater into the air via free space in the soil pores. The groundwater-vapor exposure pathway is considered complete for the Site.

4.4 Potential Receptors

A receptor is an individual human (e.g., resident, commercial/industrial worker, construction worker) or ecological population (e.g., terrestrial or aquatic wildlife, terrestrial plants) that has the potential to be exposed to a hazardous substance through a complete exposure pathway. The Site is zoned as a Regional Development District, which by designation would allow the Site to be used for retail sales and services, high-density residential, financial institutions, professional office buildings, hotels, condominiums, and corporate headquarters. Although an existing restrictive covenant restricts most of the Site to industrial and commercial land uses, Ecology has requested that the RI also evaluate future residential land use based on inclusion of "high-density residential" in the zoning designation. Therefore, the potential Site receptors that will be considered in the RI are the following:

- **Residents (adults and children).** Future residents could potentially be exposed to hazardous substances at the Site through direct contact (i.e., ingestion, dermal contact) with the soil and groundwater, and inhalation of soil vapors and soil particles.
- **Site commercial/industrial workers (adults).** Commercial/industrial workers could potentially be exposed to hazardous substances at the Site through direct contact (i.e., ingestion, dermal contact) with the soil and groundwater, and inhalation of soil vapors and soil particles.
- **Site construction workers (adults).** Construction workers could potentially be exposed to hazardous substances at the Site through direct contact (i.e., ingestion, dermal contact) with the soil and inhalation of soil vapors and soil particles.
- **Terrestrial plants and wildlife.** Terrestrial plants and wildlife could potentially be exposed to hazardous substances at the Site through direct contact (i.e., uptake, ingestion) with the soil.
- **Aquatic wildlife.** Aquatic wildlife could potentially be exposed to hazardous substances from the Site through direct contact if hazardous substances are present at concentrations above surface water cleanup levels in the groundwater that discharges to the Yakima River.

5.0 Data Gap Analysis

A comprehensive review of existing investigation data and historical land uses along with local knowledge of operations on the Site was completed to identify potential areas of concern (AOCs) and data gaps at the Site. Much of the planned investigation will take place on the northern two-thirds of the Site that has not been extensively investigated to identify releases of hazardous substances in and around historical features in this area. Based on earlier investigations and knowledge about historical operations in these areas, TPH (diesel or oil) is the primary COC. Other COCs will be added as appropriate as described in this section.

Potential AOCs were identified using the RECs and potential environmental concerns identified in the Landau Phase I ESA (Landau, 2013a; Landau, 2013c) and also by considering additional areas based on Site history and local knowledge. A data gap analysis was then conducted to assess how well the potential AOCs have been characterized. Potential AOCs were categorized into one of the following categories:

1) previous investigation and remediation have been completed and closure was approved by Ecology or another appropriate regulatory agency;
2) existing investigation data has characterized the potential AOC and the environmental impacts are concluded to be de minimis;
3) historical land use and operating history does not suggest the potential for a significant release of hazardous substances; and
4) historical land use, operating history, and/or previous investigation results suggest the potential of a release that has not been investigated or fully characterized.

The potential AOCs in category 4 represent the majority of the AOCs that will be investigated under this RI Work Plan. Potential AOCs that have been cleaned up for specific impacts will remain under evaluation for other impacts. All of the data gaps identified in the Background Information and Acquisition Memorandum completed for the City of Yakima (Landau, 2013c), with the exception of the steam cleaning shed and the AST containment area, are considered AOCs that have not been investigated or fully characterized and will be addressed during the RI. In addition to the data gaps identified by Landau, seven additional AOCs that have either not been investigated or fully characterized have been identified based on historical use and operational history (Mill Transformers (AOC 10), Hog Fuel Pile (AOC 14), Fuel Distribution System (AOC 16), Plywood Plant Transformers (AOC 22) , Paint Machine and Storage Shed (AOC 15), Barker Building at the Plywood Plant (AOC 23), and the North First Lateral Drain (AOC 2) and will be included as AOCs in the RI. Finally, one AOC was added as directed by Ecology following review of the May 2017 Draft RI Work Plan (AOC 24 - Southwest Area) and a second AOC was added as directed by Ecology following review of the December 2017 Final RI Work Plan (AOC 27 – Machine Shop Pit).

The following features have been investigated sufficiently and are not considered AOCs for the purposes of this RI:

Feature	**Basis for not including in RI**
Four USTs removed in 1989	No Further Action from Ecology (see Section 3.1.1). The area where the tanks were located will be investigated with the comprehensive investigation of the fuel distribution system.
One UST removed in 1993	No Further Action from Ecology (see Section 3.1.2).
1993 ethylene glycol release	No glycol impacts found during investigation (see Section 3.1.3).
Soil outside of AST Containment Area	No impacts found during Landau Phase II ESA (Landau, 2013b). No staining observed during 2016 Site Reconnaissance and soil sufficiently characterized as being below MTCA Method A cleanup levels. The area where the tanks were located will be investigated with the comprehensive investigation of the fuel distribution system.
Steam Cleaning Shed	No impacts found during Landau Phase II ESA and soil sufficiently characterized as being below MTCA Method A cleanup levels (Landau, 2013b). (See Figure 21 for location of steam cleaning shed and Landau Phase II borings.)

5.1 Areas of Concern

Based on the historical investigations and the data gap analysis, twenty-seven (27) AOCs have been identified for further assessment. The AOCs include 19 RECs and potential environmental concerns identified in the Phase I ESA (Landau, 2013a; Landau, 2013c), seven AOCs identified during the data gap analysis, and one specified by Ecology following review of the May 2017 Draft RI Work Plan. Below is a summary of previous investigation data and associated data gaps for each AOC. Figure 12 shows the locations of the AOCs. Table 1 provides a concise summary of each AOC, previous investigation data, data gaps, Stage 1 sampling design, and COCs and other analytes. The soil sampling depths that will be used at each AOC in Stage 1 of the RI are shown on Table 2. A summary of the sampling approach for each AOC is summarized below with further details regarding the sampling rationale and protocols provided in the SAP (Exhibit A).

Many of these AOCs have not been investigated previously. Soil or groundwater exceeding MTCA screening levels that are identified in this stage of the RI will be investigated further in Stage 2 of the RI to provide a complete definition of the magnitude and extent of any identified impacts exceeding MTCA cleanup levels.

Area-wide soil sampling will be used across AOCs where specific potential hazardous waste release points have not been identified. Targeted soil and groundwater sampling will be used in AOCs where specific potential release points have been identified based on Site knowledge, operational features, and/or previous investigations. Samples tested for diesel and heavy oil range petroleum hydrocarbons, will be analyzed with and without silica gel cleanup. Additional information on the sampling design is provided in the SAP (Exhibit A). Note that AOCs are described/organized in a roughly north to south direction.

- **Potential Wood Waste Landfill Remnant (AOC 1):** The area north of the North First Lateral Drain is commonly referred to as the "pasture area," as a result of a former lease for cattle grazing. The easternmost portion of this area has been suggested as a remaining portion of an unpermitted wood waste landfill that was used for facility operations up until 1991. This area has been identified as the "potential wood waste landfill remnant." The presence of wood waste and the boundaries of the wood waste, if present in this area, have not been identified. The landfill reportedly received wood waste, ash from the wood waste boiler, and other mill wastes. The majority of the wood waste landfill (5.7 acres) was closed by removing the waste material in 2003 and 2004 (see section 3.1.5). The closed portion of the landfill was sold for redevelopment. This AOC is the potential wood waste landfill remnant.

  The Wood Waste Landfill located north of the Site received a final closure determination from the Yakima Health District in 2005 (see Section 3.1.5). The extent of wood waste on the Site beyond the boundary of the former Wood Waste Landfill was identified as an area of potential concern in the Landau Phase I ESA (Landau, 2013a) and as a data gap in the Landau background data review memo (Landau, 2013c). The potential extent of the remnant wood waste is shown on Figure 13. Although this Potential Wood Waste Remnant has been identified as an AOC, it is considered unlikely that any waste remnant on the Site would have adversely impacted the Site. Notably, soil data collected in 2003 and 2004 during closure of the wood waste landfill did not show impacts above MTCA cleanup levels in the soil below the wood waste. This data is in Appendix E.

  Test pits will be used to investigate the soil below any wood waste landfill remnants remaining on the Site. Planned test pit locations are shown on Figure 13. The presence of methane in soil gas will be evaluated as part of Site-wide methane monitoring (AOC 26). Soil samples from immediately below any wood waste encountered will be collected and analyzed for TPH (gasoline, diesel, and oil range organics), metals, VOCs, SVOCs, BTEX and fuel additives, and chlorinated pesticides/herbicides, as summarized in Table 1 and more specifically described in the SAP and QAPP. The soil sampling intervals are described in Table 2.

- **North First Lateral Drain (AOC 2):** In response to issues raised by Ecology in the April 5, 2017 RI Work Plan planning meeting, the potential impact of the Site on the North First Lateral Drain near the north Site boundary will be investigated in this RI. This area has not been investigated previously and was not identified as a REC or area of concern in previous investigations. The North First Lateral Drain is the outfall of the Old Union Canal and the North First Lateral irrigation systems, which serve an area of predominately residential properties between North 4th and North 6th Street, northwest of the Mill Site. The North First Lateral Drain is a ditch across the Mill Site with water flowing from west to east across the Site, beneath Interstate 82 and toward the Yakima River. The irrigation water for the North First Lateral Drain originates from the Naches River through the Old Union Canal. The North First Lateral Drain is present in aerial photographs by 1991 but likely dates to the late 1890s.

The potential impact of the Site on the North First Lateral Drain will be investigated by collecting ditch bottom material samples from locations upstream and downstream of the Site. The samples will be analyzed for TPH (diesel and oil-range organics), metals, and TOC as summarized in Table 1 and more specifically described in the SAP and QAPP. The soil sampling intervals are described in Table 2. The sampling locations are shown on Figure 13. Sampling locations may need to be adjusted to collect samples with similar grain-size distribution and organic fraction. Water levels in the ditch will also be measured for comparison to groundwater levels.

- **Equipment Boneyard (AOC 3):** Out-of-use but potentially usable equipment was stored in an equipment boneyard located on the northwestern portion of the Site. TPH, BTEX, metals, a brief list of SVOCs, and PCBs were all below MTCA Method A cleanup levels in a previous surface soil sample collected from this area (Parametrix, 2008) and no staining or stressed vegetation was observed during a recent site reconnaissance. The equipment boneyard once had a gravel covered surface, which may explain the absence of vegetation in this area during much of the year. Previous uses of this area were limited to storage of lumber prior to shipment. The equipment boneyard is beyond the areas of the Mill Site used for log yards or water conveyance. This area was identified as a potential environmental concern in the Landau Phase I ESA (Landau, 2013a) and as a data gap in the Landau background data review memo (Landau, 2013c) because only one sample has been collected from this area.

  Soil quality at the equipment boneyard will be assessed using six spatially distributed test pits and the analysis of samples for TPH (diesel and oil range organics), metals, SVOCs, and chlorinated pesticides/herbicides (3 locations) as summarized in Table 1 and more specifically described in the SAP and QAPP. The sample locations targeted for analysis of chlorinated pesticides/herbicides are detailed in the SAP. The soil sampling intervals are described in Table 2. The spatially distributed placement of test pits is appropriate since no specific releases of hazardous substances have been identified in this AOC. The location of the equipment boneyard and the locations of the planned test pits are shown on Figure 14.

- **Dry Kilns (AOC 4):** The dry kilns were a series of buildings used to dry the sawn lumber from the large log sawmill (LLM) and the small log sawmill (SLM) before cooling and final cutting (e.g., planing) and packaging and existed at this location since the 1960s. Equipment/machinery used in these buildings consisted primarily of metal rails on a concrete slab, cart racks to hold the sawn lumber, and steam heat exchangers and piping to add steam to the air and fans/blowers to circulate the air and to remove moisture in the air by venting. Lumber was transferred by a transfer rail line from the dry kilns to the planer shed located to the west of the kilns. The dry kiln area is beyond the areas of the Mill Site used for log ponds or water conveyance.

  Potential petroleum impacts to surface soils were observed adjacent to the large dry kiln building during facility operations. Condensation was observed dripping from the building roof during kiln operation (Landau, 2013a). Hydraulic equipment, which was used to transfer cut boards from the dry kiln to the cooling and storage sheds and into the planer shed operated to the west of the dry kiln building. No samples have been collected around this building location in previous investigations.

Soil quality adjacent to the dry kiln building will be assessed for potential petroleum impacts during the RI. If petroleum impacts are identified adjacent to this most recently operational kiln building, soil quality at the other historical kiln buildings on the Site will be assessed in Stage 2 of the RI. Historical kilns were located west of the former machine shop in the Triangular Parcel and in the northern portion of the large log sawmill area.

Soil samples will be analyzed for TPH (gasoline, diesel, and oil range organics), SVOCs, BTEX, and fuel additives as summarized in Table 1 and more specifically described in the SAP and QAPP. The soil sampling intervals are described in Table 2 .The location of the most recently operational dry kiln area and the locations of the planned test pits are shown on Figure 15.

- **Kiln Ponds (AOC 5):** The north kiln pond received steam condensate and “evaporate” from drying wood in the dry kiln. The south kiln pond received exhaust scrubber water from the boiler house. The exhaust scrubber water contained ash, which primarily settled out in the south kiln pond. The south kiln pond was at one time connected to the north kiln pond, or to a similar water feature in use at the time, which was connected in the 1980s and 1990s to the north log pond and to the recycle pond. Water from these features would have eventually overflowed toward the Yakima River after significant dilution. The kiln ponds have been filled with common borrow fill from the Mill Site. Concentrations of TPH (oil-range), iron, manganese, and DEHP exceeding screening levels were measured in surface water samples collected from one or both of the kiln ponds in 2008 (Parametrix, 2008). The kiln ponds have not been sampled since 2008. The settled solids that were at the bottom of the ponds have not been sampled.

  Two borings will be placed in the south kiln pond and two borings will be placed in the north kiln pond to evaluate the fill, the residual pond bottom material, and the soil immediately below the pond bottom material. Care will be taken in the field to collect a sample from the pond bottom material in each pond. A temporary well will be placed in one boring in each pond and a groundwater sample will be collected from each temporary well before the temporary well is removed and the boring is sealed.

  Soil and groundwater samples will be analyzed for TPH (gasoline, diesel, and oil range organics), metals, SVOCs, BTEX and fuel additives, VOCs, and TOC (groundwater) during the RI as summarized in Table 1 and more specifically described in the SAP and QAPP. The soil sampling intervals are described in Table 2. The locations of the Kiln Ponds and the planned sampling locations are shown on Figure 15.

- **North Log Pond Fill (AOC 6):** This area was historically used for a log pond (north log pond) and then a log deck. Photographs document that the north log pond was excavated beginning in the early 1900s. Excavated material was likely used to build dikes around the pond. Historical aerial photographs indicated that the maximum size of the north log pond was on the order of 40 acres.

The log pond was gradually filled beginning in the early 1960s. It is considered logical that the dike materials would have been pushed into the pond as fill. Log decks were constructed over the filled portions of the pond. Final closure of the remaining six-acre portion of the pond occurred in 1994. Basalt rock fill was reportedly brought from a quarry near Naches, Washington for the final closure. Log yard material recovery from the north log pond has been conducted since cessation of operations in 2009.

Nine test pits (TP-8, TP-14 through TP-17, TP-23 through TP-26) were completed into the fill material within (5 test pits) or adjacent to (4 test pits) the North Log Pond in 2008 by Parametrix. Soil samples were analyzed for TPH diesel and motor oil range. Soil sample concentrations from two of the test pits (TP-16 and TP-17) were above MTCA cleanup levels and soil sample concentrations from five test pits were below MTCA cleanup levels (two test pits adjacent to the North Log Pond were not sampled) (Parametrix, 2008). Silica gel cleanup was not used in the analysis of these samples.

A fly ash sample, collected near TP-15 in 2008, was analyzed for TPH, BTEX, metals, PCBs, and SVOCs. The fly ash sample had concentrations greater than MTCA cleanup levels for cadmium (Parametrix, 2008).

Landau concluded that the contents of the north log pond fill have not been fully characterized during previous investigations (Landau, 2013c). The historical sampling locations and a comparison of the results with MTCA cleanup levels for this AOC are shown on Figure 16.

The quality of the fill and native soil beneath log yard materials or fill will be evaluated for TPH (gasoline, diesel, and oil range organics), SVOCs, metals, and BTEX and fuel additives during the RI using 12 spatially distributed test pits in the former north log pond and four spatially distributed test pits in the log yard material fill area located west of the north log pond, all as summarized in Table 1 and more specifically described in the SAP and QAPP. The soil sampling intervals are described in Table 2. Samples from four locations in the log pond fill will also be analyzed for chlorinated pesticides/herbicides as described in the SAP. With the three existing test pits in the log pond fill, this will provide coverage of about one test pit per three acres of filled log pond. With the two existing test pits with sampling results in the adjacent filled area, this will provide about one test pit per two acres of log yard material fill in the filled area.

Samples of the fill soils below any remaining log yard material and of the native soil below the fill will be collected. Rock and boulder fill will not be sampled. The spatially distributed placement of test pits in these areas is appropriate since no specific points of hazardous substance release have been identified. Soil gas wells will be installed within the north log pond fill as part of Site-wide methane monitoring (AOC 26). The location of the north log pond, the log yard material fill area, and the locations of planned test pits are shown on Figure 16.

- **Recycle Pond (AOC 7):** The recycle pond is present on aerial photographs and Site maps dating back to 1961. It originally received overflow from the north log pond and discharged to the east toward the Yakima River. The outfall from the recycle pond toward the Yakima River has been cut off since at least 1997. The recycle pond was used as part of the log deck sprinkling and water recycling system that was used in warm months of the year. The recycle pond collected log deck runoff water through a gravity ditch system. The collected water was put through a filter and reused through the log deck sprinkler system. Hypochlorite was added to the recycle pond to control algae growth. No other chemicals were known to have been added to the pond.

Concentrations of TPH (diesel and oil range organics), manganese, and iron were measured above the respective MTCA Method A cleanup levels or EPA secondary MCLs in a surface water sample from the recycle pond collected in 2008; however, silica gel cleanup was not used in the TPH (diesel and oil) analysis (Parametrix, 2008). The recycle pond was considered to be a data gap in the Landau data review memo (Landau, 2013c). The recycle pond has not been sampled since 2008 so the current quality of the pond water is unknown. The settled solids at the bottom of the pond have not been sampled.

A water sample, a sample of the pond bottom material, and a sample of soil below the bottom material will be collected from the recycle pond. The water sample will be analyzed for TPH (diesel, and oil range organics), metals, and SVOCs. Bottom material and underlying soil samples will be analyzed for those COCs plus TPH (gasoline range organics, BTEX and fuel additives, VOCs, TOC, and chlorinated pesticides/herbicides, all as summarized in Table 1 and more specifically described in the SAP and QAPP. The soil sampling intervals are described in Table 2. Groundwater downgradient of the recycle pond is monitored at well MW-5 as described in AOC 25. The location of the recycle pond is shown on Figure 17.

- **Settling Pond (AOC 8):** The settling pond is first visible on a 1991 aerial photograph. The settling pond was used in the warm months of the year as part of the log deck sprinkling and recycling system. The settling pond collected log deck surface runoff water through a gravity ditch system. The collected water was filtered and reused through the log deck sprinkler system. There is no record of or indication that a discharge to surface waters ever occurred from the settling pond. Hypochlorite was added to the settling pond to control algae growth. No other chemicals were known to have been added to the pond.

  Concentrations of TPH (diesel and oil range organics) iron, and manganese were measured above the respective MTCA Method A cleanup levels or EPA secondary MCLs in a surface water sample from the settling pond collected in 2008, however, silica gel cleanup was not used in the TPH (diesel and oil) analysis (Parametrix, 2008). The settling pond was considered to be a data gap in the Landau data review memo (Landau, 2013c). The pond has not been sampled since 2008 so the current quality of the pond water is unknown. The settled solids at the bottom of the pond have not been sampled.

  A water sample and a sample of the pond bottom material and a sample of the soil underlying the pond bottom material will be collected from the settling pond. The water sample will be analyzed for TPH (diesel, and oil range organics), metals, and SVOCs. The pond bottom sample and the underlying soil sample will be analyzed for those COCs plus TPH (gasoline range organics), BTEX, fuel additives, VOCs, TOC, and chlorinated pesticides/herbicides, all as summarized in Table 1 and more specifically described in the SAP and QAPP. The soil sampling intervals are described in Table 2. Groundwater downgradient of the settling pond is monitored at MW-6 as described in AOC 25. The location of the settling pond is shown on Figure 17.

- **Fruitvale Wasteway (AOC 9):** The Fruitvale Wasteway is the outfall of the Fruitvale irrigation system. The Wasteway is in a corrugated metal culvert that runs west to east across the Mill Site and then south of the CBR tracks and north of the Landfill Site. The culvert outlets to a ditch at the northeast corner of the Landfill Site which eventually discharges to the Yakima River after crossing beneath Interstate 82. The outlet of the Fruitvale Wasteway is shown on Figure 17. The Old Union Canal irrigation system is also connected to the Fruitvale Wasteway. The Fruitvale irrigation system receives water from the Naches River through the Fruitvale Canal. The Fruitvale Wasteway has also been referred to as the PP&L Ditch, the Old Union Ditch, and the Irrigation Culvert. The Fruitvale Wasteway has changed orientation across the Site over time, but the outfall location has remained constant.

  Previous reports identified the potential that the Fruitvale Wasteway may have received process water or blowdown from the boiler house, which may have resulted in environmental impact (Landau, 2013a). The historical irrigation ditch has been replaced with a culvert that now carries the irrigation water across the Site. The location of the former ditch is unknown. The Fruitvale Wasteway (either as a ditch or a culvert) was not sampled in previous investigations.

  Soil quality at the outfall of the Fruitvale Wasteway culvert will be evaluated for TPH (gasoline, diesel, and oil range organics, BTEX, fuel additives, metals, SVOCs, and VOCs as part of the RI as summarized in Table 1 and more specifically described in the SAP and QAPP. The soil sampling intervals are described in Table 2. The location of the present-day Fruitvale Wasteway across the Site and the proposed sampling location are shown on Figure 17.

- **Mill Transformers (AOC 10):** Oil-filled transformers used for mill operations were present at the following six locations on the sawmill portion of the Site: 1) west of the large log sawmill, 2) east of the large log sawmill, 3) southwest corner of the small log sawmill, 4) south of the small log sawmill, 5) east of the dry kiln building, and 6) south of the dry kiln building. The transformers were located on competent soils (not log yard material) at each of these locations.

  Potential for the release of PCBs and/or mineral oil from the Mill Transformers was not identified as a REC or a data gap in previous investigations and has not been investigated in previous investigations of the Site. The mill transformers are considered an AOC for this RI.

  Surface soil quality adjacent to each mill transformer will be assessed for PCB and mineral oil impacts as part of the RI. The samples will be analyzed for TPH (mineral oil range organics) and PCBs as summarized in Table 1 and more specifically described in the SAP and QAPP. The soil sampling intervals are described in Table 2. The locations of the mill transformers and the sampling locations are shown on Figures 15 and 18.

- **Large Log Sawmill (AOC 11):** The LLM processed larger diameter logs. The LLM is shown to be present in a 1909 Sanborn map. The shape of the building changed over the years as additions were constructed and modifications were made. Equipment included saws and conveyors to debark, cut, and move logs and lumber. Chemicals used at the sawmill primarily included lubricating oil and hydraulic oil. A dry well for steam condensate was reportedly located in the basement of the LLM.

  As described in Section 3.1.6, petroleum impacts were identified in soil near a suspected dry well and buried concrete manhole east of the Large Log Sawmill (TP-10 area including TP-18, 19, and 20; Parametrix, 2008). Hydraulic oil was reported to be present on the concrete basement floor during site operations (URS, 2003). The historical sampling locations and a comparison of the results with MTCA cleanup levels for this AOC are shown on Figure 18.

  Soil and groundwater quality adjacent to subsurface structures at the LLM (including the TP-10 and TP-18, 19, and 20 area identified in 2008 [Parametrix 2008]) and beneath the concrete floor slab will be evaluated as part of the RI using test pits, borings, and temporary wells. Samples will be analyzed for TPH (diesel and oil range organics) as summarized in Table 1 and more specifically described in the SAP and QAPP. The soil sampling intervals are described in Table 2. A permanent monitoring well will be placed south of the LLM to provide more complete groundwater information in this portion of the Site. This well will be sampled as described in AOC 25. The location of the LLM and the planned locations of test pits, soil borings, temporary wells, and the permanent monitoring well are shown on Figure 18. This figure shows how the new monitoring locations will help define the magnitude and extent of the petroleum impacts that were identified in 2008. Additional borings, test pits, and/or temporary or permanent wells will be placed in Stage 2 of the RI as needed to complete the definition of soil and groundwater impacts in this area.

- **Small Log Sawmill (AOC 12):** The SLM processed smaller diameter logs. The SLM was constructed as a new facility in the late 1980s and was powered by hydraulic equipment. Equipment included saws and conveyors to debark, cut, and move logs and lumber. Chemicals used at the sawmill included primarily lubricating oil and hydraulic oil. An oil dispensing room was located on the south side of the building. Oil was commonly present on the concrete floor of the building and asphalt surrounding the building. Used oil tanks were located outside the building for storage of used hydraulic oils.

  Hydraulic oils were used in the SLM and several storm drain features were identified that could have potentially carried oily water from the sawmill to the subsurface (Landau, 2013a). Hydraulic oil was also reported to be present on the concrete basement floor during facility operations (URS, 2003). These areas have not been investigated in previous investigations of the Site.

The extent of petroleum impacts adjacent to the storm drain features and petroleum impacts beneath the concrete floor slab will be evaluated through soil and groundwater samples collected from borings and temporary monitoring wells and analyzed for TPH (diesel and oil range organics). The soil samples collected from a boring in the used oil storage area will also be analyzed for TPH (gasoline range organics), BTEX and fuel additives, metals, and SVOCs, all as summarized in Table 1 and more specifically described in the SAP and QAPP. The soil sampling intervals are described in Table 2. The location of SLM and planned locations of soil borings, and temporary wells are shown on Figure 18.

- **Boiler House (AOC 13):** The boiler house was constructed by 1950 as shown on Sanborn maps and provided steam used in Site operations. Chemicals stored within this building included caustic and boiler water treatment chemicals. Boiler blow down water, water softener backwash, and steam condensate were discharged to the City's sanitary sewer. Scrubber wash water was discharged to a ditch/culvert system leading to the south kiln pond. A pole-mounted capacitor is present near the boiler house.

  Surface soil samples with PAH concentrations greater than the MTCA Method B cleanup levels and total chromium concentrations less than the trivalent chromium MTCA Method A cleanup level but slightly greater than the hexavalent chromium MTCA Method A cleanup level were collected from the southern end of the boiler house near a drain and beneath a caustic AST (Parametrix, 2008). Chromium was not speciated during the investigation. There was also a report of a possible release from a capacitor near the boiler house in 1988 (URS, 2003). This reported release was not investigated in previous investigations of the Site. The historical sampling locations and a comparison of the results with MTCA cleanup levels for this AOC are shown on Figure 19.

  Soil quality adjacent to the drain and beneath the caustic ASTs will be assessed for metals, SVOCs, and VOCs. Soil adjacent to the capacitor will be assessed for TPH (mineral oil range organics) and PCBs, all as summarized in Table 1 and more specifically described in the SAP and QAPP. The soil sampling intervals are described in Table 2. The location of the boiler house area, the two locations where the capacitator could have been located, and the sampling locations are shown on Figure 19.

- **Hog Fuel Pile (AOC 14):** Wood waste (hog fuel) to be burned as fuel in the boiler house was stockpiled in an area south of the LLM and east of the boiler house. The hog fuel included wood waste, wood pallets/scrap wood, and wood debris used to clean up incidental spills of oil, plywood adhesive, and similar. Used oil was reportedly occasionally dumped on the hog fuel pile prior to burning the hog fuel at the boiler house, as was permitted under the Title V Air Operating Permit.

  There is the potential for impacts from the reported addition of used oil and other flammables to the wood waste and other saw mill materials in the hog fuel pile prior to burning. While this area was not identified by Landau as a REC or a data gap, it is considered a data gap for this RI. A test pit was placed in the area of the hog fuel pile in the Parametrix 2008 Phase II ESA. A sample collected from 8 feet bgs was analyzed for TPH, BTEX, metals, VOCs, PCBs and SVOCs and all detected analytes were below MTCA cleanup levels.

Potential impacts to soils at the hog fuel pile area will be evaluated through analysis of samples from spatially distributed soil borings for TPH (gasoline, diesel, and oil range organics), BTEX and fuel additives, VOCs, SVOCs, metals, and chlorinated pesticides/herbicides as summarized in Table 1 and more specifically described in the SAP and QAPP. The soil sampling intervals are described in Table 2. The location of the former hog fuel pile and the locations of the planned soil borings are shown on Figure 19. The spatially distributed placement of borings is appropriate for this AOC since no specific releases of hazardous substances have been identified.

- **Paint, Machine, and Storage Shed (AOC 15):** A small storage shed was present at this location from before the 1920s until about 1959 (as identified by Sanborn maps). This building was used for the storage of paints, solvents, machinery, and for general storage.

  The potential impact from the storage of paints, solvents, and petroleum products has not been investigated at the former Paint, Machine, and Storage Shed. This area was not identified as a REC or a data gap in previous investigations of the Site but is considered an AOC for this RI.

  TPH (gasoline, diesel and oil range organics), BTEX and fuel additives, metals, SVOCs, VOCs, and chlorinated pesticides/herbicides impacts to soils and groundwater will be evaluated using test pits, one north and one south of the former shed, and one soil boring completed as a temporary well, all as summarized in Table 1 and more specifically described in the SAP and QAPP. The soil sampling intervals are described in Table 2. The location of the paint, machine, and storage shed and the locations of the planned test pits and boring/temporary well are shown on Figure 19.

- **Fuel Distribution System (AOC 16):** A fueling system existed at the Site since at least 1964 (Ecology's common default date for tanks of unknown installation) when three 10,000- to 20,000-gallon diesel and gasoline USTs were reported to be operational. A fourth UST was installed in 1981. These USTs were removed in 1989 and replaced with two 10,000-gallon diesel ASTs and one 10,000-gallon gasoline AST. Three fuel dispensing stations were used at the Site – one diesel fuel dispenser island located west of the log yard shop, one diesel fuel dispenser located west of the machine shop, and one gasoline dispenser near the oil house. The USTs/ASTs and the dispensing pumps were connected with underground fuel lines.

  Elevated concentrations of diesel and oil range petroleum hydrocarbons have been detected in groundwater samples collected downgradient of the eastern portion of the fuel distribution system (Landau, 2015; TP-12 area in Parametrix 2008). Potential petroleum impacts along the fuel lines connecting the former USTs/ASTs with the fuel dispensers have not been evaluated, nor were the fuel lines identified as a REC or data gap in previous investigations. The ASTs and the fuel distribution system reportedly passed "tightness testing" in 2003, but records of the test are not available (URS, 2003). The fuel distribution system is considered an AOC for this RI.

The locations of the fuel lines will be determined using a private locator and/or a geophysical survey and soil samples will be collected for analysis of TPH (gasoline, diesel, and oil range organics), BTEX, and fuel additives from test pits placed along the fuel lines and in the vicinity of the fuel dispensers during the RI as summarized in Table 1 and more specifically described in the SAP and QAPP. The soil sampling intervals are described in Table 2. Temporary groundwater monitoring wells will be placed and the groundwater samples from the temporary wells will be analyzed for TPH (gasoline, diesel, and oil range organics), BTEX, and fuel additives, as summarized in Table 1 and more specifically described in the SAP and QAPP. Three soil borings and a boring/temporary well will placed to help determine the magnitude and extent of contamination in the TP-12 area where petroleum contaminated soil was identified in a test pit placed in 2008 (Section 3.1.6). The approximate location of the fuel distribution system and possible soil sampling locations, and temporary well locations are shown on Figure 20. Final soil sampling locations will depend on the locations of the fuel distribution lines. The locations of the soil borings and temporary well that will be placed in the TP-12 area are also shown on Figure 20. A permanent monitoring well will be placed south of the fuel distribution system to help complete the monitoring well network in this area. This well will be sampled with the other sitewide monitoring wells, as summarized in Table 1 and more specifically described in the SAP and QAPP for AOC 25. Additional soil and/or groundwater samples will be collected in Stage 2 of the RI as necessary to complete delineation of the extent and magnitude of any identified releases in this AOC.

- **Mill Supply Warehouse and Auto Repair Shop (AOC 17):** The mill supply warehouse and auto repair shop was originally constructed and used as a horse barn at the mill. The building is first shown on a 1920 Sanborn map and has served a variety of uses. Prior to construction of the building, the original sawmill was present at this location. The building is referenced as a storehouse until 1959 and then as equipment storage beginning in 1962. An auto lube pit was installed in the eastern portion of the building at some point in time. Petroleum storage, including lubricants, hydraulic oils, and used oil, occurred in the auto shop. A lubricating oil tank, hydraulic oil tank, and used oil tank were present in the northeast corner of the building.

  The potential for petroleum impacts near the former oil storage area and lube pit at the east end of the mill supply warehouse and auto repair shop has been identified (Landau, 2013a; Landau, 2013c).

  Soil quality adjacent to and below the floor of the eastern portion of the mill supply warehouse and auto repair shop will be assessed as part of the RI. Borings will be placed within and outside of the building footprint and samples will be analyzed for TPH (gasoline, diesel, and oil range organics), BTEX, fuel additives, metals, SVOCs, and VOCs, as summarized in Table 1 and more specifically described in the SAP and QAPP. The soil sampling intervals are described in Table 2. The location of the mill supply warehouse and auto repair shop and the locations of the borings are shown on Figure 21.

- **Oil House/Service Pit (AOC 18):** An oil storage building and an adjacent vehicle service pit were present northeast of the mill supply warehouse and auto repair shop. The oil house was historically used for the storage of new and used oil. The oil house is located adjacent to the gasoline fuel dispenser.

  Petroleum impacts as evidenced by elevated TPH concentrations have been identified in a surface soil sample (SS-1) collected at the oil house/service pit (Parametrix, 2008; Landau, 2013b; Landau, 2013c). The total chromium concentration at this surface soil sample location near the Service Pit was less than the MTCA Method A cleanup level for trivalent chromium but greater than MTCA Method A cleanup level for hexavalent chromium (Parametrix, 2008). No speciation was completed. TPH (diesel and oil range organics) exceeded MTCA Method A cleanup levels in this sample (Parametrix, 2008). The oil house and service pit was identified as potential environmental concern and as a data gap by Landau (Landau 2013a, Landau 2013c). The historical sampling locations and a comparison of the results with MTCA cleanup levels for this AOC are shown on Figure 21.

  Soil samples will be collected adjacent to the oil house/service pit from soil borings placed north and south of the oil house including the SS-1 sample location. The samples will be analyzed for TPH (gasoline, diesel, and oil range organics), BTEX, fuel additives, metals, SVOCs, and VOCs, as summarized in Table 1 and more specifically described in the SAP and QAPP. The soil sampling intervals are described in Table 2. The location of the oil house/service pit and the planned boring locations are shown on Figure 21. As shown on Figures 6 and 21, a number of borings and test pits were placed in the vicinity of this AOC in previous investigations and soil exceeding MTCA cleanup levels was not identified (Landau, 2013b).

- **Log Yard Shop (AOC 19):** The log yard shop area was used to perform maintenance on log yard equipment. Log yard equipment was steam cleaned outside the west side of the building. Smaller equipment and vehicles were cleaned in the steam clean shed. Lubricating oil and hydraulic oil were stored near the southwest corner of the log yard shop building. Used oil was stored along the northern edge of the building. Gasoline and diesel ASTs were shown on a 2004 SPCC Plan in secondary containment to the west of the shop but it is believed that this location was incorrect.

  Potential petroleum impacts near the log yard shop were observed in 2013 (Landau, 2013a). A previous soil sample was below MTCA Method A cleanup levels for TPH, BTEX, metals, and SVOCs (Parametrix, 2008); however, the collected soil sample was not located near the potential release areas at the east corner of the shop or at the north bay entrance identified during the 2013 Phase I ESA (Landau, 2013a) or in the oil storage area.

  Samples collected from seven borings and a temporary well will be analyzed for TPH (gasoline, diesel, and oil range organics), BTEX and fuel additives, VOCs, SVOCs, and metals to assess soil and groundwater quality as summarized in Table 1 and more specifically described in the SAP and QAPP. The soil sampling intervals are described in Table 2. The location of the Former Log Yard Shop and the planned boring and temporary well locations are shown on Figure 21.

- **Plywood Plant (AOC 20):** A plywood plant was constructed at the Site in approximately 1960. The plywood plant area was constructed at the northwest corner of the former southern log pond, which was filled to construct the plant and associated buildings (e.g., VAT, plywood barker, etc.). Previous investigations established that the pond fill beneath the plywood plant consists of compacted soil. The plant included a number of ASTs (caustic, resin, adhesive, lubricating oil, chain oil, hydraulic oil, used oil). Equipment (lathe) peeled the debarked logs into veneer for plywood sheets that were trimmed for product and shipped off site by truck and rail. Approximately 15-foot deep pits were located beneath the two hydraulic presses. An approximately 15-foot deep pit was located beneath the lathe in the northeast corner of the plant. Marine-grade plywood was once manufactured at the plant but the details of the process are unknown. Drums and totes of hydraulic oil and lubricating oil were stored near the lathe pit in the northeastern portion of the plant and in a storage room in the northwestern portion of the plant. Resin, adhesive, and adhesive/water mixtures were stored on the eastern edge of the plant. Used oil was stored in the southeast corner of the plant.

  A large number of soil and groundwater samples have been collected in the vicinity of the plywood plant. Samples collected in the western portion of the plywood plant area have shown no evidence of impacts above MTCA cleanup levels in soil or groundwater (Parametrix, 2008; Landau 2013b; Landau 2015; Figures 6 and 7). This included groundwater samples that were analyzed for SVOCs including phenols consistent with the chemicals used in the manufacturing of marine-grade and exterior-grade plywood, although it is recognized that the detection limits used in the prior investigations sometimes exceeded the MTCA groundwater cleanup levels.

  Elevated concentrations of diesel range and oil range petroleum hydrocarbons have been detected in soil and groundwater samples collected in the eastern portion of the plywood plant area, especially in the northeast corner of the plant adjacent to the lathe pit (Parametrix, 2008; Landau, 2013b; Landau, 2015; Figures 6, 7, and 11 in this RI Work Plan). As described above, the bottom of the hydraulic lathe pit is approximately 15 feet bgs, which is near the water table.

  The historical sampling locations and a comparison of the results with MTCA cleanup levels for this AOC are shown on Figure 22. Soil samples collected from 11-16 feet bgs in the groundwater smear zone had TPH concentrations (diesel and oil range) greater than MTCA Method A cleanup levels. Soil samples collected from 0-10 feet bgs in borings near the lathe pit were below MTCA Method A cleanup levels and had only minor field indications of petroleum impacts (odor or sheen) which suggests that soil impacts are primarily the result of release(s) from near the bottom lathe pit. The horizontal extent of soil with concentrations greater than MTCA cleanup levels is approximately 200 feet by 400 feet, as shown on Figures 10 and 22.

  Groundwater samples collected from soil borings and monitoring wells adjacent to and downgradient of the lathe pit had TPH concentrations (diesel and oil range) greater than MTCA Method A cleanup levels. Isocontours of diesel range and oil range concentrations from sampling events conducted between July 2013 and June 2015 are provided on Figure 11. The extent of groundwater with concentrations greater than MTCA Method A cleanup levels generally coincides with the extent of soil impacts in the groundwater smear zone; however, there is significant variability in groundwater concentrations between sampling events. The northern extent of the groundwater impacts and the potential contribution from upgradient sources (e.g. fuel distribution system) has not been defined.

Soil borings and new and existing monitoring wells will be used to further evaluate soil and groundwater quality in the eastern portion of the plywood plant area, including the extent of petroleum impacts from the lathe pit. The locations of the existing borings, test pits, and monitoring wells, the estimated limits of soil and groundwater exceeding MTCA cleanup levels, and the locations of three new borings needed to complete the delineation of soil and groundwater exceeding MTCA cleanup levels in this area are shown on Figure 22. Soil samples will be analyzed for TPH (diesel and oil range organics), and SVOCs. Groundwater samples collected from four existing wells (FPP-MW-1, FPP-MW-2, FPP-MW-3, MW-12) will be analyzed as summarized for samples collected in AOC 25 as summarized in Table 1 and more specifically described in the SAP and QAPP. The soil sampling intervals are described in Table 2. A boring/temporary well placed as a part of the investigation of the plywood plant barker building (AOC 23) will also be used to delineate the extent of impacts to soil and groundwater in this area. Additional soil and/or groundwater samples will be collected in Stage 2 of the RI as necessary to complete the delineation of the extent and magnitude of any identified releases in this AOC.

Soil borings will be placed at the locations of the former press pits, resin storage area, used oil storage area, and the location of a previous surface sample with elevated metals and PAHs. These samples will be analyzed for TPH (diesel and oil range organics), metals and SVOCs with the samples from the used oil storage location and the previous surface sample also analyzed for TPH (gasoline range organics) and BTEX and fuel additives, as summarized in Table 1 and more specifically described in the SAP and QAPP. The soil sampling intervals are described in Table 2.

Elevated methane concentrations in soil gas have been detected in proximity to MSW and log yard materials in the eastern portion of the plywood plant area (Landau, 2015; Parametrix, 2008; Landau, 2013c). The samples were not characterized to evaluate the methane source(s). The locations of the methane probes that have been used in previous investigations are shown on Figure 8. The locations of new gas probes to complete the delineation of methane in this area are shown on Figure 25 and the sampling for AOC 26 as summarized in Table 1 and more specifically described in the SAP.

- **Equalization Pond (AOC 21):** The equalization pond was constructed south of the plywood plant and received veneer dryer wash water, electrostatic precipitator blowdown, steam system condensate, and adhesive system wash water from the plywood plant and non-contact cooling water from the log utilization center located adjacent to the plywood plant. Discharge from the equalization pond went to the City of Yakima POTW (under a State Disposal System Permit since at least 1997). The pond was reportedly dredged annually with the dredged material dewatered and sent to a permitted landfill. The pond was filled after operations ceased.

Petroleum constituents (diesel and oil range organics) and iron were measured at concentrations above MTCA Method A cleanup levels (petroleum) and the EPA secondary MCL (iron) in a 2008 surface water sample collected from the equalization pond (Parametrix, 2008). Recent groundwater monitoring results at a well downgradient of the equalization pond were below MTCA Method A cleanup levels (Landau, 2015) although a groundwater sample from a boring in an earlier investigation showed TPH as oil-range organics slightly above the MTCA Method A cleanup level. The pond was filled subsequent to the collection of the 2008 surface water sample. Soil and groundwater quality adjacent to the former equalization pond is not related to soil and groundwater impacts in the vicinity of the lathe pit since the equalization pond is not downgradient of the lathe pit.

The pond has not been sampled since 2008. The settled solids that were at the bottom of the pond have not been sampled.

Soils and pond bottom material samples collected from a soil boring placed in the filled pond will be analyzed for TPH (gasoline, diesel, and oil range organics), BTEX and fuel additives, metals, SVOCs, VOCs, and chlorinated pesticides/herbicides during the RI. Samples of the fill soils, pond bottom material, and underlying soil will be collected and analyzed as summarized in Table 1 and more specifically described in the SAP and QAPP. The soil sampling intervals are described in Table 2. The location of the equalization pond and the proposed sampling location are shown on Figure 22.

- **Plywood Transformers (AOC 22):** Oil-filled transformers used for plywood plant operations were present at three locations: (1) east of the plywood plant, (2) southwest corner of the plywood plant, and (3) east of the barker building.

  The potential for the release of PCBs and/or mineral oil from the plywood plant transformers has not been investigated, nor were these transformers identified as a REC or data gap in previous investigations of the Site. Each of the plywood plant transformer locations is considered an AOC for this RI.

  Surface soil quality adjacent to the plywood plant transformers will be assessed for TPH (mineral oil range) and PCBs using a boring placed at each transformer location as summarized in Table 1 and more specifically described in the SAP and QAPP. The soil sampling intervals are described in Table 2. The location of the plywood plant transformers and the planned sampling locations are shown on Figure 22.

- **Barker Building at Plywood Plant (AOC 23):** The plywood barker building was used to remove bark from the logs prior to cutting to length and soaking in hot water in the VAT building and peeling of the logs for plywood veneer.

  Petroleum staining on the ground and floor surface within and outside of the barker building and elevated concentrations of petroleum constituents in soil and petroleum constituents, arsenic, iron, and manganese in groundwater have been detected at the barker building (Landau, 2013b; Landau, 2015).

Soil and groundwater quality will be evaluated for TPH (diesel and oil range organics), as summarized in Table 1 and more specifically described in the SAP and QAPP, using six borings placed through the floor of the barker building, one boring placed in an area of oil staining outside the building, and a boring/temporary well placed downgradient of the lathe pit at the plywood plant to complete the definition of the magnitude and extent of contamination exceeding MTCA Method A cleanup levels in this portion of the Site. The soil sampling intervals are described in Table 2. The location of the barker building, the locations of previous soil and groundwater samples, the estimated extent of soil and groundwater exceeding MTCA Method A cleanup levels based on the available information, and the planned sampling locations are shown on Figure 22. Additional soil and/or groundwater samples will be collected in Stage 2 of the RI to delineate the extent and magnitude of any identified releases in this AOC, if necessary.

- **Southwest Area (AOC 24):** Ecology directed that this portion of the former mill property be designated an AOC for this RI. The southwest area of the former mill property was in residential use or was vacant up until the plywood plant was constructed in about 1960. After plywood plant construction, portions of the area were used for truck parking and wood storage (see Appendix B2).

  Soil, soil gas, and groundwater investigations have been conducted in the southwest area (references in Appendix B2). Methane was not present in five gas probes located in the area. No metals or TPH were identified above levels of concern in the soil samples. Field logs from one boring indicated faint petroleum odors in soils. Groundwater sampling identified low and sporadic concentrations of endosulfan II, chloroform, and naphthalene.

  Potential exists for impact to shallow soils in gravel covered areas that may have been used for truck parking. The potential for truck parking to have resulted in contaminated surface soils will be evaluated by completing two soil borings on the Mill Site to assess soil quality beneath the truck parking area. The soil samples will be analyzed for TPH (gasoline, diesel, oil range organics). BTEX and fuel additives, and chlorinated pesticides/herbicides as summarized in Table 1 and more specifically described in the SAP and QAPP. The soil sampling intervals are described in Table 2. Well MW-100 will be included in the sitewide groundwater monitoring program (AOC 25) to represent conditions at this AOC. These sampling locations are shown on Figure 23.

- **Site-Wide Groundwater (AOC 25):** An original network of four monitoring wells was installed on the Site to investigate the wood waste landfill in the mid-1990s (Landau, 1998). These wells were supplemented with an additional six monitoring wells during the 1997 hydrogeologic study of the Boise Cascade mill and plywood plant required under the 1997 State Disposal System Permit (Landau, 1998). Of the original four wood waste landfill-related wells, only MW-01 remains. All of the six monitoring wells installed in 1997 remain; however, MW-09 has been removed from use and replaced in 2008 by MW-09A. Additional wells were added to the plywood plant parcel and triangular parcel during investigations by SLR (2009) and Landau (2013 and 2015). Except for one of these wells, all remain in use. Numerous wells have also been installed on and downgradient of the Landfill Site. While the existing network of groundwater monitoring wells provides a general understanding of groundwater conditions, new monitoring wells will be installed to provide additional monitoring points to define groundwater quality and gradients/direction of flow across much of the Site.

Total and dissolved iron and manganese concentrations above the secondary MCLs and low pH have been measured in monitoring well samples since the 1990s (Landau, 2015). Elevated arsenic was identified in groundwater samples during Site-wide groundwater monitoring in 2013 and 2014 and during completion of the Supplemental RI for the Landfill Site (Fulcrum, 2013; Landau, 2015).

The low pH in the groundwater and the presence of log yard materials on the Site (and MSW on the Landfill Site) have led to the possibility that reducing conditions in the groundwater have likely resulted in the solubilization of naturally occurring iron, manganese, and arsenic into the groundwater. Limited data has been collected to understand the reason(s) for the elevated iron, manganese, and arsenic concentrations and the low pH. Limited groundwater data has been collected from upgradient portions of the Site to understand if the elevated metal concentrations and the low pH are a regional or a Site issue.

The current monitoring well network will be supplemented with the new wells to provide sufficient locations to:

- Evaluate conditions in the north, northwest, northeast and west portions of the Site, upgradient of current or former buildings and operations at the Site and to augment the groundwater data that has been collected since the 1990s.
- Evaluate the geochemistry of the groundwater on the Site.
- Measure iron, manganese, and arsenic concentrations in the former operation area north of the CBR tracks.
- Measure the magnitude and extent of groundwater impacted by historical operations on the Site.
- Evaluate the potential impact of Site groundwater on surface waters on the Site and on the Yakima River east of the Site.
- Evaluate the potential connectivity between impacted groundwater on the Site and domestic water supply wells located west of the Site.

Groundwater quality (including an assessment of geochemical conditions) and groundwater flow will be assessed by collecting samples at existing wells and new wells as part of the RI. The locations of monitoring wells that will be used in the RI are shown on Figure 24. Four rounds of quarterly samples will be collected from the permanent monitoring wells. As summarized in Table 1 and more specifically described in the SAP and QAPP, groundwater samples will be analyzed for TPH (gasoline, diesel, and oil range organics), VOCs, SVOCs, metals, BTEX, and fuel additives. Samples will also be analyzed for iron, manganese, and TOC. Metals including manganese and iron will be analyzed on filtered and unfiltered samples to support assessment of geochemical conditions through evaluation of metals in their reduced or oxidized form. Groundwater samples will also be analyzed for the electron acceptors nitrate and sulfate to support the evaluation of the natural attenuation of petroleum constituents and to support assessment of geochemical conditions, all as summarized in Table 1 and more specifically described in the SAP and QAPP.

After two rounds of groundwater sampling are completed, the groundwater monitoring plan will be modified with Ecology concurrence to eliminate parameters that have consistently been non-detect or an order of magnitude or more below all applicable MTCA cleanup levels.

TPH (diesel and oil range organics) will be analyzed with and without silica gel cleanup completed by the laboratory in at least the first two rounds of sampling. TOC will also be analyzed on these samples. Silica gel cleanup will remove naturally occurring polar hydrocarbons known to be present at the Site because of the history of wood handling operations, the prevalence of buried log yard materials, and the visible suspended particulates in the groundwater samples. The use of silica gel cleanup was shown to have a significant effect on the reported diesel and oil-range organic concentrations in the plywood plant area in the Landau 2015 Supplemental RI (Landau, 2015). The TPH chromatograms and TOC concentrations will be evaluated and a weight at evidence approach will be used to provide an opinion as to the petroleum fraction of the TPH concentration for diesel and oil range organics. A decision may be made after the first two rounds of sampling with Ecology concurrence to modify the groundwater monitoring effort to, for example, not analyze certain groundwater samples both with and without silica gel cleanup if silica gel cleanup is found to be useful (or not to be useful).

In Stage 1 of the RI, groundwater levels, groundwater quality and ditch bottom material monitoring upstream and downstream on the North First Lateral Drain will be used to determine if groundwater impact to surface water in the North First lateral Drain is of concern. Groundwater monitoring in the vicinity of the spring diversion ditch will be used to determine if groundwater is impacting surface water quality in this portion of the Site.

Available information indicates that groundwater from the southwestern portion of the Mill Site flows beneath the Landfill Site and discharges to the Yakima River southeast of the Landfill Site (Landau, 2015). Available information also suggests that groundwater flow on the northeastern portion of the Mill Site leaves the Site to the southeast without flowing beneath the Landfill Site.

There is no information from previous investigations at the Site to assess whether the Yakima River is gaining or losing flow in the reach east of the Site and whether groundwater from the northeastern portion of the Site flows directly to the River. To help close this data gap, water level measuring gages will be placed in the river at, or as close to as is feasible, the three locations shown on Figure 24. These gages will be surveyed so that river elevations at the gage locations can be recorded during groundwater sampling events. River elevations recorded at the gage locations during groundwater sampling events will be used in conjunction with groundwater elevations measured during these sampling events to assess whether the River is gaining or losing flow and whether groundwater at the Site flows to the River.

Groundwater quality monitoring along the eastern Site boundary will be used in Stage 1 of the RI to determine if groundwater impact to surface water east of Interstate 82 is of concern. The Stage 1 data will be evaluated with Ecology to determine whether additional data is needed in Stage 2.

- **Site-Wide Methane (AOC 26):** Soil gas probes have been installed in the vicinity of the plywood plant in the City's investigations of the Landfill Site and across a strip of the Site for the City's right-of-way investigation (Figure 25). Elevated methane concentrations exceeding the LEL in soil gas have been measured at soil gas probes completed on the southern portion of the Site, primarily south of the CBR tracks (Parametrix, 2008; Landau, 2013b, Landau, 2015). The potential source(s) (e.g., MSW, petroleum in soil and groundwater, log yard materials, another source) and the extent of the methane at the Site have not been determined. Methane generation has not been identified on the central and northern portions of the Site. Methane was not detected in the three northernmost gas probes placed for the City's right-of-way investigation. These probes were not identified by the field geologist as having been placed in log yard materials. Soil gas probes have not been installed at other locations with log yard materials across the Site.

  The extent of methane in soil gas will be assessed by monitoring for methane using a landfill gas analyzer at selected existing gas probes and at new gas probes. In addition to methane, hydrogen sulfide, carbon monoxide, carbon dioxide, and oxygen will be analyzed using field instruments as summarized in Table 1 and more specifically described in the SAP and QAPP. The Site-wide soil gas monitoring network for the RI is shown on Figure 25. Four quarterly rounds of methane measurements will be collected in the RI.

  Current activities and all occupied buildings are on the central and northern portions of the Site; therefore, methane generation is not considered to be a current risk. Moreover, the impact of elevated methane on potential future structures can be mitigated during Site redevelopment.

- **Machine Shop Pit (AOC 27):** The 2003 URS Phase I Investigation identified a 1 to 2 foot deep pit in the northwest corner of a store room in the carpenter's shop located along the north wall of the machine shop. The pit contained oily sawdust. The lack of information regarding how the pit was closed and the lack of information on soil and groundwater in this area was considered a data gap by Landau (Landau 2013c). Ecology requested that this pit be added as an AOC in comments to the December 2017 Final RI Work Plan.

An approximately 8-foot long by 4.5-foot wide concrete “pit” is constructed into a concrete slab to the northwest and outside the footprint of the former machine shop. The extent of any impacts from releases from this pit will be investigated by placing soil borings next to the east and west walls of the pit. Samples from the borings will be analyzed for TPH (gasoline, diesel and oil range organics), BTEX and fuel additives, metals, SVOCs, and VOCs, as summarized in Table 1 and more specifically described in the SAP and QAPP. The soil sampling intervals are described in Table 2. The location of the machine shop pit and the locations of the planned borings are shown on Figure 19.

5.2 Development Considerations

It is anticipated that the Site will be developed as a brownfield property with remediation coordinated with a specific development plan for the Site. It is further anticipated that soil exceeding cleanup levels within the upper 15 feet of the soil column (MTCA point of compliance). for soil-direct contact pathway) will be remediated in areas where future tenants, residents, workers, or visitors will be exposed or that workers will be protected with appropriate institutional controls in areas where workers may be exposed but tenants, residents or visitors will not (e.g., below roadways, green space, etc.). MTCA Method A and Method B unrestricted land use cleanup levels will be used to screen the sampling results and help determine specific areas of soil-direct contact pathway concern at the Site. When applicable, natural background concentrations in soil will also be considered in setting screening levels.

The CBR tracks transect the Site from west to east. A number of rail spurs were installed and utilized at the facility from this CBR rail line, and a second line along H Street, as a part of facility operations. Rail spurs provided a significant route for the transport of finished lumber products from the mill. No products were delivered by railcar to the facility that would result in a release of contaminants to the rail spurs. Materials used in spur construction consisted of typical ballast, ties, and rail. Removal of rail, ties, and ballast will be completed as redevelopment occurs. Ballast beneath the ties is commonly found to have been impacted by tie preservatives or oil dripping from equipment to a depth of a foot or less. Ballast with residual petroleum hydrocarbons and PAHs can be effectively recycled into asphalt products during redevelopment and is appropriately managed as will be described in the Feasibility Study and Draft Cleanup Action Plan (DCAP).

Septic systems were reportedly once present at the former log yard shop, the LLM and the SLM, the shipping shed, and the machine shop (URS, 2003; Landau, 2013a). There is no evidence that the septic systems were used for anything other than common restroom and kitchen waste. None of the systems remain operational and the only operational buildings on the Site are connected to City of Yakima services. The locations of the septic systems are unknown and are not apparent by observing the ground surface at the Site. It is considered unlikely that the septic systems included drain fields considering the makeup of the shallow geologic materials and the age of the systems. Soil sampling at the assumed locations of the former septic systems will not be conducted as part of the RI. Removal of the septic systems and management of any localized impacted soil will occur if and when such systems are encountered during development on the Site.

The former operational areas on the Site are extensively covered with buildings, building foundations, asphalt, and concrete. This RI Work Plan has been developed to identify areas of potentially significant environmental impact at the Site through evaluation of facility operations and identification of data gaps where further environmental investigation is warranted. Investigations of known sources of petroleum storage and significant use are described in the RI Work Plan. However, given the history of facility operations, the potential remains for undetected localized releases of petroleum products originating from such events as equipment failure to exist at the Site. By recognizing that the Site is a brownfield property, planning and preparation for the potential discovery of localized areas of contaminated soils will be incorporated into pre-development investigations, contractor notifications, construction specifications, observation and potential sampling, and appropriate soil management plans for implementation during redevelopment. Such development work tasks will be developed in the DCAP.

6.0 Remedial Investigation Activities

Remedial investigation activities will be completed at the AOCs identified in Section 5.0 and shown on Figure 12. Proposed investigation activities are designed to assess potential impacts from each AOC and to characterize Site-wide conditions. Follow-up work, if necessary, will be conducted in a Stage 2 of the RI to complete the delineation of the magnitude and extent of soil and groundwater determined to exceed the MTCA cleanup levels (i.e., Site screening levels).

6.1 Project Team

The roles and responsibilities for the project team that will be responsible for implementing this RI are described in Section 5 of the QAPP (Exhibit B). Remedial investigation activities will be coordinated by Allan Gebhard, the Project Coordinator identified under Part VIII.B of the Agreed Order.

6.2 Pre-Field Activities

Preparation for the RI field investigation will include coordinating schedules and work scopes with subcontractors, ordering sample containers for the field sampling, assembling the equipment needed for the sampling, marking the sampling locations in the field, and coordinating access to the Site. All public and private utilities in the vicinity of the intrusive sampling locations will be located and cleared prior to field activities. All clearances will be the responsibility of the investigation subcontractors (i.e. drillers, excavators). Prior to starting the investigation, information regarding the locations of public utilities will be obtained using the Washington Utility Notification Center. A private underground utility locating service will be used for utility location services on the Site as deemed necessary.

A PHASP has been prepared for use during implementation of the RI and is in Exhibit C. The PHASP was prepared in accordance with WAC 173-340-810 and 29 CFR 1910.120 requirements and describes the level of personal protective equipment (PPE) required for the investigation activities, procedures and frequency of air monitoring, and exposure hazards for the COCs. Barr/Fulcrum staff and the investigation subcontractors working at the Site will be 40-hour HAZWOPER trained and will follow the PHASP.

As with all investigation projects, it is possible that unexpected conditions will be encountered during the RI. A framework describing how unexpected environmental conditions will be handled and a discussion of common contingency action scenarios are in the Investigation Contingency Plan (ICP) in the PHASP. The ICP addresses safety as well as other contingent actions. All contingent actions will be documented in a field report.

6.3 Field Investigation Activities

The field investigation methods, sampling rationale, sampling locations and intervals, standard operating procedures (SOPs), boring and test pit placement, temporary and permanent groundwater monitoring well installation, soil gas well installation, decommissioning damaged well decommissioning, river staff gage placement, surveying, utility location and geophysical surveying, and investigation-derived waste management are described in the SAP (Exhibit A) and are not repeated here.

6.4 Laboratory Analysis

Soil and water samples will be sent to Fremont Analytical, Inc. in Seattle, WA for analysis. Details regarding analytical parameters and methods, data quality objectives, data quality assurance and quality control procedures, data validation, and data management are in the QAPP (Exhibit B) and are not repeated here.

6.5 Stage 2 RI Investigation

The investigation scope described in this Work Plan and the supporting documents (SAP, QAPP, and PHASP) was prepared based on the preliminary CSM developed from existing information and local knowledge. Data collected during this portion of the RI will be used to refine the CSM, as necessary. Evaluation of the RI data will include an assessment of whether or not data gaps still exist that require further investigation to meet the requirements of MTCA. If remaining data gaps are identified, the scope of a Stage 2 Remedial Investigation will be presented to Ecology prior to any supplemental field work being performed as described in Section 8.2 of this Work Plan. It is assumed that the methods and procedures presented in the SAP (Exhibit A), the QAPP (Exhibit B), and the PHASP (Exhibit C) will be followed during any supplemental investigation. Any necessary revisions to the supporting documents will also be presented to Ecology prior to implementation.

7.0 Risk Screening Evaluation

This section describes the screening level risk assessment that will be conducted for the Site as part of the RI. Sample locations or areas that do not meet MTCA cleanup levels will be described on tables and maps in the RI Report.

7.1 Potential Human Health Impacts

Data collected at the Site will be screened using Method A cleanup levels and standard Method B default values as developed by Ecology pursuant to Washington's MTCA Act (part VII of chapter 70.105D RCW) and released to stakeholders through the Cleanup Levels and Risk Calculation (CLARC) web site to determine whether concentrations of hazardous substances warrant further consideration with regard to potential human health impacts. Standard Method B cleanup levels will be adjusted for additive health effects associated with multiple hazardous substances and pathways of exposure in accordance with WAC 173-340-708. Locations that meet Method A or Method B cleanup levels may generally be used without future use restrictions on the property due to residual levels of contamination.

As described in WAC 173-340-700(6)(d), practical quantitation limits (PQLs) will also be considered during the screening level human health risk assessment. PQLs and Site screening levels that will be used in the RI are described in the QAPP in Exhibit B. The importance of using laboratory methods that will provide PQLs at or below Site screening levels is acknowledged.

7.2 Potential Ecological Impacts

Potential ecological impacts will be evaluated by following the requirements for a terrestrial ecological evaluation (TEE) set forth in WAC 173-340-7491 through WAC 173-340-7493 to determine whether concentrations of hazardous substances warrant further consideration with regard to terrestrial receptors (including soil biota, plants, and wildlife), Site conditions identified through the RI will be evaluated to determine whether the Site meets any of the no further evaluation criteria for a TEE in WAC 173-340-7491(1). The four no further evaluation criteria are:

- All soil contaminated with hazardous substances is, or will be, located below the point of compliance.
- All soil contaminated with hazardous substances is, or will be, covered by buildings, paved roads, pavement, or other physical barriers that will prevent plants or wildlife from being exposed to the soil contamination.
- There is less than 1.5 acres of contiguous undeveloped land on the Site or within 500 feet of the Site contaminated with hazardous substances and there is less than ¼ acre of contiguous undeveloped land on or within 500 feet of the Site affected by specific hazardous substances known to pose ecological concern.
- Concentrations of hazardous substances in soil do not exceed natural background levels.

The results of this evaluation will be documented in the RI Report. It is acknowledged that the no further evaluation criteria are dependent on institutional controls and/or completion dates for future development that are acceptable to Ecology.

If an exclusion from a TEE cannot be documented, then Site conditions will be evaluated to determine whether the Site meets any of the criteria for a site-specific TEE as set forth in WAC 173-340-7491. In summary, the site-specific TEE criteria are:

- The site is located on, or directly adjacent to, an area where management or land use plans will maintain or restore native or semi-native vegetation.
- The site is used by a threatened or endangered species.
- The area of contamination is located on a property that contains at least ten acres of native vegetation within 500 feet of the contamination, not including vegetation beyond the property boundaries.
- The department determines that the site may present a risk to significant wildlife populations.

If none of these site-specific criteria apply to the Site, then a simplified TEE will be conducted as set forth in WAC 173-340-7492 and the results will be summarized in the RI Report. If one or more of these site-specific criteria apply to the Site, then a site-specific TEE will be conducted as set forth in WAC 173-340-7493 and the results will be summarized in the RI Report. WAC Table 749-3 will be used for initial screening purposes using the COCs used in the RI.

8.0 Reporting and Schedule

8.1 RI Report

An RI Report will be prepared in accordance with Part VII.H of the Agreed Order that summarizes the nature and extent of impacts and supports the preparation of a feasibility study for selecting a cleanup action under WAC 173-340-360.

The RI Report will include soil, groundwater, surface water, pond bottom material, and soil gas sampling data per chemical class and environmental media (RI data and previously reported data) compared to applicable MTCA cleanup levels. In addition, the report will include an updated CSM that incorporates soil concentration maps, groundwater concentration maps, groundwater contour maps, soil gas concentration maps, and as appropriate, geologic cross sections. Laboratory analytical reports, boring logs, and field sampling documentation will be included as appendices. The validated RI Report data will be uploaded to Ecology's Environmental Information Management (EIM) database as required by Part VIII.E of the Agreed Order. The results from potential human health screening evaluation and the TEE will be summarized in the RI Report.

The overall objective of the RI Report is to sufficiently define Site conditions in order for the FS to define remedial action objectives and remedial alternatives.

8.2 Stage 2 RI Work

Upon completion of the work to be performed in Stage 1 of the RI Work Plan, the data from the soil, sediment, and pond investigations and from the early rounds of groundwater sampling (including all temporary well results) and methane monitoring will be reviewed to determine whether Stage 2 RI work is necessary.

The Stage 1 RI work will be summarized and provided to Ecology in a format that includes the following:

- **Site Characterization Narrative:** including discussion of current Site characterization activities for each site medium (surface water/sediment, soil, groundwater systems, air, and cultural history/archeology, if applicable). Site constituents of concern, will be identified along with the reasons they were chosen and describing how prior and current work efforts contributed to the understanding of the nature and extent of impacts.

- **Sampling/Analytical Results:** including discussion of the sampling/analytical results and constituents analyzed for in samples from each applicable Site medium. This will include a comparison of the results to the applicable cleanup levels, the sampling method, the laboratory method, and any special sampling or analytical protocols (e.g., silica gel, filtration) that were used. This will also include an evaluation of the quality of the data as described in the QAPP.

- **Updated Conceptual Site Model:** An updated CSM will be provided for each AOC where a release of hazardous substances above MTCA cleanup levels has been identified. The lateral and vertical extent of impacts, as currently understood, will be described. Contaminant release, fate and transport, exposure pathways and potential receptors will be described including typical concerns for this type of environmental impact. Site specific issues (i.e., hydrogeologic setting, groundwater/surface water interaction, receptors, current or future site zoning/land use) will be identified. Figures will be used to show hazardous substance release, transport and fate, exposure pathways, and potential and actual receptors.

- **Terrestrial Ecological Evaluation (TEE):** The results from the TEE will be provided as part of the identification of possible cleanup levels or, in the alternative, default soil terrestrial cleanup levels will be applied.
- **Site Maps:** Maps will be used to show overall Site layout with Site features and existing well, boring, test pit and sampling locations labeled consistent with current and historical sample names and current Site data. Figures will be provided showing geologic/hydrogeologic cross sections and ground water level contours.
- **Tables:** Tables will be provided showing sampling information and laboratory methods, including numeric cleanup levels, PQLs, and any special sampling protocols. Raw laboratory data and laboratory reports will be in appendices.

If necessary, a Stage 2 RI scope of work and schedule will be prepared for approval by Ecology. The Stage 2 RI scope of work is anticipated to provide recommended locations for additional borings, test pits, surface and deeper soil samples, bottom material samples, surface water samples, and temporary or permanent monitoring wells and gas probes needed to complete the definition of impacts exceeding MTCA cleanup levels on the Site to the MTCA points of compliance. The Stage 2 RI scope of work is also anticipated to recommend appropriate changes to COCs for each AOC based on the Stage 1 results as well as recommended revisions to the groundwater and/or methane monitoring programs as appropriate. To the extent that the results from the second round of groundwater and methane sampling are available before the Stage 2 RI scope of work is finalized, those results would also be taken into consideration. Lastly, to the extent that further Stage 2 work is determined to be necessary, the Stage 2RI work scope is anticipated to track the movement of groundwater impacted by the Site toward the Yakima River along with its potential to impact water quality in the river.

If Stage 2 RI work is determined to be necessary, it may be more efficient to update the approved Final RI Work Plan, SAP, and QAPP with the new scope of work, rather than producing an entirely new work plan for Stage 2.

8.3 Schedule

The general schedule for completion of the RI is provided below. A detailed schedule for Stage 1 of the RI is in the SAP.

- Preparations for field activities including contracting with drilling and test pitting subcontractors – anticipated to be completed within 60 days following receipt of Ecology approval of Final RI Work Plan as described in the Agreed Order.
- Stage 1 RI field investigation activities and first groundwater and soil gas monitoring event – anticipated to occur during the period 60 to 250 days after Ecology approval of Final RI Work Plan (detailed schedule in SAP).
- Draft Stage 2 RI Work Plan or a draft amendment to the approved Final RI Work Plan (if necessary) including data from Stage 1 of the RI and an updated CSM in the format and with the content set forth in Section 8.2 – submittal within 90 days following completion of Stage 1 RI activities (i.e., receipt and QA/QC completed for soil, pond bottom, groundwater samples from temporary wells, first quarterly groundwater samples (and the second quarterly samples, if available), and soil gas monitoring event data) as described for the Draft RI Report in the Agreed Order (schedule in SAP).
- Second groundwater and soil gas monitoring event – quarter following first quarter sampling (schedule in SAP). The results from this round of samples may be available before the Stage 2 RI scope of work is finalized in which case recommendations regarding appropriate revisions to the monitoring programs will be included in the Stage 2 RI scope of work. Draft revisions to the Stage 1 groundwater and methane monitoring programs (if appropriate) based on first two rounds of data will be provided to Ecology as a separate document if not included in the Stage 2 RI scope of work Plan.
- Stage 2 RI (if necessary) – anticipated to occur beginning 30 days following Ecology approval of Stage 2 RI scope of work (detailed schedule for this task and following tasks will be provided in the Stage 2 RI scope of work).
- Third groundwater and soil gas monitoring event – quarter following second quarter sampling and following Ecology approval of revised groundwater and/or methane monitoring programs.
- Fourth groundwater and soil gas monitoring event – quarter following third quarter sampling.
- RI Pre-Report Check-In and FS Planning Meeting – 30 days following validation of all RI data as described in Ecology guidance.
- Draft RI Report – submitted within 90 days following completion of all RI activities (receipt and QA/QC completed for all Stage 2 RI data and fourth groundwater, surface water, and soil gas monitoring event data).

- Revised Draft RI Report – submitted within 60 days following receipt of Ecology comments on Draft RI Report.

9.0 References

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Work Plan Tables

(No changes from September 2018 Revised Final RI Work Plan submittal)

Table 1
Stage 1 Investigation and Sampling Rationale
Yakima Mill Site Remedial Investigation Work Plan
Yakima, Washington

Area of Concern	Description	Previous Investigations	Data Gaps / Environmental Concerns	Sampling Approach[1]	COCs[2]
Potential Wood Waste Landfill Remnant **(AOC 1)** Figure 13	The area north of the North First Lateral Drain is commonly referred to as the "pasture area", as a result of a former lease for cattle grazing. The easternmost portion of this area has been suggested as a remaining portion of an unpermitted wood waste landfill that was used for facility operations up until 1991. The presence of wood waste and the boundaries of the wood waste, if present in this area, has not been delineated. The landfill reportedly received wood waste, ash from the wood waste boiler, and other mill wastes. The majority of the wood waste landfill (5.6 acres) was closed by removing the waste material in 2003 and 2004. The closed portion of the landfill was sold for separate redeveloped. This AOC is the remaining portion of the landfill on the Mill Site.	No previous investigations within this area. Soil samples collected beneath the removed wood wastes during 2003 and 2004 investigations on the now closed and developed portion of the wood waste landfill were below MTCA cleanup levels for petroleum hydrocarbons (gasoline, diesel, kerosene, heavy fuel oil, and lubricating oil), RCRA metals, polycyclic aromatic hydrocarbons, and three phenolic compounds common to wood treating. The extent of wood waste on the Site beyond the boundary of the former wood waste landfill was identified as a potential environmental concern in the Landau Phase I ESA (Landau, 2013a) and as a data gap in the Landau data review memo (Landau, 2013c).	Wood waste may be present beyond the extent formerly established. If wood waste is present, the soil beneath wood waste landfill remnant materials may be impacted.	**Area-wide sampling:** evaluate soil quality by completing 6 test pits to determine if wood waste is present and evaluate soil quality; collect soil samples as described in Table 2.	• TPH – Dx • TPH – Gx • BTEX and Fuel Additives • Metals • VOCs • SVOCs • Chlorinated Pesticides/Herbicides
North First Lateral Drain **(AOC 2)** Figure 13	The North First Lateral Drain is the outfall of the Old Union Canal and the North First Lateral irrigation systems, which serve an area of predominately residential properties between North 4th and North 6th Street, northwest of the Mill Site. The Drain is a ditch across the Mill Site with water flowing from west to east across the Site, beneath I-82 and toward the Yakima River. The irrigation water for the Drain originates from the Naches River through the Old Union Canal. The North First Lateral Drain is present in aerial photographs by 1991 but likely dates to the late 1890s.	No investigations have been conducted on the North First Lateral Drain on the Mill Site and the Drain was not identified as a REC, area of potential environmental concern, or data gap in previous investigations.	The North First Lateral Drain passes through the Site and carries excess irrigation water to the Yakima River. No operational history was established that indicates that the North First Lateral Drain was a part of Site operations. However, potential exists for impact to ditch bottom soils within the drain from Site runoff or groundwater inflow. This AOC was added to the RI at direction of Ecology. A challenge will be to separate impacts from upstream sources from any impacts attributable to the Site and to collect samples of similar grainsize distribution and organic fraction.	**Focused sampling (operational feature):** evaluate quality of ditch bottom material from upgradient and downgradient sampling locations; collect samples as described in Table 2.	• TPH-Dx • Metals Samples also analyzed for TOC which is not a COC.
Equipment Boneyard **(AOC 3)** Figure 14	This area was historically used to store out-of-use but potentially usable equipment for future reuse, sale, or parts. The equipment boneyard once had a gravel covered surface which may explain the absence of vegetation in this area during much of the year. Previous uses have been limited to storage of lumber prior to shipment. The equipment boneyard is beyond the areas of the Mill Site used for log yards or water conveyance.	Oil staining of surface soils was observed in the 2003 Phase I (URS). One surface soil sample (SS-2) collected in 2008 by Parametrix had concentrations below MTCA cleanup levels for TPH, BTEX, metals, SVOCs, and PCBs. This area was identified as a potential environmental concern in the Landau Phase I ESA (Landau, 2013a) and as a data gap in the Landau data review memo (Landau, 2013c) because only one sample had been collected from the area.	Sufficient number/density of soil samples to evaluate potential releases to ground surface from out-of-use equipment.	**Area-wide sampling:** evaluate soil quality by completing 6 test pits to evaluate soil for the presence of potential contaminants associated with former storage of equipment; collect soil samples as described in Table 2.	• TPH – Dx • Metals • SVOCs • Chlorinated Pesticides/Herbicides (three locations)

Table 1
Stage 1 Investigation and Sampling Rationale
Yakima Mill Site Remedial Investigation Work Plan
Yakima, Washington

Area of Concern	Description	Previous Investigations	Data Gaps / Environmental Concerns	Sampling Approach[1]	COCs[2]
Dry Kiln **(AOC 4)** Figure 15	The dry kilns were a series of buildings used to dry the sawn lumber from the LLM and the SLM before cooling, final cutting (e.g., planing) and packaging and existed at this location since the 1960s. Equipment/machinery used in these buildings consisted primarily of metal rails on a concrete slab, cart racks to hold the sawn lumber, and steam heat exchangers and piping to add steam to the air and fans/blowers to circulate the air and to remove moisture in the air by venting. Lumber was transferred by a transfer rail line from the dry kilns to the planer shed located to the west of the Kiln. The dry kiln area is beyond the areas of the Mill Site used for log yards or water conveyance.	Potential petroleum impacts to surface soils were observed adjacent to the large dry kiln building during facility operations. The URS 2003 Phase I reported oil dripping from the kiln building roof onto the ground surface likely from the condensation off warm air being vented from the kiln (URS, 2003, Landau, 2013a). This condensate likely contained natural wood oils from the drying of wood in the kiln. The kiln building was considered to be a data gap in the Landau data review memo (Landau, 2013c). No soil samples have been collected near the dry kiln in previous investigations.	Surface soil quality where it was reported that oil was dripping from the roof and adjacent to the dry kiln in the transfer rail line where leaking hydraulic oil releases were known to have occurred during operations.	**Focused sampling (operational feature):** evaluate soil quality by completing 10 test pits around the perimeter of the Dry Kiln; collect soil samples as described in Table 2.	• TPH – Dx • TPH – Gx • BTEX and fuel additives • SVOCs
Kiln Ponds **(AOC 5)** Figure 15	The north kiln pond received steam condensate and "evaporates" from the dry kiln. The south kiln pond received exhaust scrubber water from the boiler house. The exhaust scrubber water contained ash which primarily settled out in the south kiln pond. The south kiln pond was at one time connected to the north kiln pond, or a similar water feature in use at the time, which was connected in the 1980s and 1990s to the center log pond and to the recycle pond. Water from these features would have eventually overflowed after significant dilution toward the Yakima River. The kiln ponds have been filled with common borrow fill from the Mill Site.	North Kiln Pond One surface water sample was collected during the 2008 Parametrix Phase II (KILN1-W) and analyzed for TPHs, BTEX, metals, and SVOCs. Motor oil-range TPH, total iron and manganese, and dissolved manganese were detected at concentrations greater than MTCA cleanup levels. South Kiln Pond One surface water sample was collected during the 2008 Parametrix Phase II (KILN2-W) and analyzed for TPHs, BTEX, metals, and SVOCs. Total iron, total manganese, and bis(2-ethylhexyl)phthalate were detected at concentrations greater than the MTCA cleanup levels. The kiln ponds were considered to be a data gap in the Landau data review memo (Landau, 2013c).	Kiln ponds received waters from the boiler scrubber, surface wash water, stormwater, and condensate (from the kilns). These sources may have resulted in contamination of pond bottoms, fill, soil quality, and groundwater beneath the former ponds.	**Focused sampling (operational feature):** evaluate soil, fill, and groundwater quality by completing 2 soil borings, one used as a temporary well, within each pond; collect soil samples as described in Table 2.	• TPH – Dx • TPH – Gx • BTEX and fuel additives • Metals • SVOCs • VOCs Groundwater sample also analyzed for TOC which is not a COC.

Table 1
Stage 1 Investigation and Sampling Rationale
Yakima Mill Site Remedial Investigation Work Plan
Yakima, Washington

Area of Concern	Description	Previous Investigations	Data Gaps / Environmental Concerns	Sampling Approach[1]	COCs[2]
North Log Pond Fill **(AOC 6)** Figure 16	This area has historically been used for a log pond (North Log Pond) and then a log deck. Photographs document that the north log pond was excavated beginning in the early 1900s. Excavated material was likely used to build dikes around the pond. The log pond was gradually filled beginning in the early 1960s. It is considered logical that the dike materials would have been pushed into the pond as fill. Log decks were constructed over the filled portions of the pond. Final closure of the remaining 6-acre portion of the pond occurred in 1994. Basalt rock fill was reportedly brought from a quarry near Naches, Washington for the final closure. Log yard material recovery has been conducted at the surface of the north log pond since cessation of mill operations in 2009.	Nine test trenches (TP-8, TP-14 through TP-17, TP-23 through TP-26) were completed into the fill material within or adjacent to the North Log Pond in 2008 by Parametrix. Soil samples were analyzed for TPH diesel and motor oil range. Soil sample concentrations from two of the test pits were above MTCA cleanup levels and soil sample concentrations from five test pits were below MTCA cleanup levels (two test pits were not sampled). A fly ash sample, collected near TP-15 in 2008, was analyzed for TPH, BTEX, metals, PCBs, and SVOCs. The fly ash sample had concentrations greater than MTCA cleanup levels for cadmium. Log yard material recovery has occurred over much of this AOC since the Parametrix investigation. The north log pond fill was considered to be a data gap in the Landau data review memo (Landau, 2013c).	Potential for impact from site operations on soil quality in the fill and in the native soil beneath the former log pond and log decks.	**Area-wide sampling:** evaluate fill and underlying soil by completing 16 test pits throughout and adjacent to the former pond to evaluate soil quality; collect soil samples as described in Table 2.	• TPH – Dx • TPH – Gx • BTEX and fuel additives • Metals • SVOCs • Chlorinated Pesticides/Herbicides (four locations)
Recycle Pond **(AOC 7)** Figure 17	The recycle pond is present on aerial photographs and site maps dating back to 1961. It originally received overflow from the north log pond and discharged to the east toward the Yakima River. The outfall from the recycle pond toward the Yakima River has been cut off since at least 1997. The recycle pond was used as part of the log deck sprinkling and water recycling system during the warm months of the year. The recycle pond collected log deck return water through a gravity ditch system. The collected water was put through a filter and reused through the log deck sprinkler system. Hypochlorite was added to the recycle pond to control algae growth. No other chemicals were known to be added to the pond.	A surface water sample was collected during the 2008 Parametrix Phase II (REC-W) and analyzed for diesel and gasoline range TPH, BTEX, and total and dissolved metals (arsenic barium, cadmium, calcium, chromium, lead, manganese, mercury, potassium, selenium, silver, and sodium). Diesel and motor oil range TPH were detected at concentrations above MTCA cleanup levels. Silica gel cleanup was not used in the analysis of the sample for TPH. The recycle pond was considered to be a data gap in the Landau data review memo (Landau, 2013c). Groundwater downgradient of the recycle pond has been evaluated through sampling at MW-5. Groundwater sample concentrations at MW-5 have been below MTCA cleanup levels.	Potential for impact from site operations to groundwater quality downgradient of the recycle pond.	**Focused sampling (operational feature)**: evaluate groundwater quality by collecting groundwater samples quarterly for 1 year from MW-5 (See AOC 25).	• TPH – Dx • TPH – Gx • BTEX and fuel additives • Metals • SVOCs • VOCs Also analyze for non-COCs: NO_3 SO_4 Fe, Mn, TOC
			Potential for impact from site operations to surface water quality in the recycle pond.	**Focused sampling (operational feature):** evaluate surface water by collecting 1 surface water sample from the recycle pond.	• TPH – Dx • Metals • SVOCs
			Potential for impact from site operations to pond bottom material quality.	**Focused sampling (operational feature):** evaluate pond bottom material quality by collecting a sample from pond bottoms, and soil immediately beneath pond bottoms (if a sample can be obtained); collect samples as described in Table 2.	• TPH – Dx • TPH – Gx • BTEX and fuel additives • Metals • SVOCs • VOCs • Chlorinated Pesticides/Herbicides also analyzed for TOC which is not a COC.

Table 1
Stage 1 Investigation and Sampling Rationale
Yakima Mill Site Remedial Investigation Work Plan
Yakima, Washington

Area of Concern	Description	Previous Investigations	Data Gaps / Environmental Concerns	Sampling Approach[1]	COCs[2]
Settling Pond **(AOC 8)** Figure 17	The settling pond is first visible on a 1991 aerial photo. The settling pond was used in the warm months of the year as part of the log deck sprinkling and recycling system. The settling pond collected log deck surface runoff through a gravity ditch system. The collected water was filtered and reused through the log deck sprinkler system. There is no record of or indication that a discharge to surface waters ever occurred from the settling pond. Hypochlorite was added to the settling pond to control algae growth. No other chemicals were known to be added to the pond.	A surface water sample was collected during the 2008 Parametrix Phase II (STL-W) and analyzed for diesel range TPH, motor oil range TPH gasoline range TPH, BTEX, metals, and lead. Diesel and motor oil range TPH were detected at concentrations greater than MTCA cleanup levels in the surface water. Silica gel cleanup was not used in the analysis of the sample for TPH. The settling pond was considered to be a REC in the Landau Phase I ESA (Landau 2013a) but was not considered to be a data gap in the Landau data review memo (Landau, 2013c). Groundwater downgradient of the settling pond has been evaluated through sampling at MW-6. Groundwater sample concentrations at MW-6 have been below MTCA cleanup levels.	Potential for impact from site operations to groundwater quality downgradient of the settling pond.	**Focused sampling (operational feature):** evaluate groundwater quality by collecting groundwater samples quarterly for 1 year from MW-6 (See AOC 25).	• TPH – Dx • TPH – Gx • BTEX and fuel additives • Metals • SVOCs • VOCs Also analyze for non-COCs: NO_3 SO_4 Fe, Mn, TOC.
			Potential for impact from site operations to surface water quality in the settling pond.	**Focused sampling (operational feature):** evaluate surface water by collecting 1 surface water sample from the settling pond.	• TPH – Dx • Metals • SVOCs
			Potential for impact from site operations to pond bottom material quality.	**Focused sampling (operational feature):** evaluate pond bottom material quality by collecting a sample from pond bottoms and soil immediately beneath pond bottoms (if a sample can be obtained); collect samples as described in Table 2.	• TPH – Dx • TPH – Gx • BTEX and fuel additives • Metals • SVOCs • VOCs • Chlorinated Pesticides/Herbicides Also analyze for TOC which is not a COC.
Fruitvale Wasteway **(AOC9)** Figure 17	The Fruitvale Wasteway is the outfall of the Fruitvale irrigation system. The Wasteway is in a corrugated metal culvert that runs west to east across the Mill Site and then across the Landfill Site. The culvert outlets to a ditch at the northeast corner of the Landfill Site and eventually discharges to the Yakima River after crossing beneath I-82. The Old Union Canal irrigation system is also connected to the Fruitvale Wasteway. The Fruitvale irrigation system receives water from the Naches River through the Fruitvale Canal. The Fruitvale Wasteway has also been referred to as the PP&L Ditch, the Old Union Ditch, and the Irrigation Culvert. The Fruitvale Wasteway has changed orientation across the Site over time but, the outfall location has remained constant.	Previous reports identified the potential that the Fruitvale Wasteway may have received process water or blowdown from the boiler house, which may have resulted in environmental impact (Landau, 2013a). The historical irrigation ditch has been replaced with a culvert that now carries the irrigation water across the Site. The location of the former ditch is unknown. The Fruitvale Wasteway (either as a ditch or a culvert) was not sampled in previous investigations. The irrigation ditch/culvert (aka Fruitvale Wasteway) was considered to be a data gap in the Landau data review memo (Landau, 2013c).	The Fruitvale Wasteway passes through the Site and carries excess irrigation water to the Yakima River. The Fruitvale Wasteway is contained in an underground culvert. The concern is the historical impact of the Site on the Fruitvale Wasteway. A challenge will be to separate impacts from upstream sources from impacts attributable to the Site	**Focused sampling (operational feature)**: evaluate soil quality at the Fruitvale Wasteway culvert discharge; collect soil samples as described in Table 2.	• TPH – Dx • TPH – Gx • BTEX and fuel additives • Metals • SVOCs • VOCs
Mill Transformers **(AOC 10)** Figures 15 & 18	Oil-filled transformers used for mill operations were present at the following six locations on the sawmill portion of the Site: 1) west of the large log sawmill, 2) east of the large log sawmill, 3) southwest corner of the small log sawmill, 4) south of the small log sawmill, 5) east of the dry kiln building, and 6) south of the dry kiln building.	The potential for the release of PCBs and/or mineral oil from the Mill Transformers was not identified as a REC, area of potential concern, or a data gap in previous investigations and has not been investigated in previously.	Previous mill operations included the use of PCB-containing mineral oils in transformers. While the majority of these units were previously removed, evaluation of soil quality did not occur in all locations. The data gap is the potential for PCB-containing mineral oils to have been released to the ground surface adjacent to the transformers.	**Focused sampling (operational feature):** evaluate soil quality near transformers by completing 1 boring at each transformer location; collect soil samples as described in Table 2.	• TPH – Dx • PCBs

Table 1
Stage 1 Investigation and Sampling Rationale
Yakima Mill Site Remedial Investigation Work Plan
Yakima, Washington

Area of Concern	Description	Previous Investigations	Data Gaps / Environmental Concerns	Sampling Approach[1]	COCs[2]
Large Log Sawmill (LLM) **(AOC 11)** Figure 18	The large log mill processed larger diameter logs. The LLM is shown to be present in a 1909 Sanborn map and was significantly expanded during Site operations. The shape of the building changed over the years as additions were constructed and modifications were made. Equipment included saws and conveyors to debark, cut, and move logs and lumber. Chemicals used at the sawmill primarily included lubricating oil and hydraulic oil. A dry well for steam condensate was located in the basement of the LLM.	Four test trenches (TP-10, TP-18, TP-19, TP-20) were completed outside of the LLM during the 2008 Parametrix Phase II to depths ranging from 7-10.5 feet bgs.TP-10 was located just east of a reported dry well located outside of the LLM, and TP-18, -19, and -20 were located east of TP-10 between the LLM and SLM. Oil was reported to be floating on the water at the base of test pits TP-10 and TP-18 (completed near the SE portion of the LLM) during the Parametrix Phase II ESA. Soil samples were collected from test trenches TP-10, and TP-20 at depths ranging from 5-13 feet bgs and were analyzed for one or more of the following: TPHs, BTEX, and SVOCs. Some samples were also analyzed for metals, PCBs, and VOCs. Diesel and motor oil range organics were detected above MTCA cleanup levels in both samples collected from test trench TP-10 (TP-10, 8 ft.; TP-10, 13 ft.). Detected concentrations were below cleanup levels in the sample collected from TP-20. Oil staining was observed on the concrete floor in the southern portion of the LLM in the vicinity of a dry well (URS, 2003). No samples were collected from this area. The LLM was considered to be a data gap in the Landau data review memo (Landau, 2013c).	Previous investigation identified the presence of petroleum impacted soil near TP-10 however, the extent of petroleum impacts in the area investigated in 2008 (TP-10 area) has not been determined	**<u>Focused sampling (delineate extent of impacts):</u>** evaluate soil and groundwater quality near the former dry well by completing 2 borings with temporary wells and 4 test pits; collect soil samples as described in Table 2.	• TPH – Dx
			Hydraulic and lubricating oils were used in LLM equipment and were observed during operations to be commonly pooled on the concrete floor surface. Potential impacts from hydraulic and lubricating oil used in the LLM and migrating through floor expansion joints and the dry well (if it can be located) inside the building.	**<u>Area-wide sampling:</u>** evaluate soil quality beneath the LLM floor by completing 6 soil borings through the concrete floor; collect soil samples as described in Table 2.	• TPH – Dx
			Potential exists for the presence of groundwater impacts from hydraulic and lubricating oils as a result of site operations in proximity of the sawmill area.	**<u>Area-wide sampling:</u>** evaluate groundwater quality by installing a new monitoring well south of the large log sawmill and sample quarterly as part of sitewide groundwater monitoring (AOC 25).	• TPH – Dx • TPH – Gx • BTEX and fuel additives • Metals • SVOCs • VOCs Also analyze for non-COCs: NO_3 SO_4 Fe, Mn, TOC
Small Log Sawmill (SLM) **(AOC 12)** Figure 18	The small log mill processed smaller diameter logs. The SLM was constructed as a new facility in the late 1980s and was powered by hydraulic equipment. Equipment included saws and conveyors to debark, cut, and move logs and lumber. Chemicals used at the sawmill included primarily lubricating oil and hydraulic oil. An oil dispensing room was located on the south side of the building. Oil was commonly present on the concrete floor of the building and asphalt surrounding the building. Used oil tanks were located outside the building (at the southwest corner) for storage of used hydraulic oils.	Hydraulic oils were used in the SLM and several storm drain features were identified that could have potentially carried oily water from the sawmill to the subsurface (Landau, 2013a). Hydraulic oil was also reported to be present on the concrete basement floor during facility operations (URS, 2003). The URS 2003 Phase I noted discharge of oily air compressor condensate to a storm drain north of a compressor room between the LLM and SLM. An oily sheen was observed on the standing water in the drain and the drain discharge point was unknown. The URS 2003 Phase I also noted oil from the oil dispensing room on the south side of building crossing an adjacent asphalt surface to soils adjacent to a log deck south of the room. A possible storm drain was observed in this area during a September 2016 site visit. These areas have not been investigated previously. The SLM was considered to be a data gap in the Landau data review memo (Landau, 2013c).	Potential exists for impacts to soil beneath the SLM from hydraulic and lubricating oil use in the SLM including leakage through expansion joints in the concrete floor.	**<u>Area-wide sampling:</u>** evaluate soil quality beneath the SLM floor by completing 3 soil borings through the concrete floor; collect soil samples as described in Table 2.	• TPH – Dx
			Potential exists for impacts to soil in the southwest corner of the SLM from used oil storage.	**<u>Focused sampling (operational feature):</u>** evaluate soil quality near the used oil containers by completing 1 soil boring; collect soil samples as described in Table 2.	• TPH – Dx • TPH – Gx • BTEX and fuel additives • SVOCs • Metals

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Area of Concern	Description	Previous Investigations	Data Gaps / Environmental Concerns	Sampling Approach[1]	COCs[2]
			Potential exists for releases to the storm drain from oil dispensing room to act as pathway for lubricating and hydraulic oils to reach soil and groundwater.	**Focused sampling (operational feature):** evaluate soil and groundwater quality by completing 2 soil borings and installing temporary wells adjacent to storm drain features; collect soil samples as described in Table 2.	- TPH – Dx
Boiler House **(AOC 13)** Figure 19	The boiler house was constructed by 1950 as shown on the Sanborn maps and provided steam generation during Site operations. Chemicals stored within this building included caustic and boiler water treatment chemicals. Boiler blow down water, water softener backwash and steam condensate were discharged to the City's sanitary sewer. Scrubber wash water was discharged to a ditch/culvert system leading to the south kiln pond. A pole-mounted capacitator is present near the boiler house.	Two surface soil samples (SS-3 and SS-4) were collected during the Parametrix 2008 Phase II and analyzed for TPHs, BTEX, metals, and SVOCs. Chromium and PAHs were detected above MTCA cleanup levels in both samples (Cr6), however chromium was not speciated. The 2003 Phase I ESA reported that in 1988 PCB-containing mineral oil was released to the ground from a capacitor southwest of the boiler house. The oil impact was reportedly cleaned up, but no laboratory results demonstrate current site conditions. The boiler house was considered to be a data gap in the Landau data review memo (Landau, 2013c).	Potential exists for soils beneath the former capacitor location to be impacted by PCB-containing mineral oils.	**Focused sampling (operational feature):** evaluate soil quality near capacitors by completing 1 boring at each potential capacitor location; collect soil samples as described in Table 2.	- TPH – Dx - PCBs
			Potential exists for soils at the boiler house to be impacted by caustic and water treatment chemical storage/use.	**Focused sampling (operational feature):** evaluate soil quality near the former boiler chemical storage areas by completing 3 soil borings; collect soil samples as described in Table 2.	- Metals - SVOCs - VOCs
Hog Fuel Pile **(AOC 14)** Figure 19	Wood waste (hog fuel) to be burned as fuel in the boiler house was stockpiled in an area south of the LLM and east of the boiler house. The hog fuel included wood waste, wood pallets/scrap wood, and wood debris used to clean up incidental spills of oil, plywood adhesive and similar. Used oil was reportedly occasionally dumped on the hog fuel pile prior to burning the hog fuel at the boiler house.	One test pit (TP-13) was completed near the location of the former Hog Fuel Pile to a depth of 8 feet bgs during the 2008 Parametrix Phase II. One soil sample was collected from TP-13 at a depth of 8 feet bgs and analyzed for TPH, BTEX, metals, VOCs, PCBs, and SVOCs. Detected concentrations were below MTCA cleanup levels. No buried waste was identified at TP-13. The hog fuel pile was not considered to be a REC, area of environmental concern, or a data gap in previous investigations	Potential exists for the incorporation of materials into the wood hog fuel pile, such as paints, oils, and other high BTU liquids and wastes that could have impacted soils beneath the hog fuel storage area.	**Area-wide sampling:** evaluate soil quality beneath the former hog fuel pile by completing 4 soil borings; collect soil samples as described in Table 2.	- TPH – Dx - TPH – Gx - BTEX and fuel additives - Metals - SVOCs - VOCs - Chlorinated Pesticides/Herbicides

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Area of Concern	Description	Previous Investigations	Data Gaps / Environmental Concerns	Sampling Approach[1]	COCs[2]
Paint, Machine, and Storage Shed **(AOC 15)** Figure 19	A small storage shed was present at this location from before the 1920s until about 1959 (as identified by Sanborn Maps). This building was used for the storage of paints, solvents, machinery, and for general storage.	Review of historic documentation identified the presence of a paint, machine, and storage shed at the site. While soil samples have been collected in the general area, no sampling has specifically targeted this location and the paint, machine and storage shed was not considered to be a REC, area of potential environmental concern, or a data gap in previous investigations.	Potential exists for the release of petroleum hydrocarbons, solvents, paints, and metals associated with former storage shed into site soils. Lack of soil data in the vicinity of this building.	**Focused sampling (operational feature):** evaluate soil and groundwater quality by completing 2 test pits and 1 soil boring with temporary well; collect soil samples as described in Table 2.	• TPH – Dx • TPH – Gx • BTEX and fuel additives • Metals • SVOCs • VOCs • Chlorinated Pesticides/Herbicides (soil only)
Fuel Distribution System **(AOC 16)** Figure 20	A fueling system has existed at the site since at least 1964 (Ecology's common default date for tanks of unknown installation) when three 10,000 to 20,000 gallon diesel and gasoline USTs were reported to be operational. A fourth UST was installed in 1981. These USTs were removed in 1989 and replaced with two 10,000 gallon diesel ASTs and one 10,000 gallon gasoline AST. Three fuel dispensing stations have been used at the Site - one diesel fuel dispenser island located west of the log yard shops, one diesel fuel dispenser located west of the machine shop, and one gasoline dispenser near the oil house. The USTs/ASTs and the dispensing pumps were connected with underground fuel lines.	A fuel distribution system connected three separate dispenser locations with three aboveground storage tanks. The general area of the aboveground storage tanks were investigation by Parametrix and Landau with no impacts identified. Elevated concentrations of diesel and oil range petroleum hydrocarbons have been detected in the soil and groundwater samples collected downgradient of the eastern portion of the fuel distribution system (Landau, 2015, Parametrix 2008). The far western portion of the fuel distribution system was investigated with no impacts identified (Landau 2013, 2015). Potential petroleum impacts along the fuel lines connecting the former USTs/ASTs with the fuel dispensers have not been systematically evaluated. The fuel lines were not identified as a REC, area of potential concern, or data gap in previous investigations. The ASTs and the fuel distribution system reportedly passed "tightness testing" in 2003, but records of the test are not available (URS, 2003).	Previous investigation has identified diesel range organics in TP-12, located west of the log yard shops fuel dispensers. The extent of TPH impacts to soil and groundwater associated with this location and generally in the eastern portion of the fuel distribution system has not been determined.	**Focused sampling (operational feature and delineate extent of impacts):** evaluate soil and groundwater quality near TP-12, the log yard fuel dispensers, and in the eastern portion of the fuel distribution system by completing 1 soil boring with temporary well immediately downgradient of the former diesel dispenser and 3 soil borings around area with known impacts (TP-12); collect soil samples as described in Table 2.	• TPH – Dx • TPH – Gx • BTEX and fuel additives
			Potential exists for a release of gasoline to have occurred at the gasoline dispenser near the machine shop.	**Focused sampling (operational feature):** evaluate soil and groundwater quality by completing 1 soil boring with temporary well immediately downgradient of the former gasoline dispenser; collect soil samples as described in Table 2.	• TPH – Dx • TPH – Gx • BTEX and fuel additives
			Potential exists for a release of diesel fuel to have occurred at the diesel fuel dispenser near the oil house.	**Focused sampling (operational feature):** evaluate soil and groundwater quality near the diesel fuel dispenser by completing 1 soil boring with temporary well immediately downgradient of the former diesel dispenser; collect soil samples as described in Table 2.	• TPH – Dx • TPH – Gx • BTEX and fuel additives
			Potential exists for releases of gasoline or diesel fuels to have occurred from buried fuel lines that connected the dispensers to the ASTs/USTs.	**Focused sampling (operational feature):** evaluate soil quality by completing test pits every 25 lineal feet along the fuel distribution piping; collect soil samples as described in Table 2.	• TPH – Dx • TPH – Gx • BTEX and fuel additives
			Potential exists for petroleum impacts from the fuel distribution system to impact groundwater downgradient of the fuel distribution system.	**Area-wide sampling:** evaluate groundwater quality from the fuel distribution system by sampling existing monitoring wells TP-MW-1 and TP-MW-2, and a new monitoring well quarterly as part of site-wide groundwater monitoring (AOC25)	• TPH – Dx • TPH – Gx • BTEX and fuel additives • Metals • SVOCs • VOCs Also analyze for non-COCs: NO_3 SO_4 Fe, Mn, TOC

Table 1
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Mill Supply Warehouse and Auto Repair Shop **(AOC 17)** Figure 21	The mill supply warehouse and auto repair shop was originally constructed and used as a barn for horses used at the mill. The building is first shown in a 1920 Sanborn map and has served a variety of uses. Prior to construction of the building, the original sawmill was present at this location. The building is referenced as a storehouse until 1959 and then as equipment storage beginning in 1962. An auto lube pit was installed at some point in the eastern portion of the building. Petroleum storage, including lubricants, hydraulic oils, and used oil, occurred in the auto shop. A lubricating oil tank, hydraulic oil tank, and used oil tank were present in the northeast corner of the building.	Oil staining was observed on the pavement during the 2003 Phase I (URS, 2003) and within the lube pit. No floor drains were identified.One soil boring (B-5) was completed east of the building during the Parametrix, 2008 Phase II to a depth of 15 feet bgs. One soil sample was collected at 10.5 feet bgs and analyzed for TPHs, BTEX, metals, VOCs, and SVOCs. Detected concentrations in soil were less than MTCA cleanup levels. The auto repair shop was considered to be a data gap as part of the Triangular Parcel in the Landau data review memo (Landau, 2013c).	Potential exists for observed oil staining or the release of other petroleum products to have impacted soil near petroleum storage and use areas (eastern portion of auto shop). Define any impacts to soil associated with auto maintenance activities that occurred in the building.	**<u>Focused sampling (operational features):</u>** evaluate soil quality near the auto repair shop by advancing 4 soil borings through the concrete floor and outside of the building footprint; collect soil samples as described in Table 2.	• TPH – Dx • TPH – Gx • BTEX and fuel additives • Metals • SVOCs • VOCs
Oil House/ Service Pit **(AOC 18)** Figure 21	An oil storage building and an adjacent vehicle service pit were present northeast of the mill service warehouse and auto repair shop. The oil house was historically used for the storage of new and used oil. The oil house is located adjacent to the gasoline fuel dispenser.	One surface soil sample was collected near the former service pit located north of the Oil House during the 2008 Parametrix Phase II (SS-1). Diesel range TPH, motor oil range TPH, and chromium exceeded screening criteria in surface soil sample SS-1 on the north side of the building. Five soil borings were completed during the Landau 2013 Phase II to depths ranging from 5-20 feet bgs . Four soil samples were collected from soil borings at depths ranging from 2-16 feet bgs. Soil samples were analyzed for one or more of the following: diesel range TPH, gasoline range TPH, BTEX, metals, VOCs, and SVOCs. Detected concentrations in soil samples collected from the soil borings were below MTCA cleanup levels. The oil house and service pit was identified as a potential environmental concern and as a data gap in the Landau Phase I and data review memo (Landau 2013a, Landau 2013c).	Determine the extent of petroleum impacted soil at the oil house/service pit including the SS-1 sample location.	**<u>Focused sampling (delineate extent of impacts):</u>** evaluate the extent of petroleum impacted soils by completing 2 borings at the oil house/service pit (including the SS-1 sample location) to further delineate soil impacts; collect soil samples as described in Table 2.	• TPH – Dx • TPH – Gx • BTEX and fuel additives • Metals • SVOCs • VOCs

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Area of Concern	Description	Previous Investigations	Data Gaps / Environmental Concerns	Sampling Approach[1]	COCs[2]
Log Yard Shop **(AOC 19)** Figure 21	The log yard shop area was used to perform maintenance on log yard equipment. Log yard equipment was steam cleaned outside the west side of the building. Smaller equipment and vehicles were cleaned in the steam clean shed. Lubricating oil and hydraulic oil were stored near the southwest corner of the building. Used oil was stored along the northern edge of the building.	One soil boring (B-9) was completed northeast of the Log Yard Shop to a depth of 15 feet bgs during the 2008 Parametrix Phase II. Two soil samples were collected at 7 and 12 feet bgs and analyzed for TPHs, BTEX, metals, and SVOCs. Detected concentrations in soil were less than MTCA cleanup levels but the samples may not have been collected in the areas most likely to have been impacted by releases from this AOC. Potential petroleum impacts near the log yard shop were observed in 2013 (Landau, 2013a). The log yard shop was identified as potential environmental concern and as a data gap in the Landau Phase I ESA and in the data review memo (Landau 2013a, Landau 2013c).	Investigate the potential for impact to soils in and around the log yard shop for petroleum, solvent, used oil and metals impacts. Evaluate deeper soils and groundwater at the log yard shop for petroleum and solvent impacts.	**<u>Focused sampling (operational features):</u>** evaluate the potential for contamination to Site soils and groundwater at the log yard shop by completing 7 borings with 1 completed as a temporary well; collect soil samples as described in Table 2.	• TPH – Dx • TPH – Gx • BTEX and fuel additives • Metals • SVOCs • VOCs
Plywood Plant **(AOC 20)** Figure 22	A plywood plant was constructed at the site in approximately 1960. The plywood plant area was constructed at the northwest corner of the former southern log pond which was filled to construct the plant and associated buildings (e.g., VATs, plywood barker, etc.). Previous investigations establish that the pond fill beneath the plywood plant consists of compacted soil. The plant included a number of ASTs (caustic, resin, adhesive, lubricating oil, chain oil, hydraulic oil, used oi). Equipment (lathe) peeled the de-barked logs into veneer for plywood sheets, dried the veneer, applied the glue, and pressed the veneer into plywood sheets that were trimmed for product and shipped off-site by truck and rail. Approximately 15-foot deep pits were located beneath the two hydraulic presses. An approximately 15-foot deep pit was located beneath the lathe in the northeast corner of the plant. Marine-grade plywood was once manufactured but the details of the process are unknown. Drums and totes of hydraulic oil and lubricating oil were stored near the lathe pit on the northeastern portion of the plant and in a storage room at the northwestern portion of the plant. Resin, adhesive, and adhesive/water mixtures were stored on the eastern edge of the plant.	A large number of soil and groundwater samples have been collected in the vicinity of the plywood plant. Samples collected on the western portion of the plywood plant area have shown no evidence of impacts above MTCA cleanup levels in soil or groundwater (Parametrix 2008; Landau 2013b; Landau 2015). This included groundwater samples that have been analyzed for SVOCs including phenols consistent with the chemical used in the manufacturing of marine-grade and exterior-grade plywood. Elevated concentrations of diesel range and oil range petroleum hydrocarbons have been detected in soil and groundwater samples collected in the eastern portion of the plywood plant, especially in the northeast corner adjacent to the lathe pit (Parametrix 2008; Landau, 2013b; Landau, 2015). The plywood plant was identified as potential environmental concern and as a data gap in the Landau Phase I ESA and the data review memo (Landau 2013a, Landau 2013c. Fourteen soil borings were completed to depths ranging from 14-25 feet bgs near the lathe pit. An additional 16 soil borings were completed to depths ranging from 9-25 feet bgs and three surface soil samples were collected in other areas around the Plywood Plant. 39 soil samples were collected at depths ranging from 1.5-23 feet bgs and analyzed for one or more of the following: TPHs, BTEX, metals, VOCs, SVOCs, and PCBs. Benzene exceeded MTCA cleanup levels in one duplicate sample. Motor oil exceeded MTCA cleanup levels in four samples. Soil samples collected below two of the samples with motor oil exceedances were less	Complete additional investigation of soil and groundwater to define the magnitude and extent of impacted soil and groundwater in the northeast corner of the plywood plant.	**<u>Focused sampling (delineate extent of impacts):</u>** define the extent of petroleum impacted soil and groundwater at the northeast portion of the plywood plant by completing 3 soil borings near the lathe pit; collect soil samples as described in Table 2.	• TPH – Dx • SVOCs
			Potential exists for a release of petroleum constituents or adhesives near the former press pits and at the resin storage area.	**<u>Focused sampling (operational features):</u>** evaluate soil quality near the former press pits and resin storage areas by completing 3 soil borings through the concrete floor; collect soil samples as described in Table 2.	• TPH – Dx • SVOCs • Metals
			Determine the extent of impacted soil as previously identified by sampling near location SS-5.	**<u>Focused sampling (delineate extent of impacts):</u>** determine the extent of potentially impacted soil near SS-5 by completing 1 soil boring through the concrete floor; collect soil samples as described in Table 2.	• TPH – Dx • TPH – Gx • BTEX and fuel additives • Metals • SVOCs

Area of Concern	Description	Previous Investigations	Data Gaps / Environmental Concerns	Sampling Approach[1]	COCs[2]
		than screening criteria. Chromium and PAHs exceeded MTCA cleanup levels in surface soil sample SS-5 at 2 feet bgs.Two soil borings were completed to a depth of 20 feet bgs near the VAT building east of the plywood plant. Two soil samples were collected at depths ranging from 5-16 feet bgs and analyzed for one or more of the following: diesel range TPH, gasoline range TPH, metals, VOCs, and SVOCs. Motor oil exceeded the MTCA cleanup levels in one sample. The remaining samples were below MTCA cleanup levels for SVOCs, VOCs, metals, and PCBs.	Potential exists for impacts to soil in the SE corner of the plywood plant from used oil storage.	**Focused sampling (operational features):** evaluate potential impacts to soil from used oil storage by completing 1 soil boring; collect soil samples as described in Table 2.	• TPH – Dx • TPH – Gx • BTEX and fuel additives • Metals • SVOCs
Equalization Pond **(AOC 21)** Figure 22	The equalization pond was constructed south of the plywood plant and received veneer dryer wash water, ESP blowdown, steam system condensate, and adhesive system wash water from the plywood plant and non-contact cooling water from the log utilization center. Discharge from the equalization pond went to the City of Yakima POTW (under a State Disposal System Permit since at least 1997). The pond was reportedly dredged annually with the dredged material dewatered and sent to a permitted landfill. The pond was filled after operations ceased.	Two soil borings were completed to a depth of 20 feet bgs (FPP-B20, FPP-B24) and one groundwater monitoring well was installed (FPP-MW-3) at and nearby the former equalization pond during the 2013 Landau Phase II. Three soil samples were collected at depths ranging from 10-16.5 feet bgs and analyzed for one or more of the following: TPHs, BTEX, metals, VOCs, SVOCs, PCBs, and hexavalent chromium. Detected concentrations in soil were less than MTCA cleanup levels. Two surface water samples were collected during the 2008 Parametrix Phase II and analyzed for diesel range TPH, motor oil range TPH gasoline range TPH, BTEX, metals, VOC, PCBs, SVOCs, and lead. Diesel and motor oil range TPH were detected at concentrations greater than MTCA cleanup levels in the surface water in both samples. Well FPP-MW-03 was placed downgradient of the former equalization pond in the 2013 Landau Phase II as described above. A sample collected in 2013 had low levels of diesel range TPH but no detectable concentrations have been present in more recent samples. The equalization pond was identified as a data gap in the Landau data review memo (Landau 2013c).	Potential exists for soil fill, pond bottoms and underlying soils to be impacted by site operations associated with use of the former equalization pond.	**Focused sampling (operational feature):** evaluate soil and fill quality by competing 1 soil boring in the former pond; collect soil samples as described in Table 2.	• TPH – Dx • TPH – Gx • BTEX and fuel additives • Metals • SVOCs • VOCs • Chlorinated Pesticides/Herbicides

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Plywood Transformers **(AOC 22)** Figure 22	Oil-filled transformers used for plywood plant operations were present at three locations: 1) east of the plywood plant, 2) southwest corner of the plywood plant, and 3) east of the barker building.	The potential for the release of PCBs and/or mineral oil from the plywood plant transformers was not identified as a REC, area of potential environmental concern, or a data gap in previous investigations and has not been investigated in previously	Previous Site operations have included the use of PCB-containing mineral oils in transformers and capacitors. While the majority of these units were previously removed, evaluation of soil quality has not occurred in all locations. The data gap is the potential for PCB-containing mineral oils to have been released to the ground surface adjacent to the transformers.	**<u>Focused sampling (operational feature):</u>** evaluate the potential for PCB-containing mineral oil impact to soils by completing 1 boring at each transformer location; collect soil samples as described in Table 2.	- TPH – Dx - PCBs
Barker Building **(AOC 23)** Figure 22	The plywood barker building was used to remove bark from the logs prior to cutting to length and soaking in hot water in the vat building and peeling of the logs for plywood veneer.	Six soil borings were completed at and near the former barker building to depths ranging from 15-25 feet bgs during the 2013 Landau Phase II. Five soil samples were collected from five soil borings at depths ranging from 14-16 feet bgs. Soil samples were analyzed for diesel range TPHs and metals. One soil sample was also analyzed for PCBs Two groundwater samples were collected from temporary wells placed in two borings. Groundwater samples were analyzed for diesel range TPHs and dissolved metals. Oil range TPH was detected at concentrations greater than the MTCA cleanup levels in one soil sample at 15-16 feet bgs. Arsenic and sodium were detected at concentrations greater than the MTCA cleanup levels in both groundwater samples, and oil range and diesel range TPH were detected at concentrations greater than the MTCA cleanup levels in the groundwater sample collected from one temporary well Petroleum staining was reported on the ground and floor surface within and outside of the barker building and elevated concentrations of petroleum constituents in soil and petroleum constituents, arsenic, iron, and manganese in groundwater have been detected at the barker building (Landau, 2013b; Landau, 2015). The barker building was not identified as a data gap in the Landau data summary memo (Landau 2013c). Liquid with petroleum sheen and odor on the ground surface southeast of the former plywood barker building at the plywood plant and staining on the floor of the building was identified as a REC in the Landau Phase I (Landau 2013a).	Delineate diesel and oil range petroleum impacts to soil and groundwater downgradient of petroleum impacts.	**<u>Focused sampling (delineate extent of impacts):</u>** evaluate Site soil and groundwater quality downgradient of the lathe pit by completing 1 boring with temporary well near eastern margin of the known petroleum impacts; collect soil samples as described in Table 2.	- TPH – Dx
			Potential exists for observed soil staining east of the Barker Building to have impacted site soils. Evaluate the soil for potential petroleum impacts at locations with concrete or asphalt staining within the barker building area. Collect samples at randomly spaced locations within the barker building operational area.	**<u>Area-wide sampling:</u>** evaluate Site soils for the presence of diesel and oil range petroleum hydrocarbon impacts to Site soils by completing 6 soil borings through the concrete floor and 1 soil boring in an area with oil staining outside of the building; collect soil samples as described in Table 2.	- TPH – Dx

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Area of Concern	Description	Previous Investigations	Data Gaps / Environmental Concerns	Sampling Approach[1]	COCs[2]
Southwest Area **(AOC 24)** Figure 23	The southwest area of the former mill property was in residential use or was vacant up until the plywood plant was constructed in about 1960. After plywood plant construction, portions of the area were used for truck parking and wood storage.	The southwest area was not identified as a REC, area of concern, or a data gap in previous investigations. Soil, soil gas and groundwater investigations have been conducted in the southwest area. Methane was not present in five gas probes located in the area. No metals or TPH were identified above levels of concern in the soil samples. Field logs from one boring indicated faint petroleum odors in soils. Groundwater sampling identified low and sporadic concentrations of endosulfan II, chloroform, and naphthalene.	Potential exists for impact to soils in gravel covered areas that may have been used for truck parking. This area was added as an AOC at the direction of Ecology.	**Focused sampling (delineate extent of impacts):** evaluate the potential for truck parking to have resulted in contaminated surface soils by completing 2 soil borings at the truck parking area; collect soil samples as described in Table 2. Well MW-100 is in the monitoring well network and will be sampled for groundwater COCs (AOC 25).	Soils • TPH – Dx • TPH – Gx • BTEX and fuel additives • Chlorinated Pesticides/Herbicides Groundwater • TPH – Dx • TPH – Gx • BTEX and fuel additives • Metals • SVOCs • VOCs Also analyze for non-COCs: NO_3 SO_4 Fe, Mn, TOC
Site wide Groundwater **(AOC 25)** Figure 24	An original network of four monitoring wells was installed to investigate the wood waste landfill in the mid-1990s. These wells were supplemented with an additional six monitoring wells during the 1997 hydrogeologic study of the Boise Cascade Mill and Plywood Plant required under the 1997 State Disposal System Permit. Of the original four landfill related wells, only MW-01 remains. All of the six monitoring wells installed in 1997 remain; however, MW-09 has been removed from use and was replaced in 2008 by MW-09A. Additional wells were added to the plywood plant parcel and triangular parcel during investigations by SLR (2009) and Landau (2013 and 2015). Except for one of these wells, all remain in use. Numerous wells have also been installed on and downgradient of the Landfill Site. While the existing network of groundwater monitoring wells provides a general understanding of groundwater conditions, the existing network does not provide sufficient monitoring points to define groundwater quality and gradients/direction of flow across the Site.	Total and dissolved iron and manganese concentrations above the secondary MCLs and low pH have been measured in monitoring well samples since the 1990s (Landau, 2015). Elevated arsenic was identified in groundwater samples during Site-wide groundwater monitoring in 2013 and 2014 and during completion of the Supplemental RI for the Landfill Site (Fulcrum, 2013; Landau, 2015). Monitoring identified petroleum-impacted groundwater in the TP-10 area by the LLM. Monitoring identified petroleum-impacted groundwater above MTCA cleanup levels on the eastern portion of the Triangular Parcel and in the northeastern portion of the plywood plant (diesel and oil). Downgradient extent is defined by several existing wells. The need for additional groundwater information was identified as a data gap in the Landau data summary memo (Landau 2013c) and metals in groundwater was identified as a REC in the Landau Phase I investigation (Landau 2013a).	The current monitoring well network and data set do not provide sufficient information to: • Evaluate conditions in the north, northwest, northeast and west portions of the Site, upgradient of current or former buildings and operations at the Site and to augment the groundwater data that has been collected since the 1990s. • Evaluate the geochemistry of the groundwater on the Site. • Measure iron, manganese, and arsenic concentrations in the former operation area north of the CBR tracks. • Measure the magnitude and extent of groundwater impacted by historical operations on the Site. • Evaluate the potential impact of Site groundwater on surface waters on the Site and the Yakima River east of the Site. • Evaluate the potential connectivity between impacted groundwater on the Site and domestic water supply wells located west of the Site. There is no information from previous investigations at the Site to assess whether the Yakima River is gaining or losing flow in the reach adjacent to the Site and whether groundwater from the northeastern portion of the Site flows to the River.	**Area-wide sampling:** evaluate Site groundwater by collecting groundwater samples from 21 monitoring wells located throughout the Site to assess groundwater quality and flow direction/gradient. Water level measuring gages will be placed in the Yakima River at three locations near the Site. These gages will be surveyed so that river elevations at the gage locations can be recorded during groundwater sampling events. River elevations recorded at the gage locations during groundwater sampling events will be used in conjunction with groundwater elevations measured during these sampling events to assess whether the River is gaining or losing flow and whether groundwater at the Site flows to the River.	• TPH – Dx • TPH – Gx • BTEX and fuel additives • Metals • SVOCs • VOCs Also analyze for non-COCs: NO_3 SO_4 Fe, Mn, TOC
Site wide Methane **(AOC 26)** Figure 25	Soil gas probes have been installed in the Landfill Site RI and for the City's right-of-way development planning but have not been installed at the Site to evaluate the potential for methane generation at the Mill Site from log yard materials, or under various conditions involving thickness of log yard materials, proximity to MSW, etc.	Soil gas probes have been installed in the vicinity of the plywood plant in the City's investigations of the Landfill Site and across a strip of the Site for the City's right-of-way investigation Elevated methane concentrations in soil gas have been measured at soil gas probes completed on the southern	Potential exists for the generation of methane from buried log yard materials. The source(s) (e.g., MSW, petroleum in soil and groundwater, log yard materials, or another source) and the presence and extent of the methane at the Site have	**Area-wide sampling:** evaluate soil gas conditions at the Site by collecting soil gas samples from 23 soil gas wells located throughout the Site to assess methane concentrations using a landfill gas analyzer; collect samples quarterly for 1 year; includes installation of 9 new soil gas monitoring wells and use of 14 existing	• Methane (also analyze for non-COCs: CO, O_2, CO_2, H_2S using landfill gas analyzer and 4-gas meter)

Table 1
Stage 1 Investigation and Sampling Rationale
Yakima Mill Site Remedial Investigation Work Plan
Yakima, Washington

Area of Concern	Description	Previous Investigations	Data Gaps / Environmental Concerns	Sampling Approach[1]	COCs[2]
		portion of the Site, primarily south of the CBR tracks (Parametrix, 2008; Landau, 2013b, Landau, 2015). Methane has been detected in the former Plywood Plant area at concentrations greater than the lower explosive limit in previous investigations associated with the Site (e.g., 2008 Parametrix Phase II, 2013 Landau Phase II) and investigations at the Site associated with the adjacent landfill (investigations completed by SLR and Landau since 2009). Methane generation has not been identified on the central and northern portions of the Site. Methane was not detected in the three northernmost gas probes placed for the City's right-of-way investigation. These probes were not identified as having been placed in log yard materials. Soil gas probes have not been installed at other locations with log yard materials across the Site. The need for additional soil gas/methane information was identified as a data gap by Landau (Landau 2013c) and the potential for methane generation from wood debris was identified as a REC in the Landau Phase II investigation (Landau 2013a).	not been determined.	soil gas wells (GP-3, GP-6, GP-10, GP-11, GP-23, GP-24, GP-25, GP-26, GP-32, GP-33, GP-34, GP-35, GP-36, GP-37).	
Machine Shop Pit **(AOC 27)** Figure 19	The 2003 URS Phase I Investigation identified a 1 to 2 foot deep pit in the northwest corner of a store room in the carpenter's shop located along the north wall of the machine shop. The pit contained oily sawdust. The lack of information regarding how the pit was closed and the lack of information on soil and groundwater in this area was considered a data gap in the Landau data review memo (Landau 2013c). Ecology requested that this pit be added as an AOC in comments to the December 2017 Final RI Work Plan.	No investigations have been conducted in the vicinity of the machine shop pit. The machine shop was identified as a data gap by Landau (Landau 2013) and as a potential environmental concern in the Landau Phase I (Landau 2013a).	This AOC was added at the direction of Ecology. Potential exists for releases from the pit into underlying soils.	**Focused sampling (operational features):** evaluate the potential for impacts to soil quality beneath the machine shop pit by advancing 2 soil borings, one immediately east of the pit and one immediately west of the pit, to evaluate soil quality; collect soil samples as described in Table 2.	• TPH – Dx • TPH – Gx • BTEX and fuel additives • Metals • SVOCs • VOCs

Footnote 1:

- Details on the sampling design and soil sampling intervals are provided in the SAP and Table 2, respectively

Footnote 2:

- **TPH-Dx** (includes heavy oil range) - analyzed by NWTPH-Dx/Dx Ext (with and without silica gel cleanup)
- **TPH-Gx** - analyzed by NWTWH-Gx
- **BTEX & Fuel Additives** (includes benzene; toluene; ethylbenzene; xylenes; EDB; EDC; MTBE; and lead) – BTEX, EDB, EDC, and MTBE analyzed by EPA Method 8260; lead analyzed by EPA Method 6020
- **Metals** (includes Cd; $Cr_{6;}$ (soil only); Cu; Pb; Ni; Zn; Ag; and As) – Cd, Cu, Pb, Ni, Zn, Ag, As analyzed by EPA Method 6020; Cr_6 analyzed by EPA Method 7196
- **VOCs** (includes acetone; MEK; carbon tetrachloride; chloroform; methylene chloride; tetrachloroethene; trichloroethene; and vinyl chloride) – analyzed by EPA Method 8260
- **SVOCs** (includes bis(2-ethylhexyl)phthalate; butyl benzyl phthalate; naphthalene; pentachlorophenol; benzo(a)anthracene; benzo(a)pyrene; benzo(b)fluoranthene; chrysene; dibenz(a,h)anthracene; and indeno(1,2,3-cd)pyrene) – analyzed by EPA Method 8270
- **Chlorinated Pesticides** (includes 4,4´-DDD; 4,4´-DDE; 4,4´-DDT; aldrin; alpha BHC; alpha-Chlordane; beta BHC; delta BHC; dieldrin; endosulfan I; endosulfan II; endosulfan sulfate; endrin; endrin aldehyde; endrin ketone; gamma BHC (Lindane); gamma-Chlordane; heptachlor; heptachlor epoxide; methoxychlor; and toxaphene) – analyzed by EPA Method 8081
- **Chlorinated Herbicides** (includes 2,4,5-T; 2,4,5-TP (Silvex); 2,4-D; 2,4-DB; 3,5-Dichlorobenzoic acid; 4-Nitrophenol; acifluorfen; bentazon; chloramben; dacthal (DCPA); dalapon; dicamba; 2,4-DP; dinoseb; MCPA; MCPP; picloram) – analyzed by EPA Method 8151A
- **PCBs** (includes Aroclor 1016; Aroclor 1221; Aroclor 1232; Aroclor 1242; Aroclor 1248; Aroclor 1254; Aroclor 1260; Aroclor 1262; Aroclor 1268) – analyzed by EPA Method 8082

Non-COC analytes are also included in this column for completeness. The analytical methods are in the QAPP (Exhibit B)

Table 2
Stage 1 Soil Sampling Intervals
Yakima Mill Site Remedial Investigation Work Plan
Yakima, Washington

Area of Concern	Sampling Intervals	COCs[1]
Potential Wood Waste Landfill Remnant **(AOC 1)** Figure 13	**Fill:** • Soil o Uppermost 2 feet of native soil	• TPH – Dx • TPH – Gx • BTEX and fuel additives • Metals • VOCs • SVOCs • Chlorinated Pesticides/Herbicides
North First Lateral Drain **(AOC 2)** Figure 13	**Drainage Feature:** • Ditch Bottom Material o 0-1 feet bgs within the drain	• TPH-Dx • Metals

Equipment Boneyard
(AOC 3)
 	
Figure 14
	Equipment Staging:
	• Soil
	  o 0-2 feet bgs
	  o 5-7 feet bgs
		• TPH – Dx
		• Metals
		• SVOCs
		• Chlorinated Pesticides/Herbicides (three locations)

Dry Kiln
(AOC 4)
 	
Figure 15
	Roof Condensate:
	• Soil
	  o 0-2 feet bgs
	  o 5-7 feet bgs
		• TPH – Dx
		• TPH – Gx
		• BTEX and fuel additives
		• SVOCs

Kiln Ponds
(AOC 5)
 	
Figure 15
	Pond Fill / Pond Bottoms:
	  o 0-2 feet bgs
	  o 5-7 feet bgs
	  o Pond bottoms
	  o Uppermost 2 feet of native soil below pond bottoms
		• TPH – Dx
		• TPH – Gx
		• BTEX and fuel additives
		• Metals
		• SVOCs
		• VOCs

North Log Pond Fill
(AOC 6)
 	
Figure 16
	Fill:
	• Soil
	  o 0-2 feet bgs
	  o 5-7 feet bgs within fill (if fill is present)
	  o 13-15 feet bgs within fill (if fill is present) or above the water table, whichever is less
	  o Uppermost 2 feet of native soil below fill (if less than 15 feet bgs)
		• TPH – Dx
		• TPH – Gx
		• BTEX and fuel additives
		• Metals
		• SVOCs
		• Chlorinated Pesticides/Herbicides (four locations)

Recycle Pond
(AOC 7)
 	
Figure 17
	Pond Bottoms:
	• Soil
	  o Uppermost 2 feet of pond bottoms
	  o Uppermost 2 feet of native soil below pond bottoms
		• TPH – Dx
		• TPH – Gx
		• BTEX and fuel additives
		• Metals
		• SVOCs
		• VOCs
		• Chlorinated Pesticides/Herbicides

Table 2
Stage 1 Soil Sampling Intervals
Yakima Mill Site Remedial Investigation Work Plan
Yakima, Washington

Area of Concern	Sampling Intervals	COCs[1]
Settling Pond **(AOC 8)** Figure 17	**Pond Bottoms:** • Soil o Uppermost 2 feet of pond bottoms o Uppermost 2 feet of native soil below pond bottoms	• TPH – Dx • TPH – Gx • BTEX and fuel additives • Metals • SVOCs • VOCs • Chlorinated Pesticides/Herbicides
Fruitvale Wasteway **(AOC9)** Figure 17	**Culvert Discharge:** • Soil o 0-2 feet bgs at the wasteway discharge o 3-5 feet bgs if in sediment	• TPH – Dx • TPH – Gx • BTEX and fuel additives • Metals • SVOCs • VOCs
Mill Transformers **(AOC 10)** Figures 15 & 18	**Transformers:** • Soil o 0-2 feet bgs	• TPH – Dx • PCBs
Large Log Sawmill (LLM) **(AOC 11)** Figure 18	**Dry Well:** • Soil o 2-foot interval at depth of dry well (visually identified) o 2-foot interval with highest field screening impacts, if impacts are identified o Uppermost non-impacted interval, or interval immediately above the water table, or 13-15 feet bgs, whichever is shallower	• TPH – Dx
	LLM surface staining: • Soil o Uppermost 2 feet beneath floor o 2-foot interval with highest field screening impacts, if impacts are identified o Uppermost non-impacted interval, or interval immediately above the water table, or 13-15 feet bgs, whichever is shallower	• TPH – Dx
Small Log Sawmill (SLM) **(AOC 12)** Figure 18	**SLM surface staining:** • Soil o Uppermost 2 feet beneath floor o 2-foot interval with highest field screening impacts, if impacts are identified o Uppermost non-impacted interval, or interval immediately above the water table, or 13-15 feet bgs, whichever is shallower	• TPH – Dx

Table 2
Stage 1 Soil Sampling Intervals
Yakima Mill Site Remedial Investigation Work Plan
Yakima, Washington

Area of Concern	Sampling Intervals	COCs[1]
	<u>Used Oil Containers:</u> - Soil o Uppermost 2 feet beneath asphalt o 2-foot interval with highest field screening impacts, if impacts are identified o Uppermost non-impacted interval, or interval immediately above the water table, or 13-15 feet bgs, whichever is shallower	- TPH – Dx - TPH – Gx - BTEX and fuel additives - SVOCs - Metals
	<u>Storm Drains:</u> - Soil o 2-foot interval at depth of storm drain o 2-foot interval with highest field screening impacts, if impacts are identified o Uppermost non-impacted interval, or immediately above the water table, or 13-15 feet bgs, whichever is shallower	- TPH – Dx
Boiler House **(AOC 13)** Figure 19	**<u>Capacitor:</u>** - Soil o 0-2 feet bgs	- TPH – Dx - PCBs
	<u>Boiler Chemical Storage:</u> - Soil o 0-2 feet bgs o 5-7 feet bgs	- Metals - SVOCs - VOCs
Hog Fuel Pile **(AOC 14)** Figure 19	**<u>Hog Fuel Pile:</u>** - Soil o 0-2 feet bgs o 5-7 feet bgs o 13-15 feet bgs or interval immediately above water table, whichever is shallower	- TPH – Dx - TPH – Gx - BTEX and fuel additives - Metals - SVOCs - VOCs - Chlorinated Pesticides/Herbicides
Paint, Machine, and Storage Shed **(AOC 15)** Figure 19	**<u>Chemical Storage:</u>** - Soil o 0-2 feet bgs o 5-7 feet bgs	- TPH – Dx - TPH – Gx - BTEX and fuel additives - Metals - SVOCs - VOCs - Chlorinated Pesticides/Herbicides

Table 2
Stage 1 Soil Sampling Intervals
Yakima Mill Site Remedial Investigation Work Plan
Yakima, Washington

Area of Concern	Sampling Intervals	COCs[1]
Fuel Distribution System **(AOC 16)** Figure 20	**Log Yard Fuel Dispensers:** • Soil o 0-2 feet bgs o 2-foot interval with highest field screening impacts, if impacts are identified o Uppermost non-impacted interval, or interval immediately above the water table, or 13-15 feet bgs, whichever is shallower	• TPH – Dx • TPH – Gx • BTEX and fuel additives
	Gasoline Dispenser: • Soil o 0-2 feet bgs o 2-foot interval with highest field screening impacts, if impacts are identified o Uppermost non-impacted interval, or interval immediately above the water table, or 13-15 feet bgs, whichever is shallower	• TPH – Dx • TPH – Gx • BTEX and fuel additives
	Diesel Fuel Dispenser: • Soil o 0-2 feet bgs o 2-foot interval with highest field screening impacts, if impacts are identified o Uppermost non-impacted interval, or interval immediately above the water table, or 13-15 feet bgs, whichever is shallower	• TPH – Dx • TPH – Gx • BTEX and fuel additives
	Distribution Piping: • Soil o 2-foot interval at depth of distribution piping (approximately 3-5 feet bgs) o 2-foot interval with highest field screening impacts, if impacts are identified o Uppermost non-impacted interval, or interval immediately above the water table, or 13-15 feet bgs, whichever is shallower	• TPH – Dx • TPH – Gx • BTEX and fuel additives
Mill Supply Warehouse and Auto Repair Shop **(AOC 17)** Figure 21	**Auto Repair Shop Surface Releases:** • Soil o 0-2 feet bgs o 5-7 feet bgs	• TPH – Dx • TPH – Gx • BTEX and fuel additives • Metals • SVOCs • VOCs

Table 2
Stage 1 Soil Sampling Intervals
Yakima Mill Site Remedial Investigation Work Plan
Yakima, Washington

Area of Concern	Sampling Intervals	COCs[1]
Oil House/ Service Pit **(AOC 18)** Figure 21	**Oil Storage:** • Soil o 0-2 feet bgs o 5-7 feet bgs	• TPH – Dx • TPH – Gx • BTEX and fuel additives • Metals • SVOCs • VOCs
Log Yard Shop **AOC 19)** Figure 21	**Chemical Use/Storage:** • Soil o 0-2 feet bgs o 5-7 feet bgs o 13-15 feet bgs (if fill is present)	• TPH – Dx • TPH – Gx • BTEX and fuel additives • Metals • SVOCs • VOCs
Plywood Plant **(AOC 20)** Figure 22	**Lathe Pit:** • Soil o 13-15 feet bgs (approximate depth of bottom of lathe pit)	• TPH – Dx • SVOCs
	Press Pits and Resin Storage Area: • Soil o 0-2 feet bgs o 5-7 feet bgs o 13-15 feet bgs	• TPH – Dx • SVOCs • Metals
	Data Gap from previous sample SS-5: • Soil o 0-2 feet bgs o 5-7 feet bgs	• TPH – Dx • TPH – Gx • BTEX and fuel additives • Metals • SVOCs
	Used Oil Storage: • Soil o 0-2 feet bgs o 5-7 feet bgs	• TPH – Dx • TPH – Gx • BTEX and fuel additives • Metals • SVOCs
Equalization Pond **(AOC 21)** Figure 22	**Pond Fill / Pond Bottoms:** • Soil o 0-2 feet bgs o 5-7 feet bgs o Pond bottoms o Uppermost 2 feet of native soil below pond bottoms	• TPH – Dx • TPH – Gx • BTEX and fuel additives • Metals • SVOCs • VOCs • Chlorinated Pesticides/Herbicides
Plywood Transformers **(AOC 22)** Figure 22	**Transformers:** • Soil o 0-2 feet bgs	• TPH – Dx • PCBs

Table 2
Stage 1 Soil Sampling Intervals
Yakima Mill Site Remedial Investigation Work Plan
Yakima, Washington

Area of Concern	Sampling Intervals	COCs[1]
Barker Building **(AOC 23)** Figure 22	**Downgradient of lathe pit:** • Soil o 0-2 feet bgs o 2-foot interval with highest field screening impacts, if impacts are identified o Uppermost non-impacted interval, or interval immediately above the water table, or 13-15 feet bgs, whichever is shallower	• TPH – Dx
	Oil use/staining: • Soil o 0-2 feet bgs o 2-foot interval with highest field screening impacts, if impacts are identified o Uppermost non-impacted interval, or interval immediately above the water table, or 13-15 feet bgs, whichever is shallower	• TPH – Dx
Southwest Area **(AOC 24)** Figure 23	**Truck Parking:** • Soil o 0-2 feet bgs o 5-7 feet bgs o 13-15 feet bgs	• TPH – Dx • TPH – Gx • BTEX and fuel additives • Chlorinated Pesticides/Herbicides
Machine Shop Pit **(AOC 27)** Figure 19	**Pit:** • Soil o 0-2 feet bgs o 5-7 feet bgs	• TPH – Dx • TPH – Gx • BTEX and fuel additives • Metals • SVOCs • VOCs

Footnote 1:

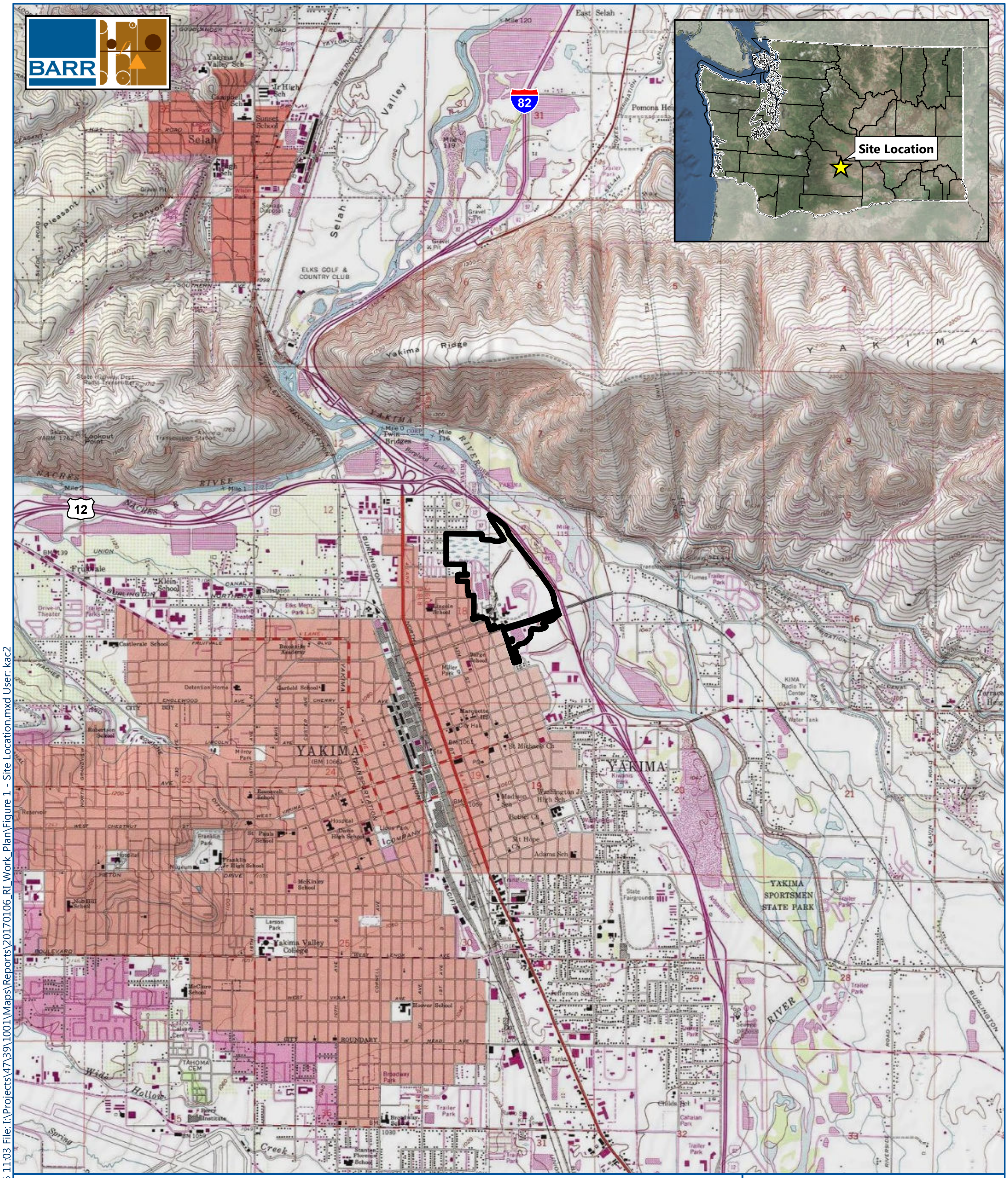
- **TPH-Dx** (includes heavy oil range) - analyzed by NWTPH-Dx/Dx Ext (with and without silica gel cleanup)
- **TPH-Gx** - analyzed by NWTWH-Gx
- **BTEX & Fuel Additives** (includes benzene; toluene; ethylbenzene; xylenes; EDB; EDC; MTBE; and lead) – BTEX, EDB, EDC, and MTBE analyzed by EPA Method 8260; lead analyzed by EPA Method 6020
- **Metals** (includes Cd; Cr_6 ; Cu; Pb; Ni; Zn; Ag; and As) – Cd, Cu, Pb, Ni, Zn, Ag, As analyzed by EPA Method 6020; Cr_6 analyzed by EPA Method 7196
- **VOCs** (includes acetone; MEK; carbon tetrachloride; chloroform; methylene chloride; tetrachloroethene; trichloroethene; and vinyl chloride) – analyzed by EPA Method 8260
- **SVOCs** (includes bis(2-ethylhexyl)phthalate; butyl benzyl phthalate; naphthalene; pentachlorophenol; benzo(a)anthracene; benzo(a)pyrene; benzo(b)fluoranthene; chrysene; dibenz(a,h)anthracene; and indeno(1,2,3-cd)pyrene) – analyzed by EPA Method 8270
- **Chlorinated Pesticides** (includes 4,4´-DDD; 4,4´-DDE; 4,4´-DDT; aldrin; alpha BHC; alpha-Chlordane; beta BHC; delta BHC; dieldrin; endosulfan I; endosulfan II; endosulfan sulfate; endrin; endrin aldehyde; endrin ketone; gamma BHC (Lindane); gamma-Chlordane; heptachlor; heptachlor epoxide; methoxychlor; and toxaphene) – analyzed by EPA Method 8081

- **Chlorinated Herbicides** (includes 2,4,5-T; 2,4,5-TP (Silvex); 2,4-D; 2,4-DB; 3,5-Dichlorobenzoic acid; 4-Nitrophenol; acifluorfen; bentazon; chloramben; dacthal (DCPA); dalapon; dicamba; 2,4-DP; dinoseb; MCPA; MCPP; picloram) – analyzed by EPA Method 8151A
- **PCBs** (includes Aroclor 1016; Aroclor 1221; Aroclor 1232; Aroclor 1242; Aroclor 1248; Aroclor 1254; Aroclor 1260; Aroclor 1262; Aroclor 1268) – analyzed by EPA Method 8082

Non-COC analytes not shown on this table

Work Plan Figures

(Title blocks updated from September 2018 Revised Final RI Work Plan submittal – no other changes)



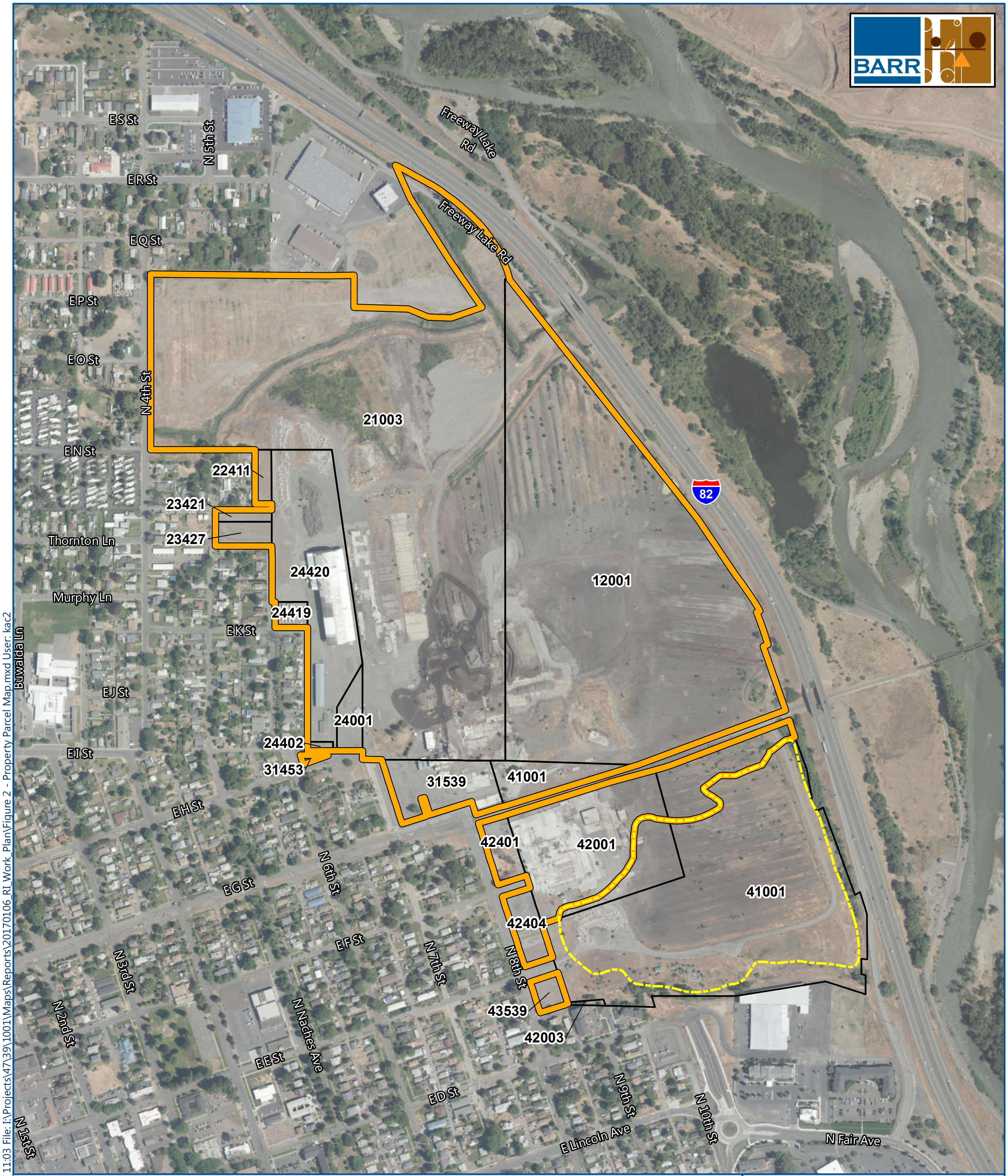
▭ Yakima Mill Site Boundary

Background Data: USGS 24k Quad (Copyright:© 2013 National Geographic Society, i-cubed); Aerial Imagery (Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community)

SITE LOCATION
Revised Final RI Work Plan-
January 2019
Yakima Mill Site
Yakima, WA

FIGURE 1

Barr Footer: ArcGIS 10.6, 2018-12-26 11:03 File: I:\Projects\47\39\1001\Maps\Reports\20170106_RI Work Plan\Figure 1 - Site Location.mxd User: kac2



▭ Yakima Mill Site Boundary (Site)

▭ Approximate Extent of Municipal Solid Waste (Landfill Site)

▭ Tax Parcel Boundary and Parcel Number (191318-XXXXX)

Background Aerial Imagery Source:
City of Yakima (June 2017)

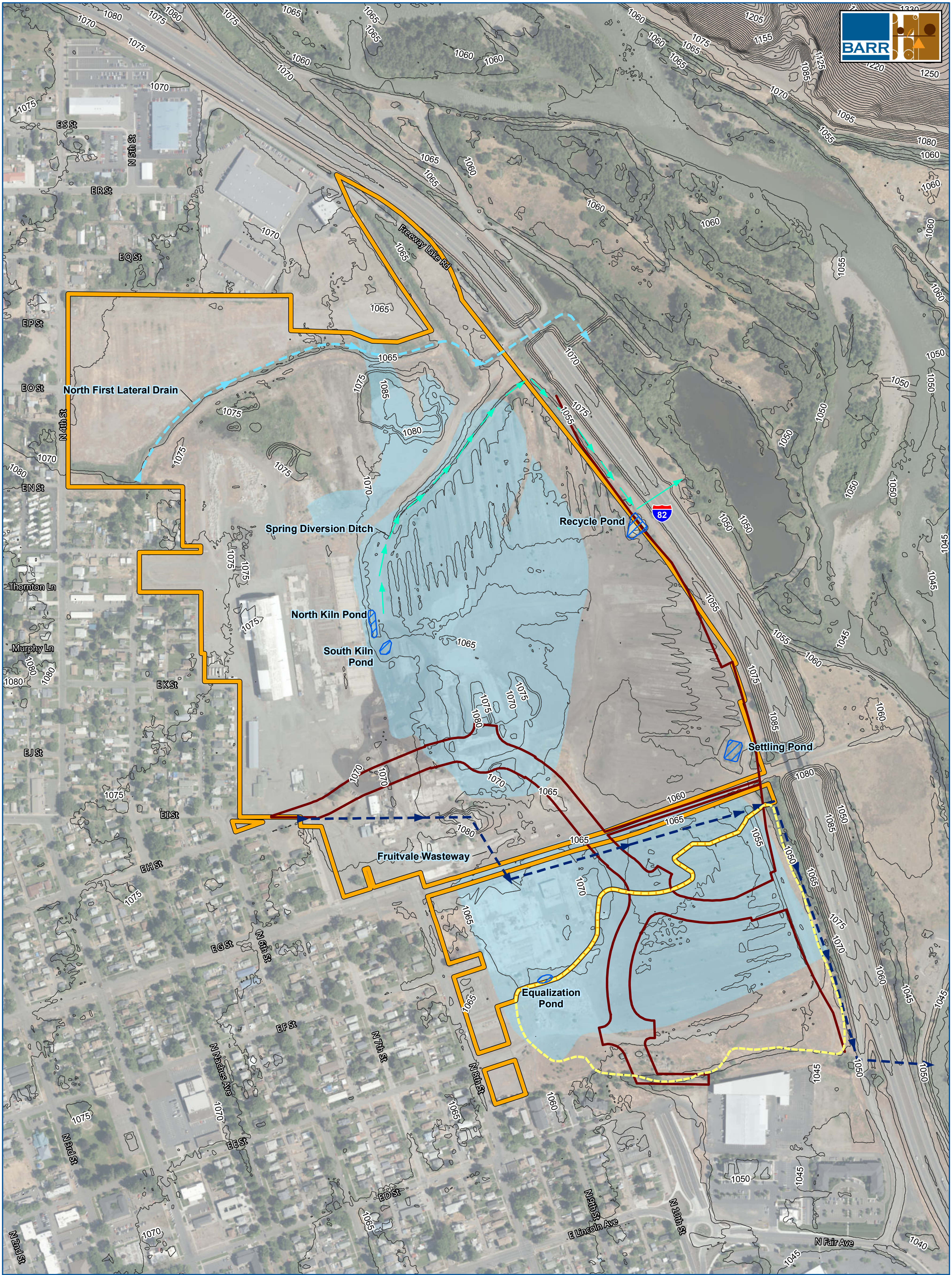
N

0 700 1,400
Feet

PROPERTY PARCEL MAP
Revised Final RI Work Plan-
January 2019
Yakima Mill Site
Yakima, WA

FIGURE 2

Barr Footer: ArcGIS 10.6, 2018-12-26 11:03 File: I:\Projects\47\39\1001\Maps\Reports\20170106_RI Work Plan\Figure 2 - Property Parcel Map.mxd User: kac2



Background Aerial Imagery Source:
City of Yakima (June 2017)

- ▭ Yakima Mill Site Boundary
- ▭ Approximate Extent of Municipal Solid Waste (Landfill Site)
- ▨ Former Mill Operation Ponds
- ▨ Historical Log Pond Extent (1947)
- - - Fruitvale Wasteway
- - - North First Lateral Drain
- - - Spring Diversion Ditch
- ～ 5ft Contour (Puget Sound LiDAR Consortium (PSLC), 2005)
- — Proposed Roadway Right-of-Way

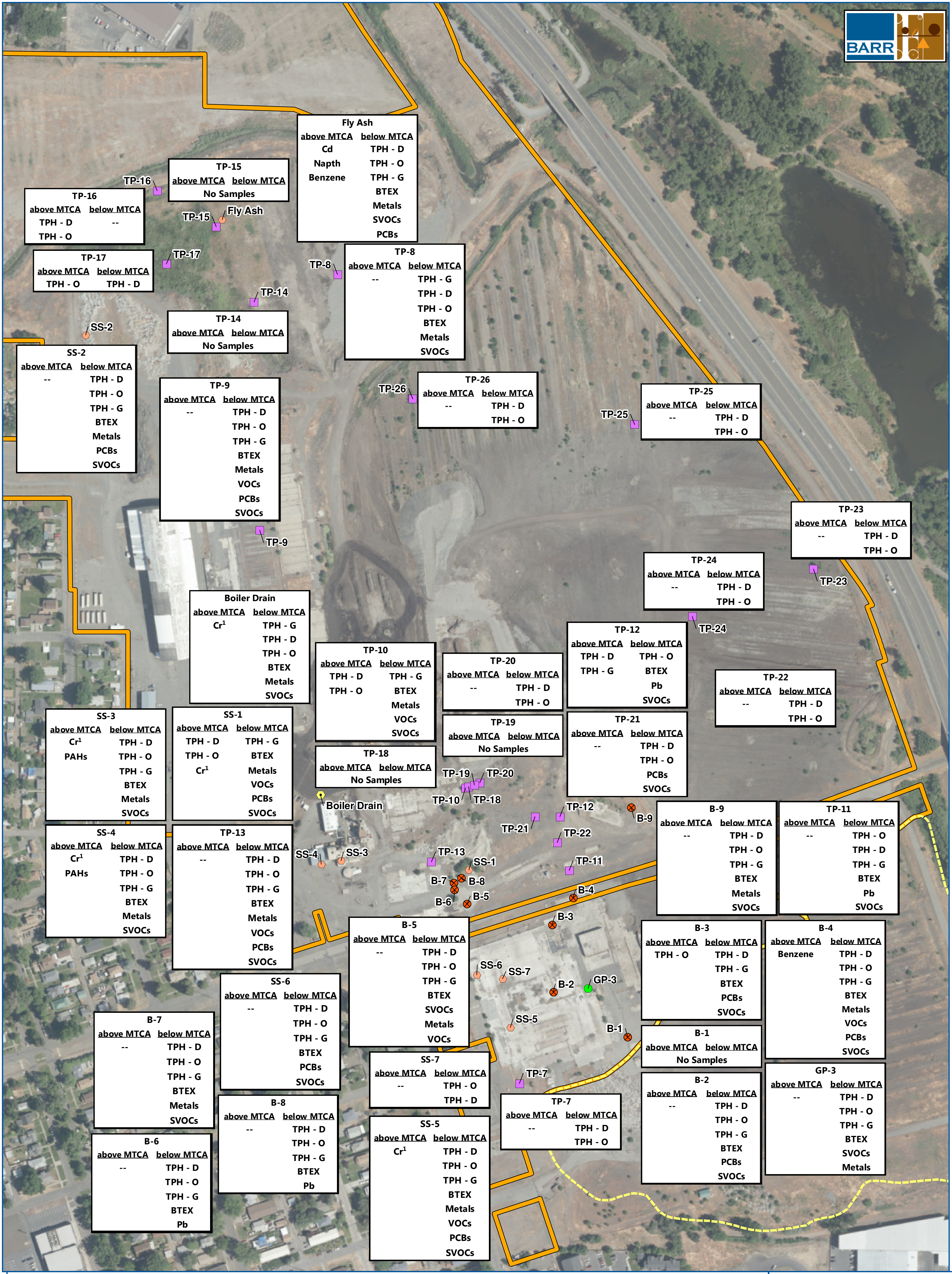
Note: Log yard material recovery has resulted in changes in topography relative to 2005 survey.

N

0 450 900
Feet

SITE LAYOUT
Revised Final RI Work Plan-
January 2019
Yakima Mill Site
Yakima, WA

FIGURE 3



Fly Ash

above MTCA	below MTCA
Cd	TPH - D
Napth	TPH - O
Benzene	TPH - G
	BTEX
	Metals
	SVOCs
	PCBs

TP-15

above MTCA	below MTCA
No Samples	

TP-16

above MTCA	below MTCA
TPH - D	--
TPH - O	

TP-17

above MTCA	below MTCA
TPH - O	TPH - D

TP-8

above MTCA	below MTCA
--	TPH - G
	TPH - D
	TPH - O
	BTEX
	Metals
	SVOCs

TP-14

above MTCA	below MTCA
No Samples	

SS-2

above MTCA	below MTCA
--	TPH - D
	TPH - O
	TPH - G
	BTEX
	Metals
	PCBs
	SVOCs

TP-9

above MTCA	below MTCA
--	TPH - D
	TPH - O
	TPH - G
	BTEX
	Metals
	VOCs
	PCBs
	SVOCs

TP-26

above MTCA	below MTCA
--	TPH - D
	TPH - O

TP-25

above MTCA	below MTCA
--	TPH - D
	TPH - O

TP-23

above MTCA	below MTCA
--	TPH - D
	TPH - O

TP-24

above MTCA	below MTCA
--	TPH - D
	TPH - O

Boiler Drain

above MTCA	below MTCA
Cr[1]	TPH - G
	TPH - D
	TPH - O
	BTEX
	Metals
	SVOCs

TP-10

above MTCA	below MTCA
TPH - D	TPH - G
TPH - O	BTEX
	Metals
	VOCs
	SVOCs

TP-20

above MTCA	below MTCA
--	TPH - D
	TPH - O

TP-12

above MTCA	below MTCA
TPH - D	TPH - O
TPH - G	BTEX
	Pb
	SVOCs

TP-22

above MTCA	below MTCA
--	TPH - D
	TPH - O

TP-19

above MTCA	below MTCA
No Samples	

TP-21

above MTCA	below MTCA
--	TPH - D
	TPH - O
	PCBs
	SVOCs

TP-18

above MTCA	below MTCA
No Samples	

SS-3

above MTCA	below MTCA
Cr[1]	TPH - D
PAHs	TPH - O
	TPH - G
	BTEX
	Metals
	SVOCs

SS-1

above MTCA	below MTCA
TPH - D	TPH - G
TPH - O	BTEX
Cr[1]	Metals
	VOCs
	PCBs
	SVOCs

B-9

above MTCA	below MTCA
--	TPH - D
	TPH - O
	TPH - G
	BTEX
	Metals
	SVOCs

TP-11

above MTCA	below MTCA
--	TPH - O
	TPH - D
	TPH - G
	BTEX
	Pb
	SVOCs

SS-4

above MTCA	below MTCA
Cr[1]	TPH - D
PAHs	TPH - O
	TPH - G
	BTEX
	Metals
	SVOCs

TP-13

above MTCA	below MTCA
--	TPH - D
	TPH - O
	TPH - G
	BTEX
	Metals
	VOCs
	PCBs
	SVOCs

B-5

above MTCA	below MTCA
--	TPH - D
	TPH - O
	TPH - G
	BTEX
	SVOCs
	Metals
	VOCs

B-3

above MTCA	below MTCA
TPH - O	TPH - D
	TPH - G
	BTEX
	PCBs
	SVOCs

B-4

above MTCA	below MTCA
Benzene	TPH - D
	TPH - O
	TPH - G
	BTEX
	Metals
	VOCs
	PCBs
	SVOCs

SS-6

above MTCA	below MTCA
--	TPH - D
	TPH - O
	TPH - G
	BTEX
	PCBs
	SVOCs

B-7

above MTCA	below MTCA
--	TPH - D
	TPH - O
	TPH - G
	BTEX
	Metals
	SVOCs

B-1

above MTCA	below MTCA
No Samples	

SS-7

above MTCA	below MTCA
--	TPH - O
	TPH - D

GP-3

above MTCA	below MTCA
--	TPH - D
	TPH - O
	TPH - G
	BTEX
	SVOCs
	Metals

B-2

above MTCA	below MTCA
--	TPH - D
	TPH - O
	TPH - G
	BTEX
	PCBs
	SVOCs

TP-7

above MTCA	below MTCA
--	TPH - D
	TPH - O

B-8

above MTCA	below MTCA
--	TPH - D
	TPH - O
	TPH - G
	BTEX
	Pb

SS-5

above MTCA	below MTCA
Cr[1]	TPH - D
	TPH - O
	TPH - G
	BTEX
	Metals
	VOCs
	PCBs
	SVOCs

B-6

above MTCA	below MTCA
--	TPH - D
	TPH - O
	TPH - G
	BTEX
	Pb

▭ Yakima Mill Site Boundary

▭ Approximate Extent of Municipal Solid Waste (Landfill Site)

Sampling Locations

⊗ Soil Boring

● Soil Gas

⊙ Soil Sample

⬢ Surface Soil Sample

■ Test Pit

Note: Soil sample concentrations compared to MTCA Method A, MTCA Method B cleanup levels or screening levels.

[1] Cr not speciated but compared to MTCA Cr(6) CUL.

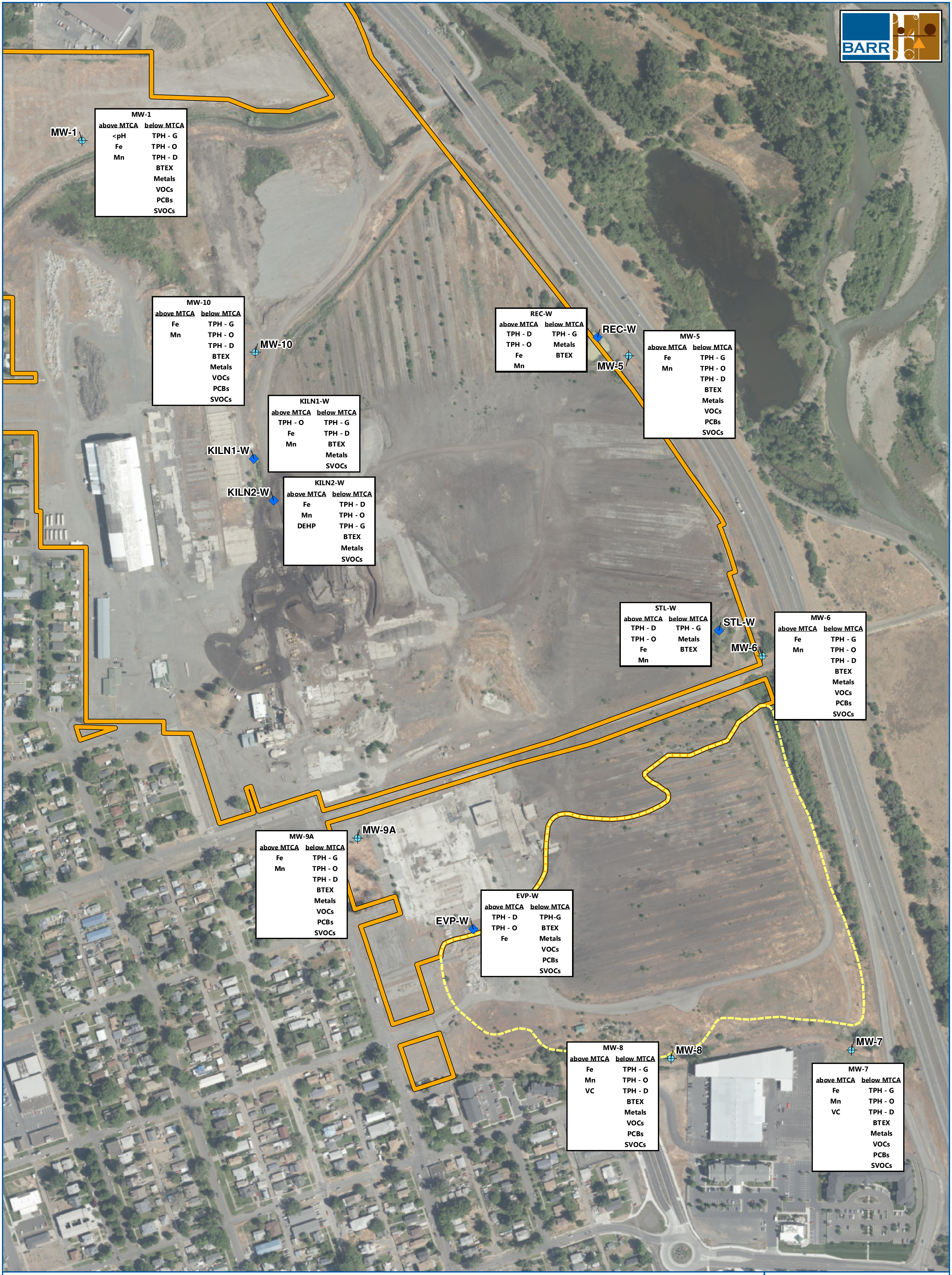
Background Aerial Imagery Source:
City of Yakima (June 2017)

N

0 300 600
Feet

HISTORICAL SOIL SAMPLING RESULTS - PARAMETRIX 2008
Revised Final RI Work Plan-
January 2019
Yakima Mill Site
Yakima, WA

FIGURE 4



MW-1

above MTCA	below MTCA
<pH	TPH - G
Fe	TPH - O
Mn	TPH - D
	BTEX
	Metals
	VOCs
	PCBs
	SVOCs

MW-10

above MTCA	below MTCA
Fe	TPH - G
Mn	TPH - O
	TPH - D
	BTEX
	Metals
	VOCs
	PCBs
	SVOCs

REC-W

above MTCA	below MTCA
TPH - D	TPH - G
TPH - O	Metals
Fe	BTEX
Mn	

MW-5

above MTCA	below MTCA
Fe	TPH - G
Mn	TPH - O
	TPH - D
	BTEX
	Metals
	VOCs
	PCBs
	SVOCs

KILN1-W

above MTCA	below MTCA
TPH - O	TPH - G
Fe	TPH - D
Mn	BTEX
	Metals
	SVOCs

KILN2-W

above MTCA	below MTCA
Fe	TPH - D
Mn	TPH - O
DEHP	TPH - G
	BTEX
	Metals
	SVOCs

STL-W

above MTCA	below MTCA
TPH - D	TPH - G
TPH - O	Metals
Fe	BTEX
Mn	

MW-6

above MTCA	below MTCA
Fe	TPH - G
Mn	TPH - O
	TPH - D
	BTEX
	Metals
	VOCs
	PCBs
	SVOCs

MW-9A

above MTCA	below MTCA
Fe	TPH - G
Mn	TPH - O
	TPH - D
	BTEX
	Metals
	VOCs
	PCBs
	SVOCs

EVP-W

above MTCA	below MTCA
TPH - D	TPH-G
TPH - O	BTEX
Fe	Metals
	VOCs
	PCBs
	SVOCs

MW-8

above MTCA	below MTCA
Fe	TPH - G
Mn	TPH - O
VC	TPH - D
	BTEX
	Metals
	VOCs
	PCBs
	SVOCs

MW-7

above MTCA	below MTCA
Fe	TPH - G
Mn	TPH - O
VC	TPH - D
	BTEX
	Metals
	VOCs
	PCBs
	SVOCs

▭ Yakima Mill Site Boundary

▭ Approximate Extent of Municipal Solid Waste (Landfill Site)

Sampling Locations

◆ Surface Water Sampling Location

⌖ Groundwater Sampling Location

Note: Soil sample concentrations compared to MTCA Method A, MTCA Method B cleanup levels or screening levels.

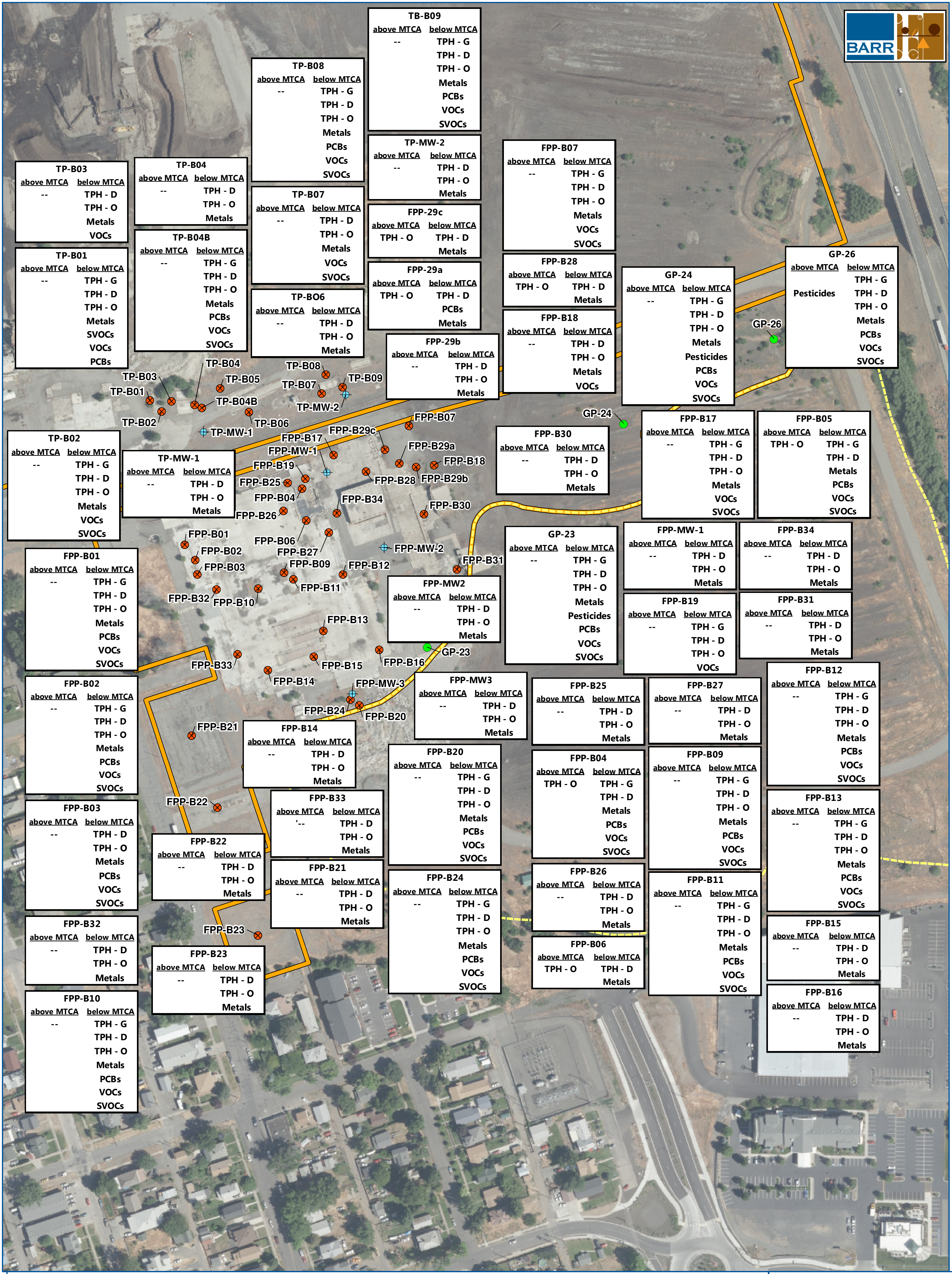
N

0 350 700
Feet

Background Aerial Imagery Source:
City of Yakima (June 2017)

HISTORICAL SURFACE WATER AND GROUNDWATER SAMPLING RESULTS - PARAMETRIX 2008
Revised Final RI Work Plan-
January 2019
Yakima Mill Site
Yakima, WA

FIGURE 5



▭	Yakima Mill Site Boundary
▭	Approximate Extent of Municipal Solid Waste (Landfill Site)

Sampling Locations

⊗	Soil Boring
●	Soil Gas
⊕	Well (Active)

Note: Soil sample concentrations compared to MTCA Method A, MTCA Method B cleanup levels or screening levels.

N

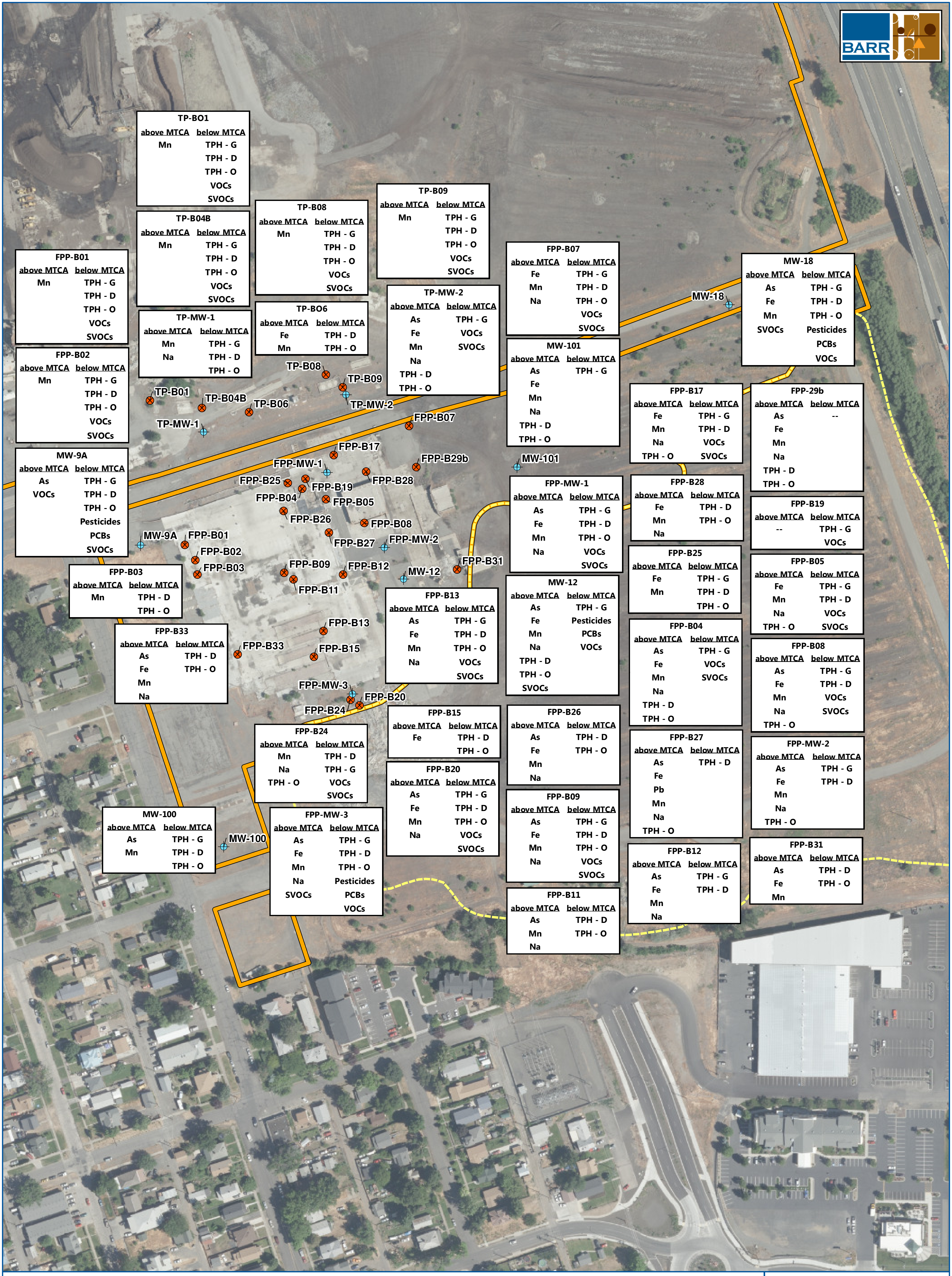
0 200 400
Feet

Background Aerial Imagery Source:
City of Yakima (June 2017)

HISTORICAL SOIL SAMPLING RESULTS - LANDAU 2013-2015
Revised Final RI Work Plan-
January 2019
Yakima Mill Site
Yakima, WA

FIGURE 6

Barr Footer: ArcGIS 10.6, 2018-12-26 11:26 File: I:\Projects\47\39\1001\Maps\Reports\20170106_RI_Work_Plan\Figure 7 - Historical Groundwater Sampling Results - Landau 2013-2015.mxd User: kac2



Yakima Mill Site Boundary

Approximate Extent of Municipal Solid Waste (Landfill Site)

Sampling Locations

Soil Boring

Well (Active)

Note: Soil sample concentrations compared to MTCA Method A, MTCA Method B cleanup levels or screening levels.

0 200 400

Feet

Background Aerial Imagery Source: City of Yakima (June 2017)

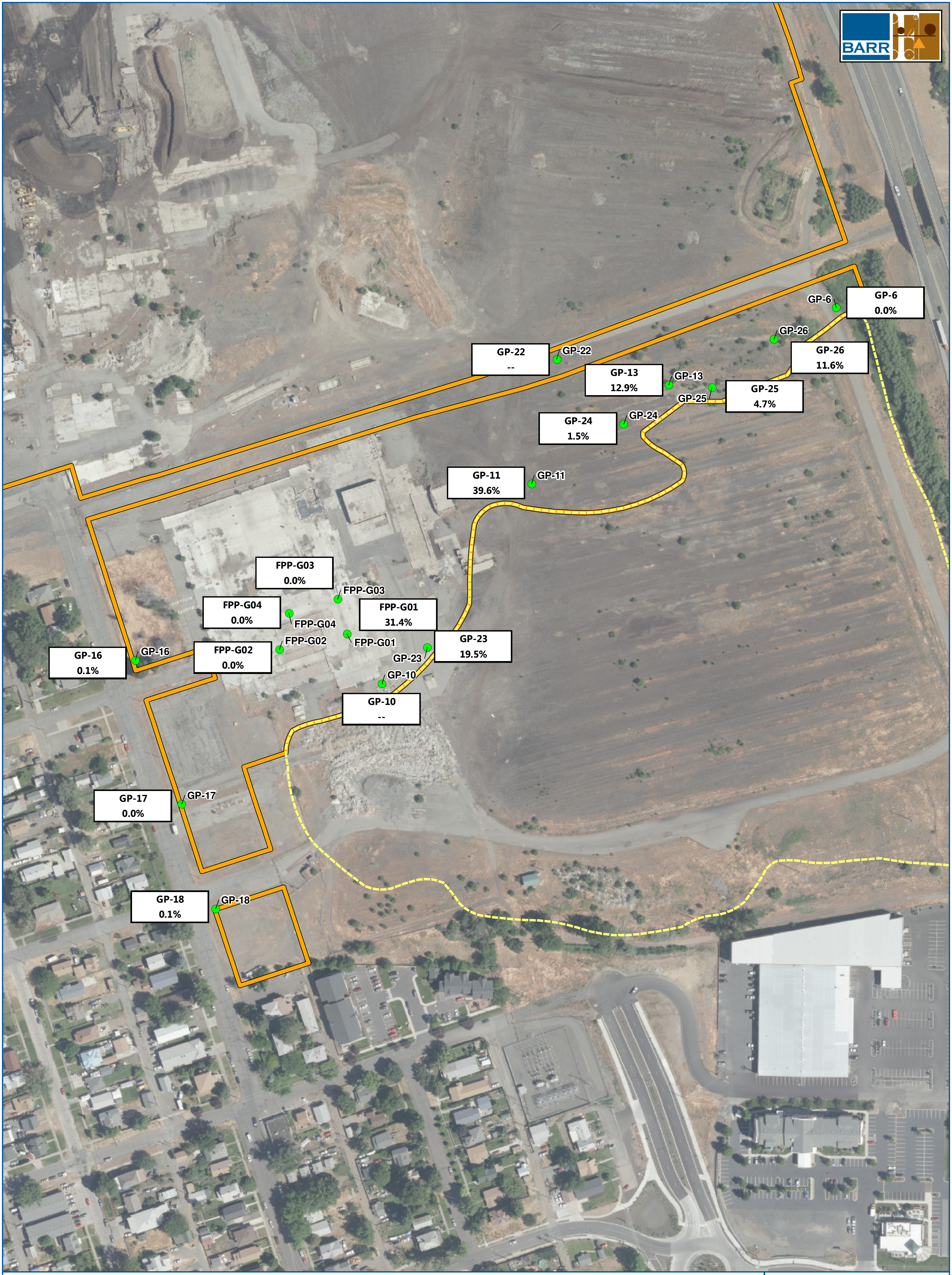
HISTORICAL GROUNDWATER SAMPLING RESULTS- LANDAU 2013-2015

Revised Final RI Work Plan- January 2019

Yakima Mill Site

Yakima, WA

FIGURE 7



🟧 Yakima Mill Site Boundary

▭ Approximate Extent of Municipal Solid Waste (Landfill Site)

Sampling Locations

● Soil Gas

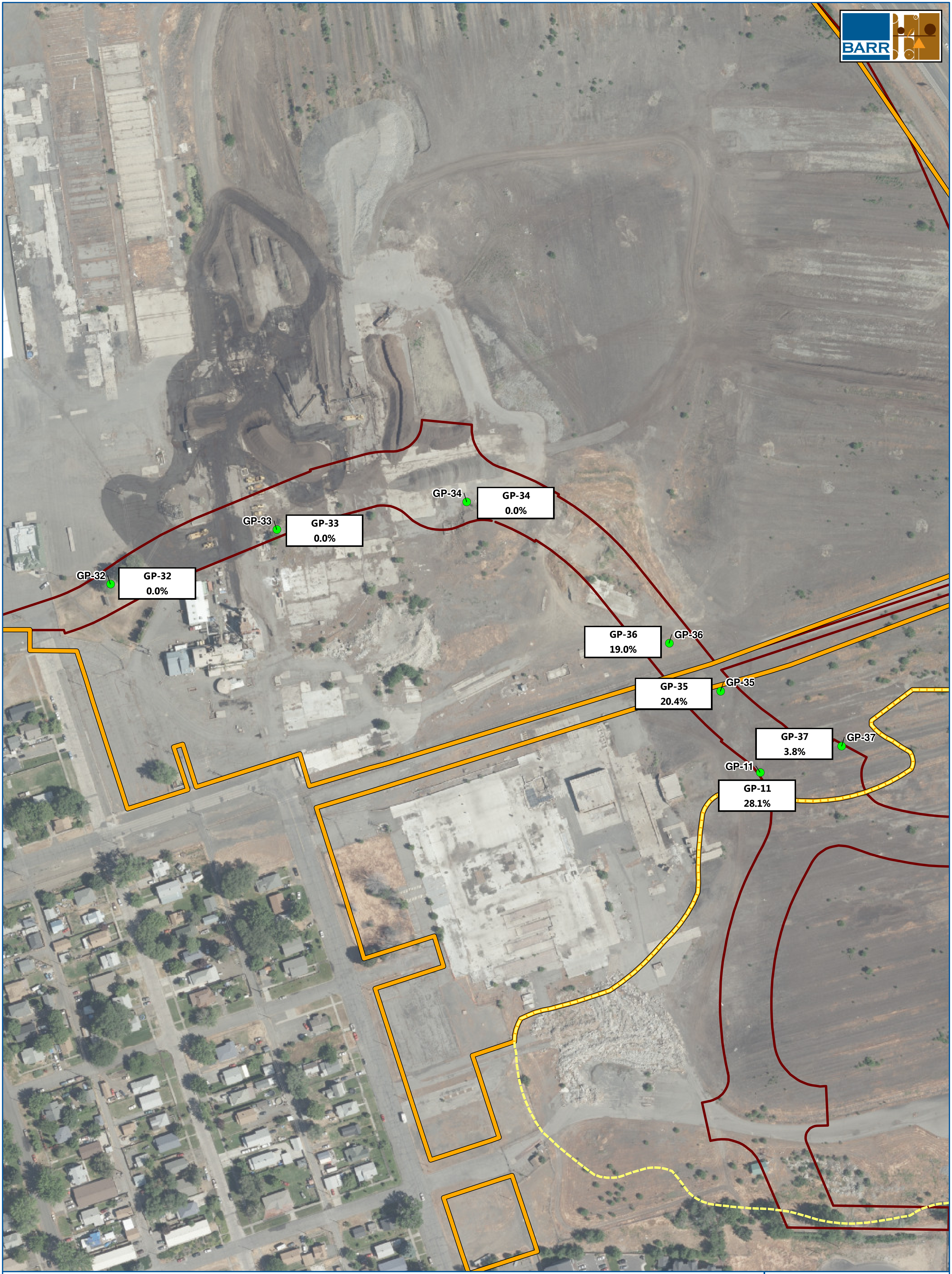
Note: Maximum methane concentration (%) from June 2013, January 2015 or June 2015 sampling events is shown.

0 200 400
Feet

Background Aerial Imagery Source:
City of Yakima (June 2017)

HISTORICAL METHANE SAMPLING RESULTS-LANDAU 2013-2015
Revised Final RI Work Plan-
January 2019
Yakima Mill Site
Yakima, WA

FIGURE 8



🟧 Yakima Mill Site Boundary

▭ Approximate Extent of Municipal Solid Waste (Landfill Site)

— Proposed Roadway Right-of-Way

Sampling Locations

● Soil Gas

Note: Maximum methane concentration (%) from October 2016, November 2016, December 21, 2016 or December 29, 2016 sampling event is shown.

N

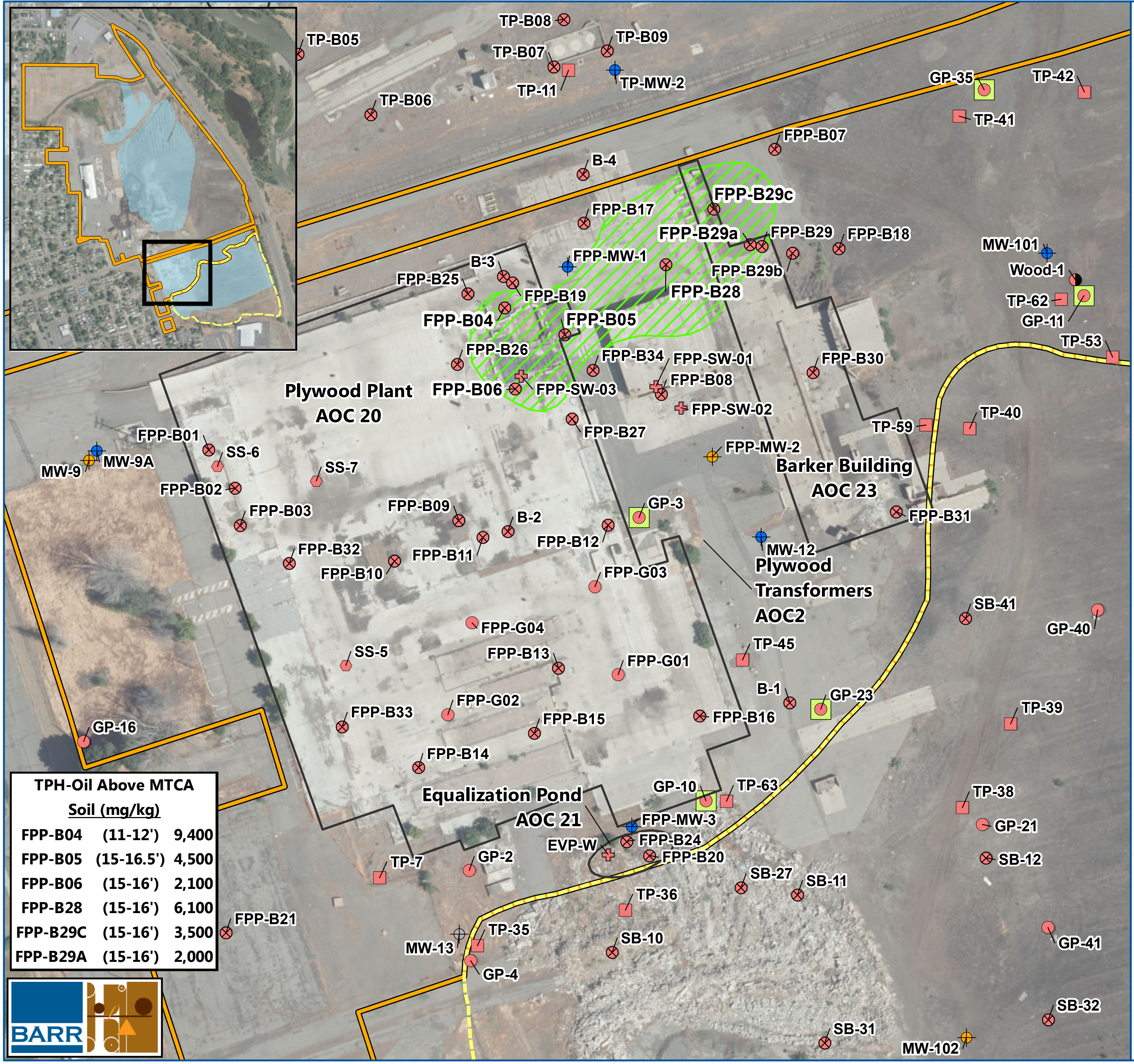
0 200 400

Feet

Background Aerial Imagery Source:
City of Yakima (June 2017)

METHANE SAMPLING RESULTS -
LANDAU 2016
Revised Final RI Work Plan-
January 2019
Yakima Mill Site
Yakima, WA

FIGURE 9



TPH-Oil Above MTCA Soil (mg/kg)

FPP-B04	(11-12')	9,400
FPP-B05	(15-16.5')	4,500
FPP-B06	(15-16')	2,100
FPP-B28	(15-16')	6,100
FPP-B29C	(15-16')	3,500
FPP-B29A	(15-16')	2,000

▭	Yakima Mill Site Boundary
▭	Approximate Extent of Municipal Solid Waste
▨	Historical Log Pond Extent
▭	Historical Site Feature
▨	Est. TPH-Oil Concentration Above 2,000 mg/kg (MTCA CUL)

Previous Investigation Location

⊗	Soil Boring
●	Soil Gas Point (Not Monitored in RI)
⬢	Surface Soil Sample
■	Test Pit
✚	Surface Water Sample
◑	Wood Waste Sample

Existing Well

⊕	Monitoring Well (To be Sampled in RI)
⊕	Well (Not Sampled in RI)
⊕	Monitoring Well (Abandoned)

N

0 120 240

Feet

Background Aerial Imagery Source:
City of Yakima (June 2017)

EXTENT OF SOIL EXCEEDING
MTCA TPH CLEANUP LEVELS -
PLYWOOD PLANT / BARKER
BUILDING
Revised Final RI Work Plan-
January 2019
Yakima Mill Site
Yakima, WA

FIGURE 10

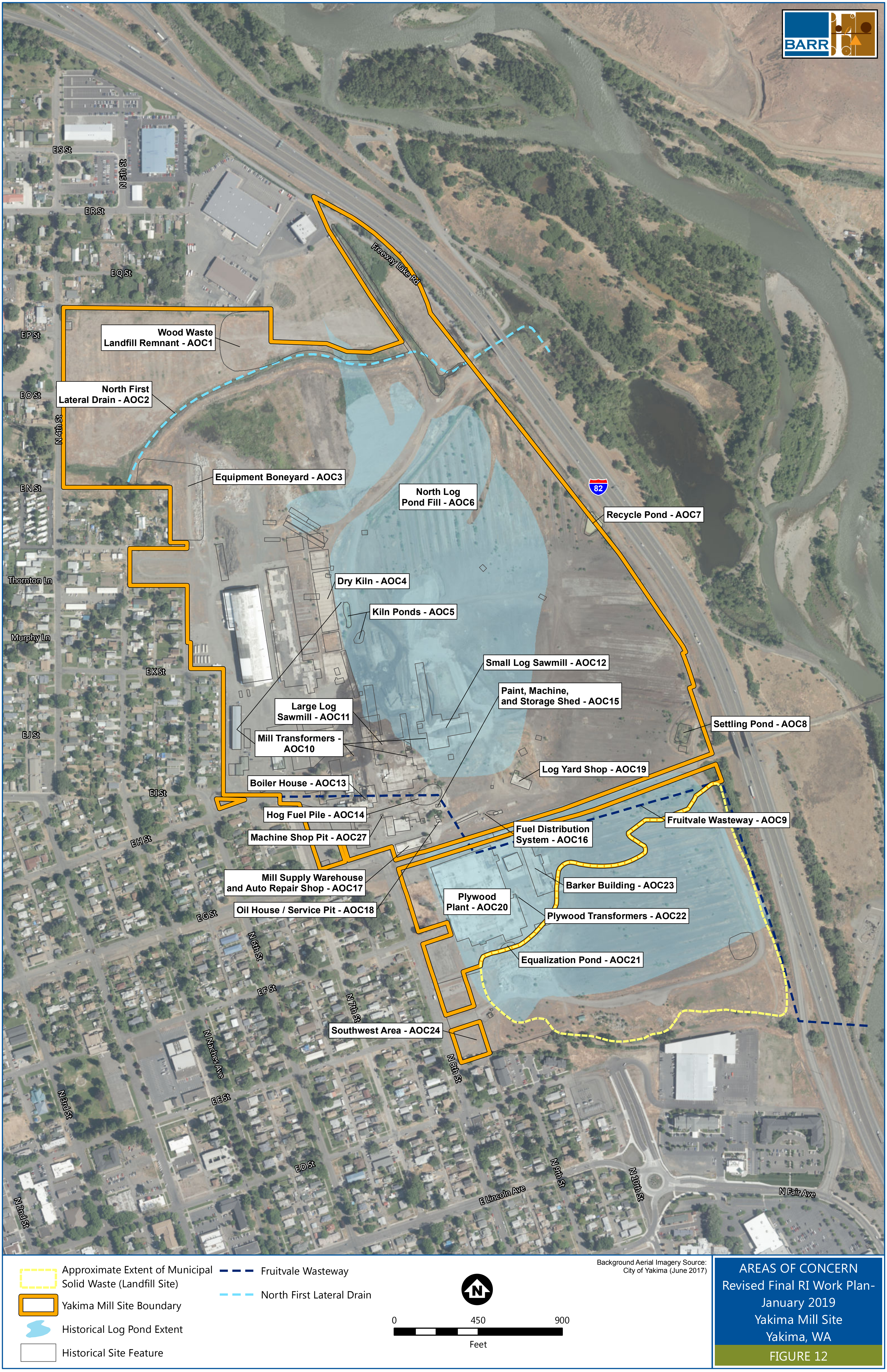
Results reported in **BOLD** are above the MTCA Method A Cleanup Level of 500 µg/L.

Background Aerial Imagery Source: City of Yakima (June 2017)

TPH (DIESEL AND OIL RANGE) IN GROUNDWATER - LANDAU 2013-2015
Revised Final RI Work Plan-
January 2019
Yakima, WA

FIGURE 11

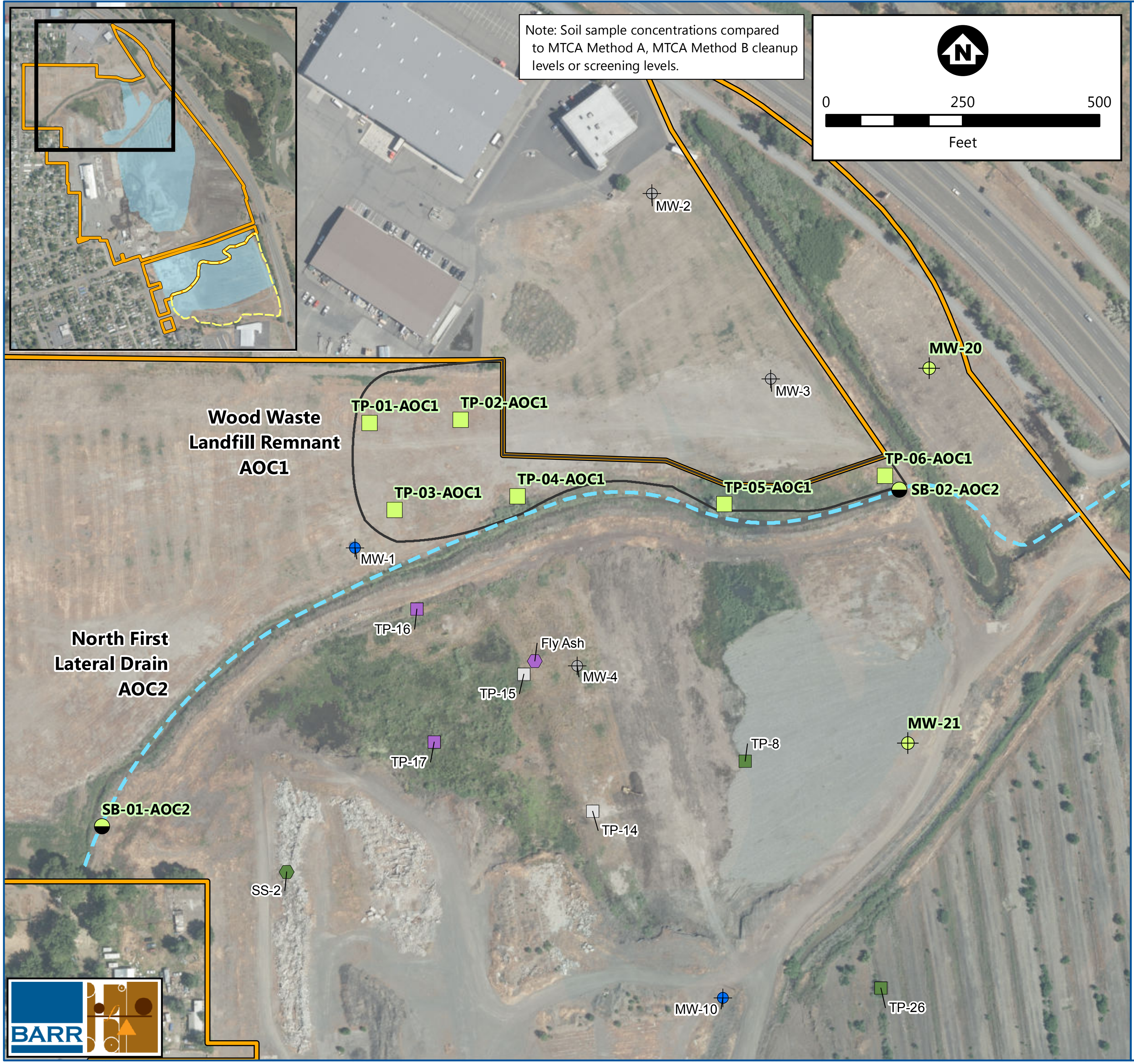
Barr Footer: ArcGIS 10.6, 2018-12-26 11:22 File: I:\Projects\47\39\1001\Maps\Reports\2017\0106_RI_Work_Plan\Figure 11 - TPH (Diesel and Oil Range) in Groundwater - Landau 2013-2015.mxd User: kac2



Background Aerial Imagery Source: City of Yakima (June 2017)

AREAS OF CONCERN
Revised Final RI Work Plan-
January 2019
Yakima Mill Site
Yakima, WA

FIGURE 12



Note: Soil sample concentrations compared to MTCA Method A, MTCA Method B cleanup levels or screening levels.

▭ Yakima Mill Site Boundary

▭ Approximate Extent of Municipal Solid Waste

Historical Log Pond Extent

▭ Historical Site Feature

-- North First Lateral Drain

Proposed Investigation Location

◒ Ditch Bottom Sample

⊕ Monitoring Well

🟩 Test Pit

Previous Investigation Location

⬡ Surface Soil Sample

☐ Test Pit

🟪 Location Above MTCA Cleanup Levels

🟩 Location Below MTCA Cleanup Levels

⬜ No Sample Collected

Existing Well

⊕ Monitoring Well (To be Sampled in RI)

⊕ Monitoring Well (Abandoned)

Background Aerial Imagery Source:
City of Yakima (June 2017)

WOOD WASTE LANDFILL REMNANT AND NORTH FIRST LATERAL DRAIN
Proposed RI Investigation Locations
Revised Final RI Work Plan-
January 2019
Yakima Mill Site
Yakima, WA

FIGURE 13

▭ Yakima Mill Site Boundary

▭ Approximate Extent of Municipal Solid Waste

Historical Log Pond Extent

▭ Historical Site Feature

Proposed Investigation Location

🟩 Test Pit

🟪 Location Above MTCA Cleanup Levels

🟩 Location Below MTCA Cleanup Levels

⬜ No Sample Collected

Note: Soil sample concentrations compared to MTCA Method A, MTCA Method B cleanup levels or screening levels.

N

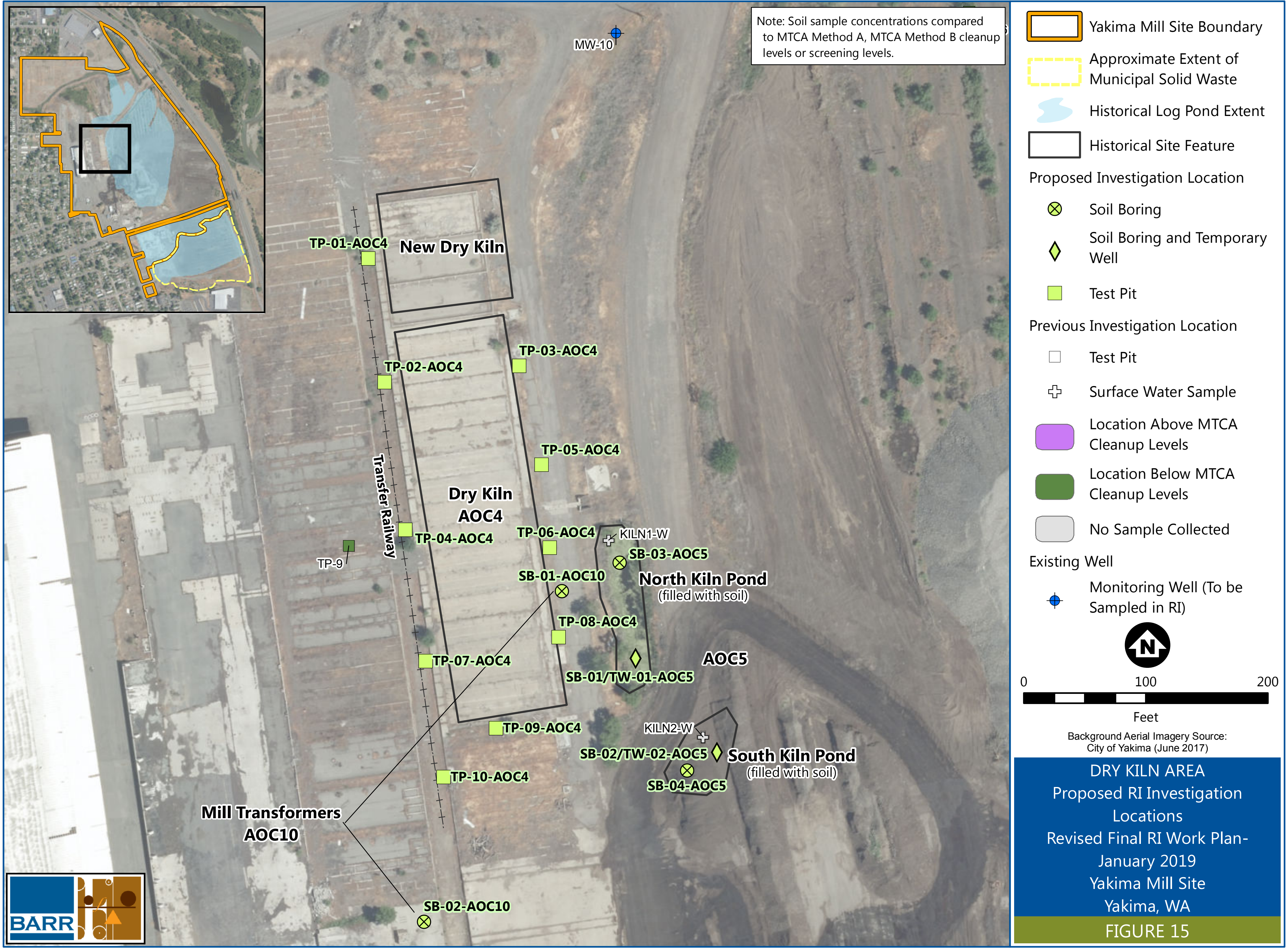
0 100 200

Feet

Background Aerial Imagery Source: City of Yakima (June 2017)

EQUIPMENT BONEYARD AREA
Proposed RI Investigation Locations
Revised Final RI Work Plan-
January 2019
Yakima Mill Site
Yakima, WA

FIGURE 14



Note: Soil sample concentrations compared to MTCA Method A, MTCA Method B cleanup levels or screening levels.

Background Aerial Imagery Source:
City of Yakima (June 2017)

DRY KILN AREA
Proposed RI Investigation Locations
Revised Final RI Work Plan-
January 2019
Yakima Mill Site
Yakima, WA

FIGURE 15

Barr Footer: ArcGIS 10.6, 2018-12-26 11:33 File: I:\Projects\47\39\1001\Maps\Reports\20170106_RI_Work_Plan\Figure 16 - North Log Pond Fill.mxd User: kac2

Note: Soil sample concentrations compared to MTCA Method A, MTCA Method B cleanup levels or screening levels.

- ▭ Yakima Mill Site Boundary
- ▭ Approximate Extent of Municipal Solid Waste
- Historical Log Pond Extent
- ▭ Historical Site Features

Previous Investigation Location

- ⊗ Soil Boring
- ⊙ Soil Sample
- ○ Soil Gas Point (Not Monitored in RI)
- ◻ Soil Gas Point (To Be Monitored in RI)
- ⬡ Surface Soil Sample
- ◻ Test Pit
- ✚ Surface Water Sample
- 🟪 Location Above MTCA Cleanup Levels
- 🟩 Location Below MTCA Cleanup Levels
- ⬜ No Sample Collected

Existing Well

- ⊕ Monitoring Well (To be Sampled in RI)
- ⊕ Well (Not Sampled in RI)
- ⊕ Monitoring Well (Abandoned)

Proposed Investigation Location

- ⊗ Soil Boring
- ◊ Soil Boring and Temporary Well
- ⊕ Monitoring Well
- 🟩 Test Pit

N

0 250 500

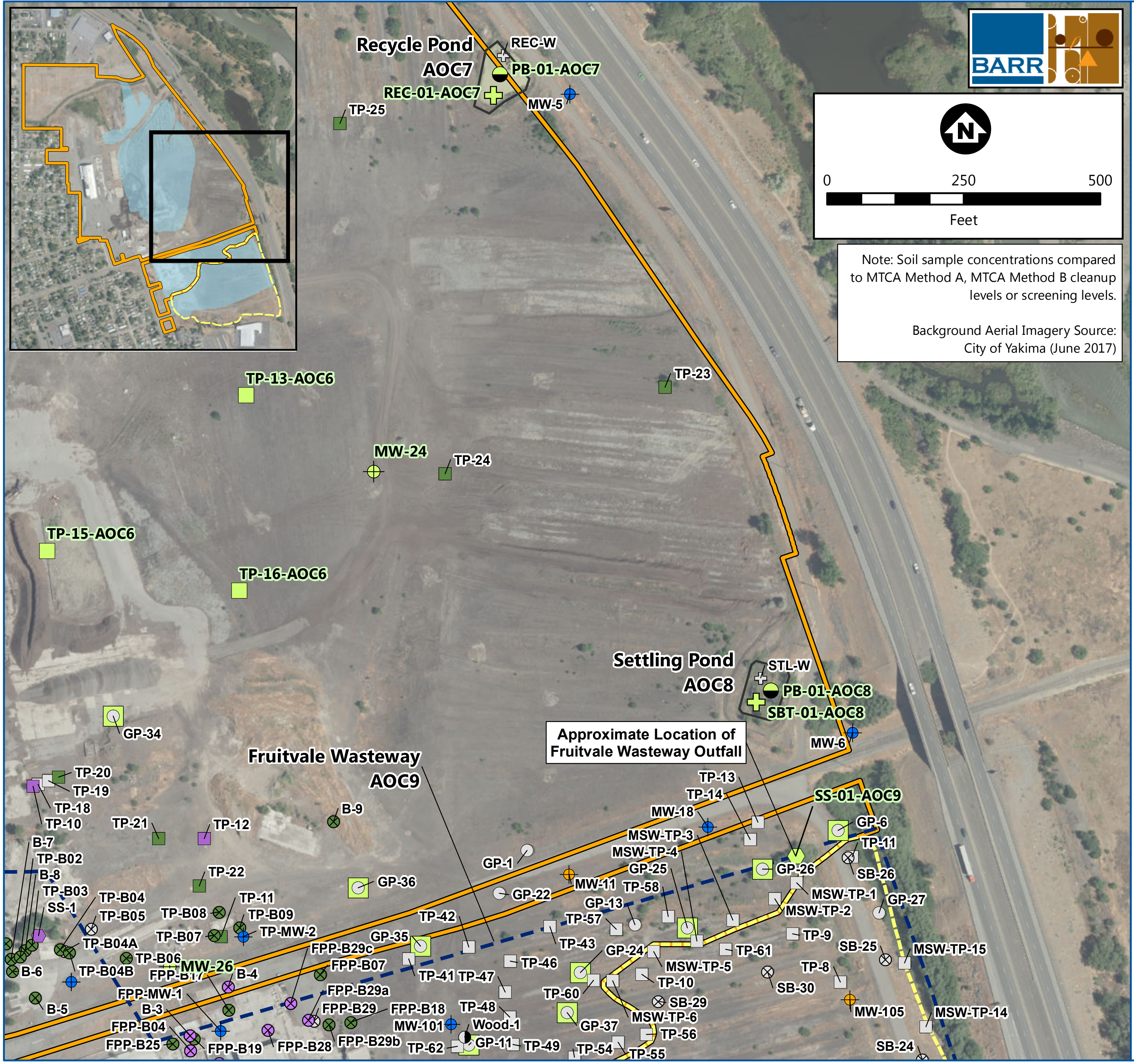
Feet

Background Aerial Imagery Source: City of Yakima (June 2017)

NORTH LOG POND FILL
Proposed RI Investigation Locations
Revised Final RI Work Plan-
January 2019
Yakima Mill Site
Yakima, WA

FIGURE 16

Barr Footer: ArcGIS 10.6, 2018-12-26 11:32 File: I:\Projects\47\39\1001\Maps\Reports\20170106_RI_Work_Plan\Figure 17 - Recycle and Settling Ponds and Fruitvale Wasteway.mxd User: kac2



Note: Soil sample concentrations compared to MTCA Method A, MTCA Method B cleanup levels or screening levels.

Background Aerial Imagery Source: City of Yakima (June 2017)

Yakima Mill Site Boundary

Approximate Extent of Municipal Solid Waste

Historical Log Pond Extent

Historical Site Feature

Fruitvale Wasteway

Proposed Investigation Location

- ◒ Pond Bottom Sample
- ⬡ Surface Soil Sample
- ⊕ Monitoring Well
- ■ Test Pit
- ✚ Surface Water Sample

Previous Investigation Location

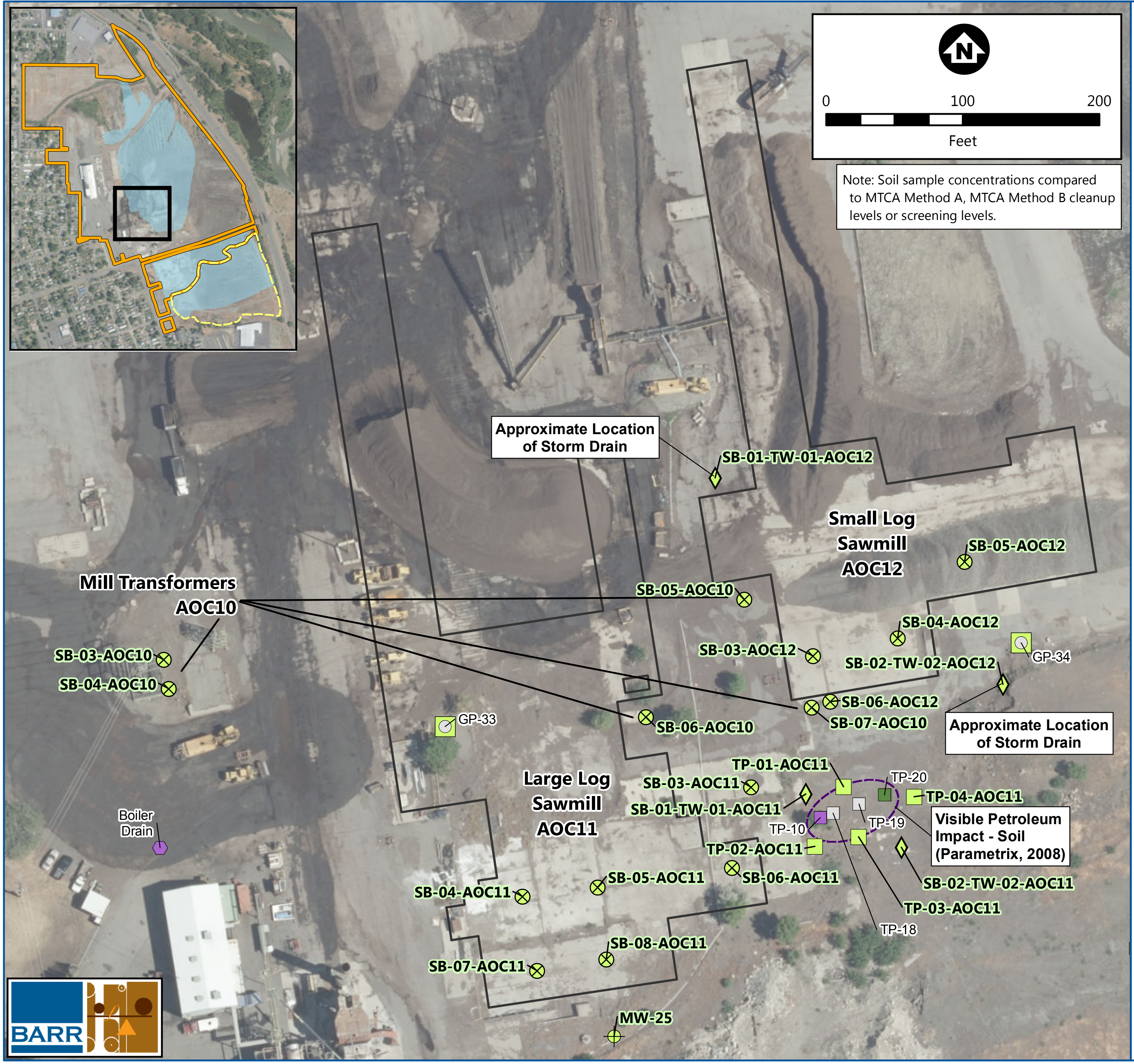
- ⊗ Soil Boring
- ○ Soil Gas Point (Not Monitored in RI)
- ▣ Soil Gas Point (To Be Monitored in RI)
- ⬡ Surface Soil Sample
- ☐ Test Pit
- ✚ Surface Water Sample
- ◑ Wood Waste Sample
- 🟪 Location Above MTCA Cleanup Levels
- 🟩 Location Below MTCA Cleanup Levels
- ⬜ No Sample Collected

Existing Well

- ⊕ Monitoring Well (To be Sampled in RI)
- ⊕ Well (Not Sampled in RI)

RECYCLE AND SETTLING PONDS
AND FRUITVALE WASTEWAY
Proposed RI Investigation Locations
Revised Final RI Work Plan-
January 2019
Yakima Mill Site
Yakima, WA

FIGURE 17



Note: Soil sample concentrations compared to MTCA Method A, MTCA Method B cleanup levels or screening levels.

Yakima Mill Site Boundary
Approximate Extent of Municipal Solid Waste
Historical Log Pond Extent
Historical Site Feature

Proposed Investigation Location
- ⊗ Soil Boring
- ◆ Soil Boring and Temporary Well
- ⊕ Monitoring Well
- 🟩 Test Pit

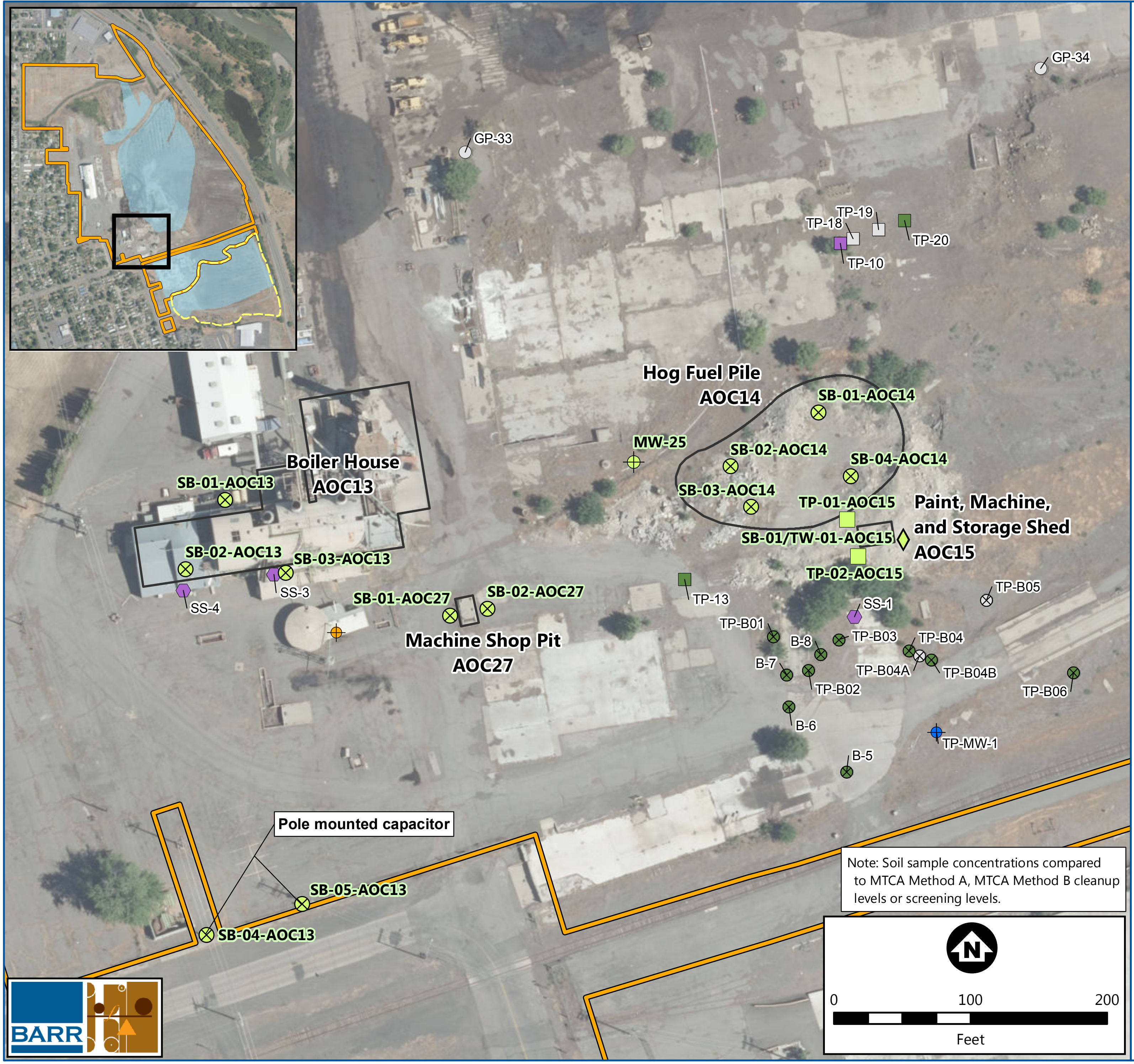
Previous Investigation Location
- ⊙ Soil Sample
- ○ Soil Gas Point (Not Monitored in RI)
- ▣ Soil Gas Point (To Be Monitored in RI)
- ☐ Test Pit
- 🟪 Location Above MTCA Cleanup Levels
- 🟩 Location Below MTCA Cleanup Levels
- ⬜ No Sample Collected

Background Aerial Imagery Source: City of Yakima (June 2017)

SAWMILL AREA
Proposed RI Investigation Locations
Revised Final RI Work Plan-
January 2019
Yakima Mill Site
Yakima, WA

FIGURE 18

Barr Footer: ArcGIS 10.6, 2018-12-26 11:29 File: I:\Projects\47\39\1001\Maps\Reports\20170106_RI_Work_Plan\Figure 19 - Boiler House, Hog Fuel Pile, Paint, Machine and Storage Shed, and Machine Shop Pit.mxd User: kac2



Note: Soil sample concentrations compared to MTCA Method A, MTCA Method B cleanup levels or screening levels.

- ▭ Yakima Mill Site Boundary
- ⬚ Approximate Extent of Municipal Solid Waste
- Historical Log Pond Extent
- ▭ Historical Site Feature

Proposed Investigation Location

- ⊗ Soil Boring
- ◊ Soil Boring and Temporary Well
- ⌖ Monitoring Well
- 🟩 Test Pit

Previous Investigation Location

- ⊗ Soil Boring
- ⊙ Soil Sample
- ○ Soil Gas Point (Not Monitored in RI)
- ⬡ Surface Soil Sample
- ☐ Test Pit
- 🟪 Location Above MTCA Cleanup Levels
- 🟩 Location Below MTCA Cleanup Levels
- ⬜ No Sample Collected

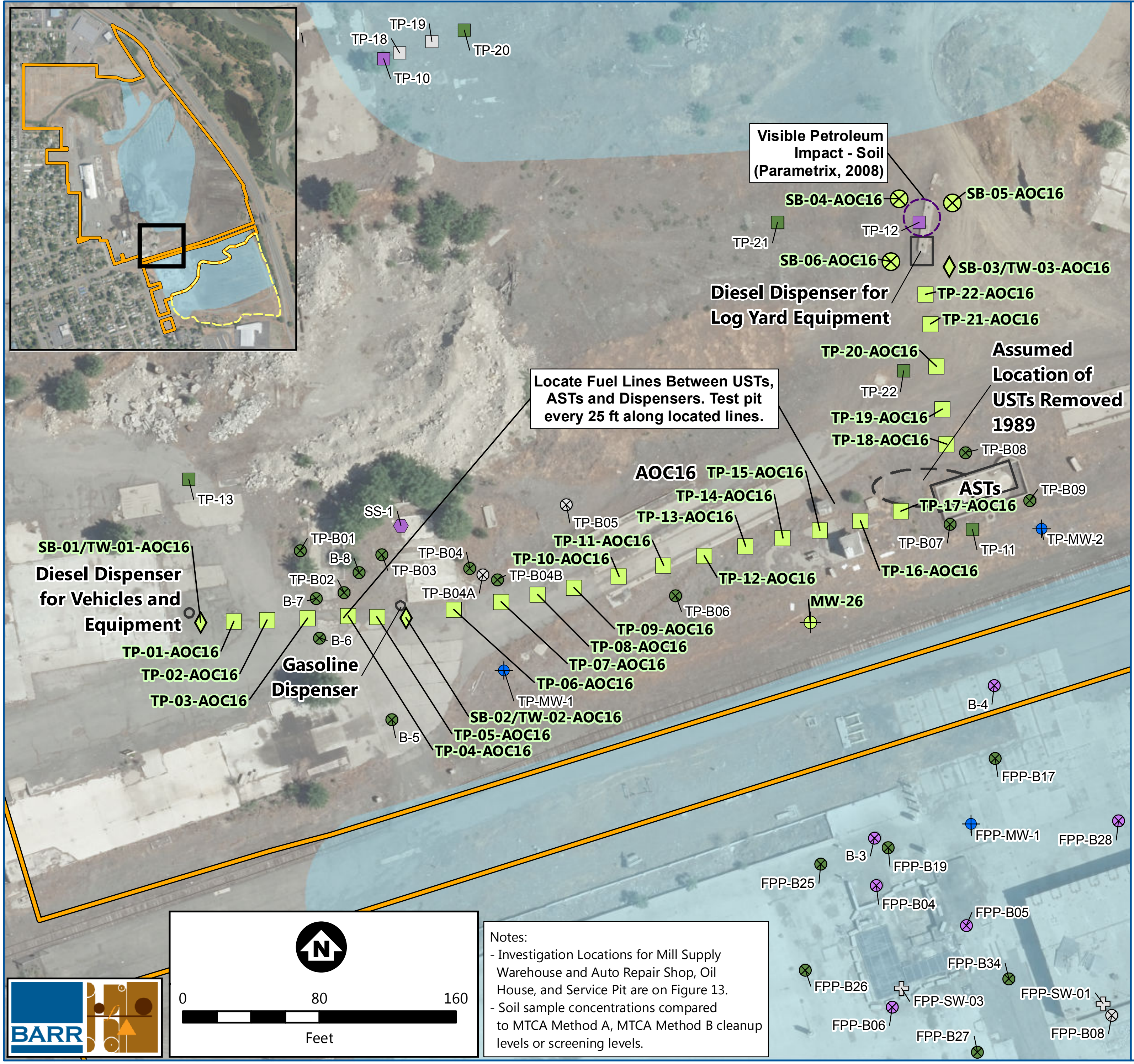
Existing Well

- ⌖ Monitoring Well (To be Sampled in RI)
- ⌖ Well (Not Sampled in RI)

Background Aerial Imagery Source:
City of Yakima (June 2017)

BOILER HOUSE, HOG FUEL PILE, PAINT, MACHINE AND STORAGE SHED, AND MACHINE SHOP PIT
Proposed RI Investigation Locations
Revised Final RI Work Plan-
January 2019
Yakima Mill Site
Yakima, WA

FIGURE 19



Notes:
- Investigation Locations for Mill Supply Warehouse and Auto Repair Shop, Oil House, and Service Pit are on Figure 13.
- Soil sample concentrations compared to MTCA Method A, MTCA Method B cleanup levels or screening levels.

▭ Yakima Mill Site Boundary

▭ Approximate Extent of Municipal Solid Waste

Historical Log Pond Extent

▭ Historical Site Feature

Proposed Investigation Location

⊗ Soil Boring

◆ Soil Boring and Temporary Well

⊕ Monitoring Well

🟩 Test Pit

Previous Investigation Location

⊗ Soil Boring

⬡ Surface Soil Sample

☐ Test Pit

✚ Surface Water Sample

🟪 Location Above MTCA Cleanup Levels

🟩 Location Below MTCA Cleanup Levels

⬜ No Sample Collected

Existing Well

⊕ Monitoring Well (To be Sampled in RI)

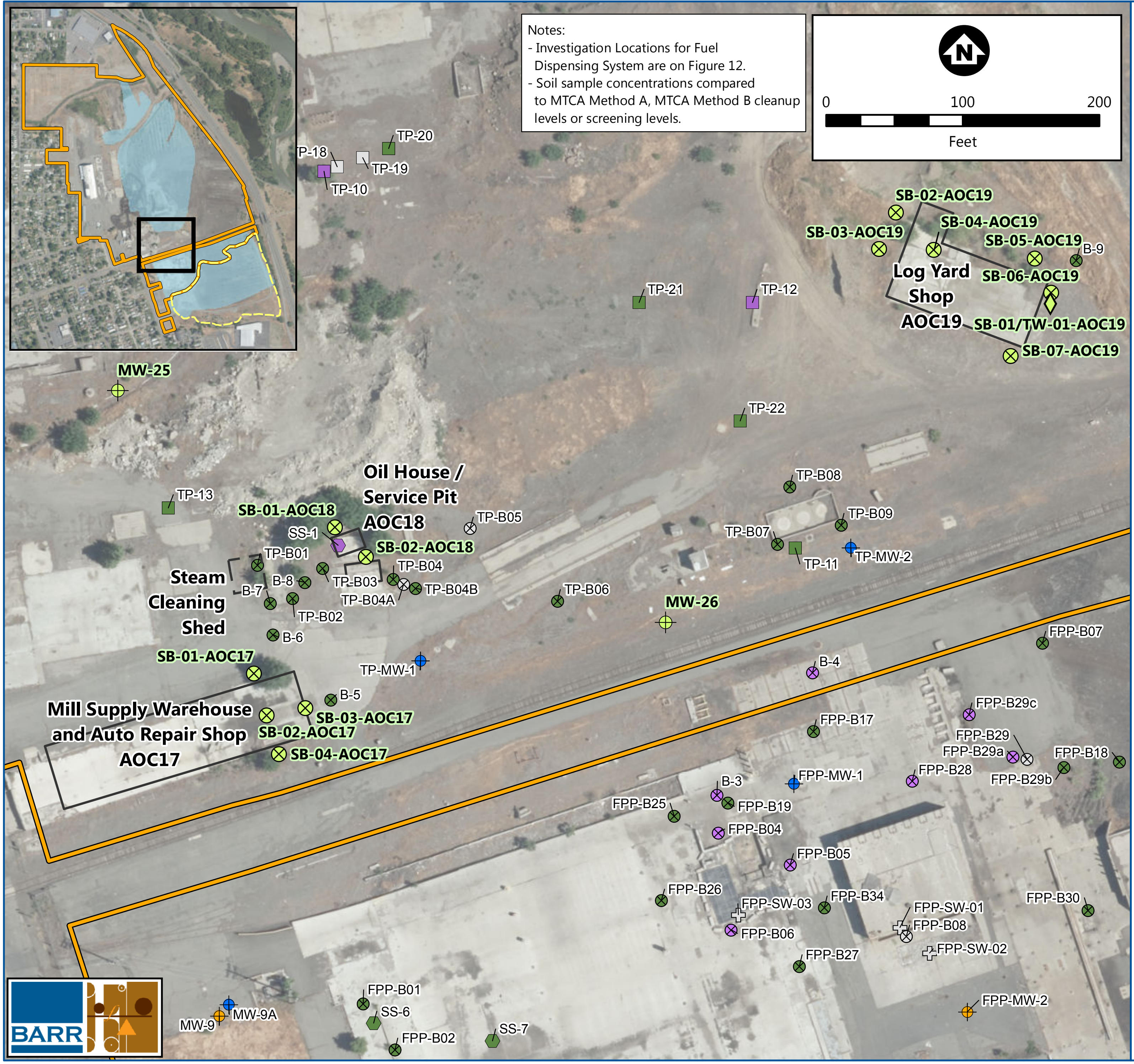
Background Aerial Imagery Source: City of Yakima (June 2017)

FUEL DISTRIBUTION SYSTEM
Proposed RI Investigation Locations

Revised Final RI Work Plan-
January 2019
Yakima Mill Site
Yakima, WA

FIGURE 20

Barr Footer: ArcGIS 10.6, 2018-12-26 11:35 File: I:\Projects\47\39\1001\Maps\Reports\20170106_RI_Work_Plan\Figure 21 - Mill Supply Oil House Log Yard Shop Area.mxd User: kac2



Notes:
- Investigation Locations for Fuel Dispensing System are on Figure 12.
- Soil sample concentrations compared to MTCA Method A, MTCA Method B cleanup levels or screening levels.

▭ Yakima Mill Site Boundary

▭ Approximate Extent of Municipal Solid Waste

Historical Log Pond Extent

▭ Historical Site Feature

Proposed Investigation Location

- ⊗ Soil Boring
- ◊ Soil Boring and Temporary Well
- ⊕ Monitoring Well

Previous Investigation Location

- ⊗ Soil Boring
- ○ Soil Gas
- ⬡ Surface Soil Sample
- ☐ Test Pit
- ✚ Surface Water Sample
- 🟪 Location Above MTCA Cleanup Levels
- 🟩 Location Below MTCA Cleanup Levels
- ⬜ No Sample Collected

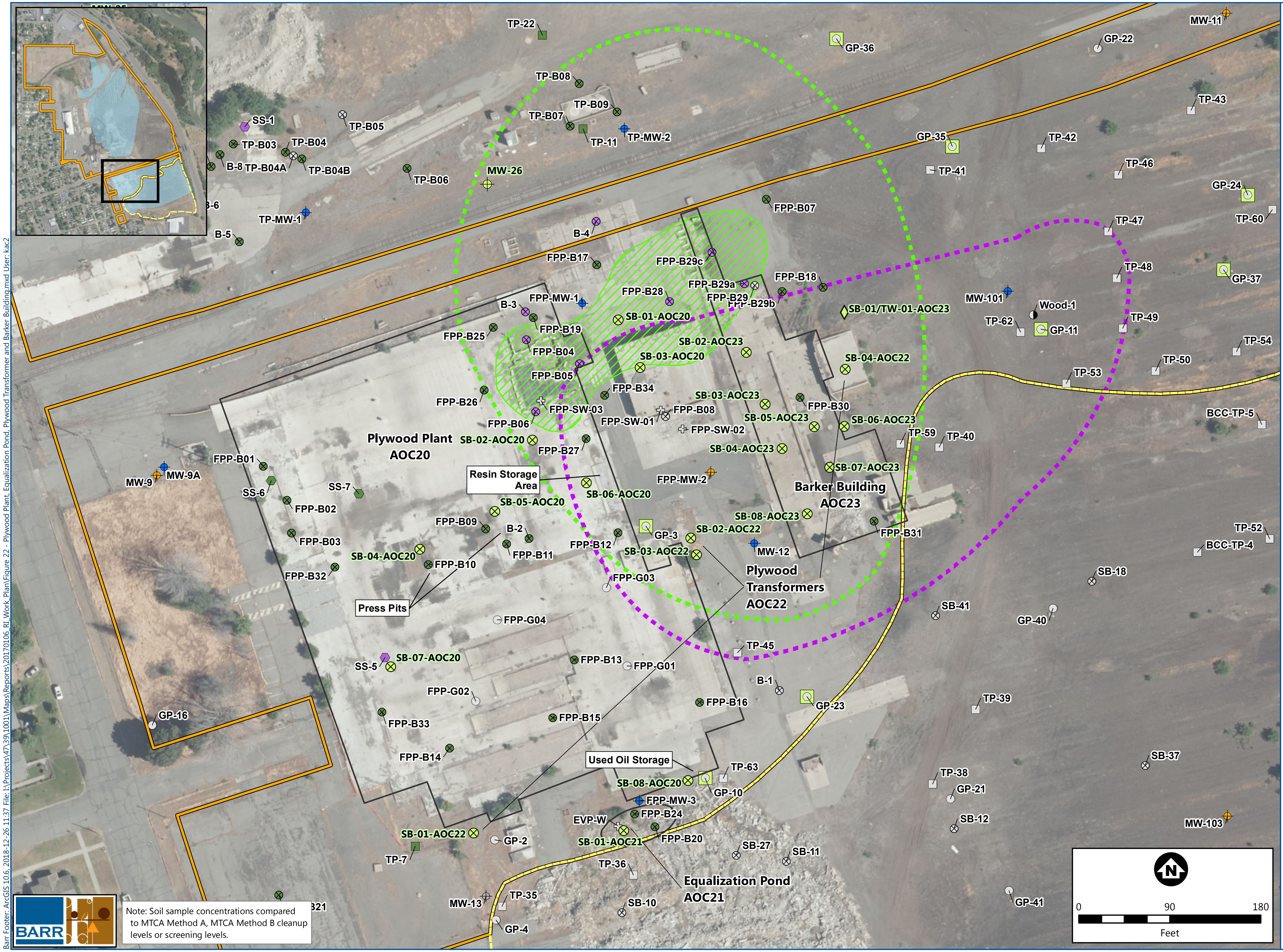
Existing Well

- ⊕ Monitoring Well (To be Sampled in RI)
- ⊕ Well (Active - Not Sampled in RI)

Background Aerial Imagery Source:
City of Yakima (June 2017)

MILL SUPPLY WAREHOUSE /
OIL HOUSE / LOG YARD SHOP AREA
Proposed RI Investigation Locations
Revised Final RI Work Plan-
January 2019
Yakima Mill Site
Yakima, WA

FIGURE 21



Note: Soil sample concentrations compared to MTCA Method A, MTCA Method B cleanup levels or screening levels.

- ▭ Yakima Mill Site Boundary
- ▭ Approximate Extent of Municipal Solid Waste
- ▨ Historical Log Pond Extent
- ▭ Historical Site Feature

Proposed Investigation Location
- ⊗ Soil Boring
- ◇ Soil Boring and Temporary Well
- ⊕ Monitoring Well

Previous Investigation Location
- ⊗ Soil Boring
- ○ Soil Gas Point (Not Monitored in RI)
- ▣ Soil Gas Point (To Be Monitored in RI)
- ○ Surface Soil Sample
- ☐ Test Pit
- ✚ Surface Water Sample
- ◑ Wood Waste Sample
- 🟪 Location Above MTCA Cleanup Levels
- 🟩 Location Below MTCA Cleanup Levels
- ⬜ No Sample Collected

Existing Well
- ⊕ Monitoring Well (To be Sampled in RI)
- ⊕ Well (Not Sampled in RI)
- ⊕ Monitoring Well (Abandoned)

- ▨ Est. TPH-Oil Concentration Above 2,000 mg/kg (MTCA CUL)
- Diesel Range Concentration Isocontour (500 ug/L) [Max Extent - September 2014]
- Heavy Oil Range Concentration Isocontour (500 ug/L) [Max Extent - March 2015]

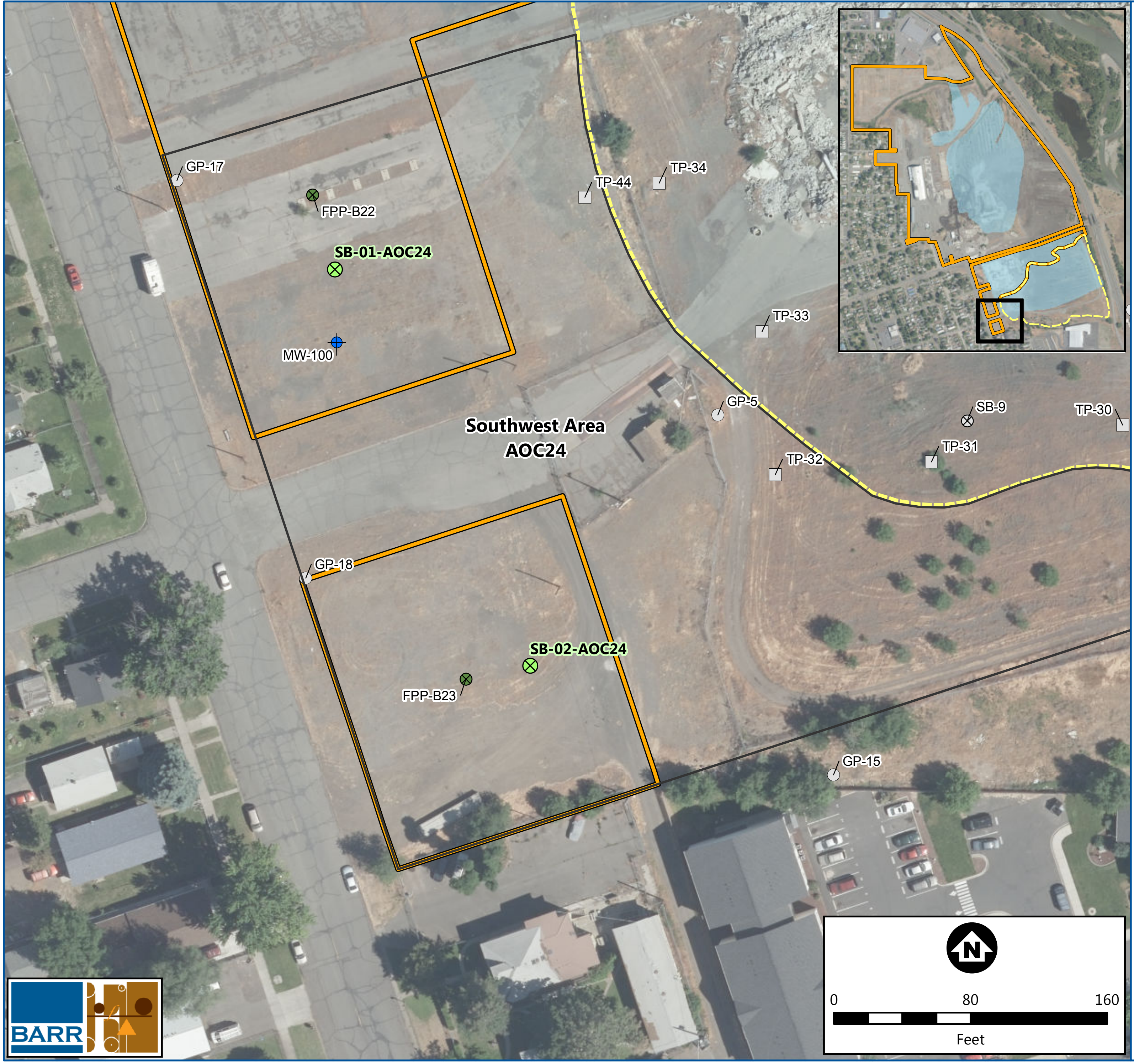
Background Aerial Imagery Source: City of Yakima (June 2017)

PLYWOOD PLANT, EQUALIZATION POND, PLYWOOD TRANSFORMERS AND BARKER BUILDING
Proposed RI Investigation Locations
Revised Final RI Work Plan-
January 2019
Yakima Mill Site
Yakima, WA

FIGURE 22

BARR

Barr Footer: ArcGIS 10.6, 2018-12-26 11:37 File: I:\Projects\47\39\1001\Maps\Reports\20170106_RI_Work_Plan\Figure 22 - Plywood Plant, Equalization Pond, Plywood Transformer and Barker Building.mxd User: kac2



▭ Yakima Mill Site Boundary

▭ Approximate Extent of Municipal Solid Waste

Historical Log Pond Extent

▭ Historical Site Feature

Proposed Investigation Location

⊗ Soil Boring

🟪 Location Above MTCA Cleanup Levels

🟩 Location Below MTCA Cleanup Levels

⬜ No Sample Collected

Existing Well

⊕ Monitoring Well (Active - To be Sampled in RI)

Note: Soil sample concentrations compared to MTCA Method A, MTCA Method B cleanup levels or screening levels.

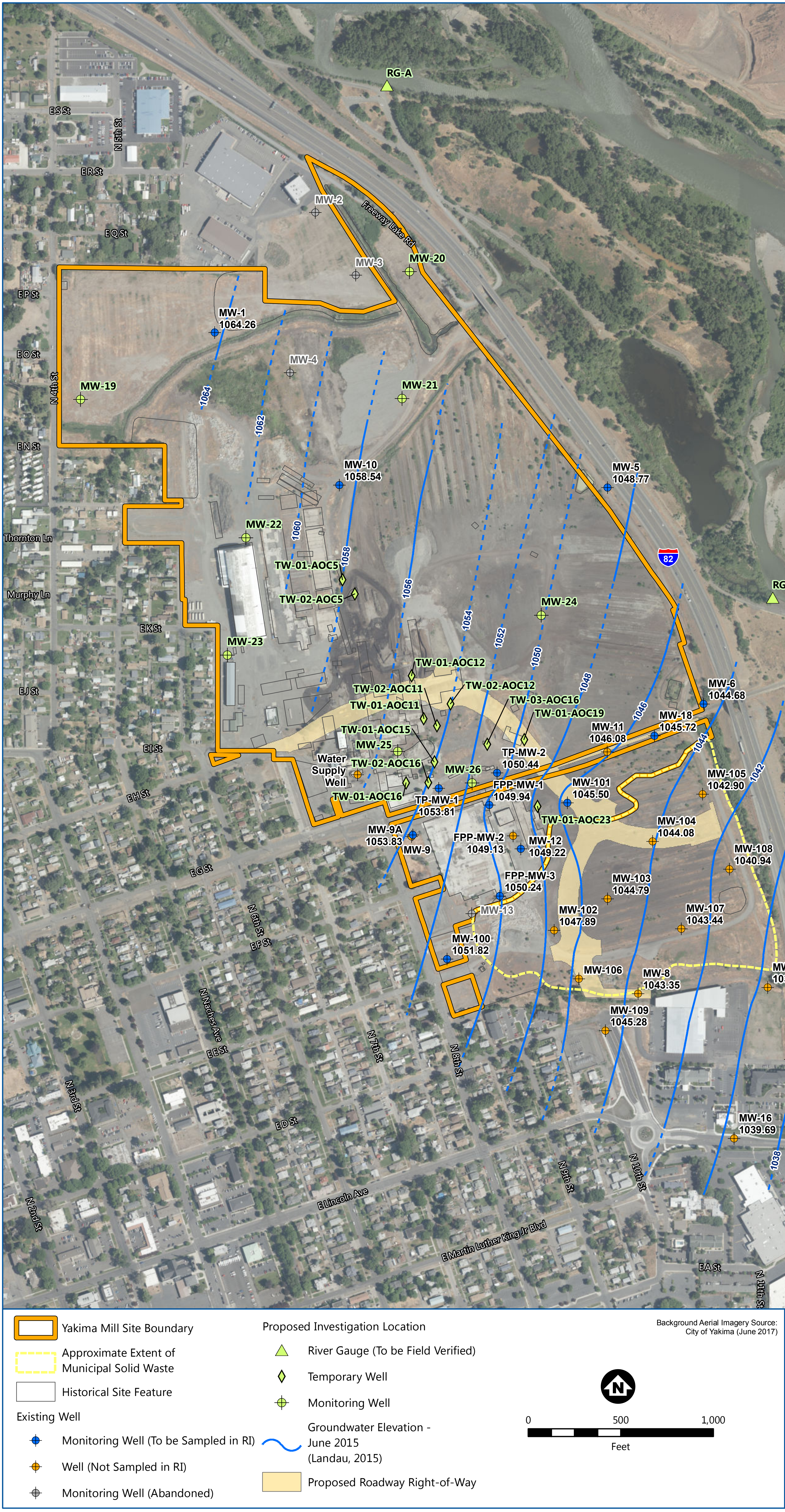
Background Aerial Imagery Source:
City of Yakima (June 2017)

SOUTHWEST AREA
Proposed RI Investigation Locations
Revised Final RI Work Plan-
January 2019
Yakima Mill Site
Yakima, WA

FIGURE 23

BARR

Barr Footer: ArcGIS 10.6, 2018-12-26 11:46 File: I:\Projects\47\39\1001\Maps\Reports\20170106_RI_Work_Plan\Figure 24 - Groundwater and River Stage Monitoring Network.mxd User: kac2



GROUNDWATER AND RIVER STAGE MONITORING NETWORK

Revised Final RI Work Plan-
January 2019
Yakima Mill Site
Yakima, WA

FIGURE 24

▭ Yakima Mill Site Boundary

▭ Approximate Extent of Municipal Solid Waste

▭ Historical Site Feature

Previous Investigation Location

● Soil Gas Point (To Be Monitored in RI)

● Soil Gas Point (Not Monitored in RI)

Proposed Investigation Location

● Soil Gas Well

▭ Proposed Roadway Right-of-Way

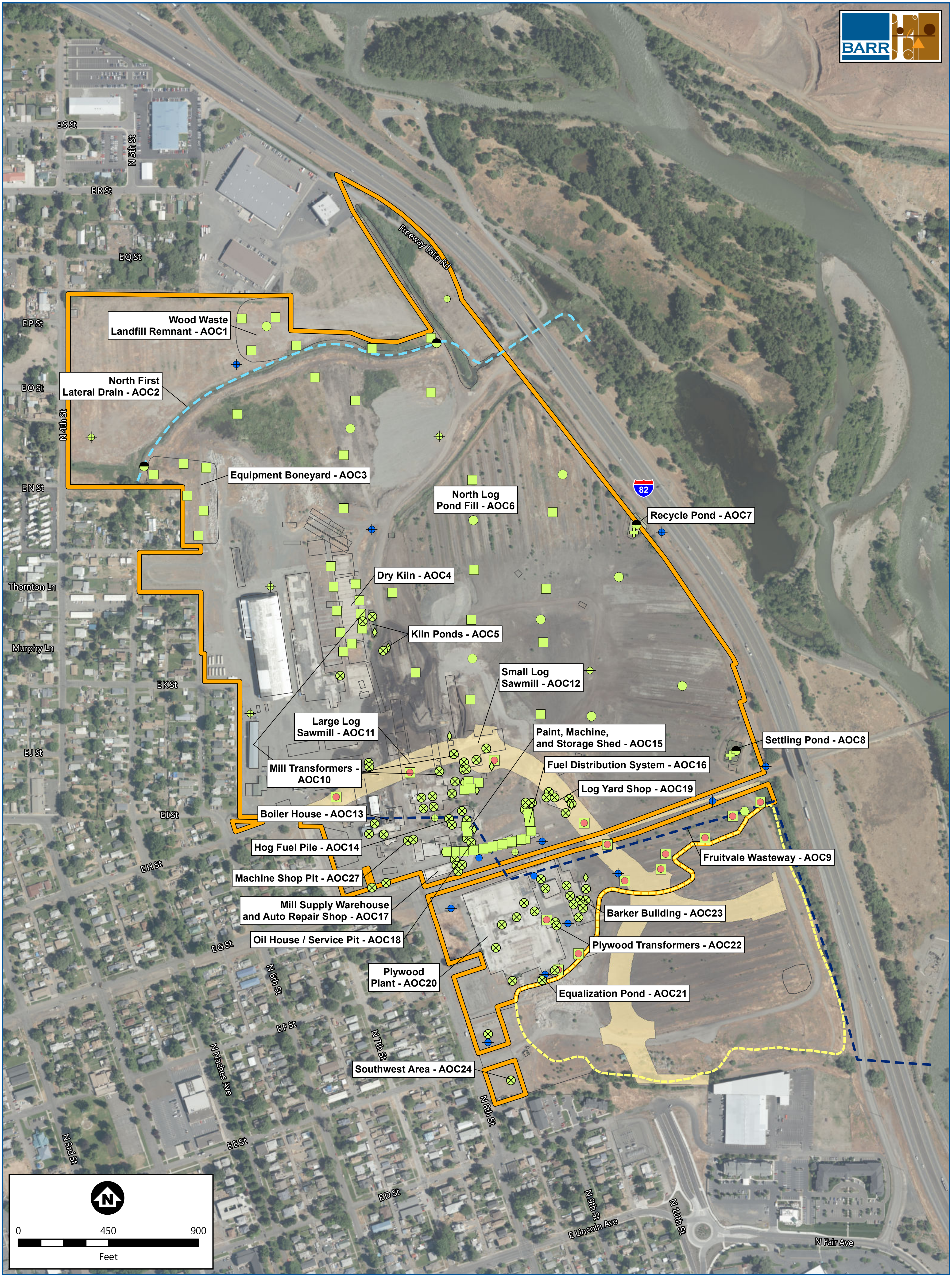
Background Aerial Imagery Source:
City of Yakima (June 2017)

N

0 450 900
Feet

METHANE
MONITORING NETWORK
Revised Final RI Work Plan-
January 2019
Yakima Mill Site
Yakima, WA

FIGURE 25



▭ Yakima Mill Site Boundary

▭ Approximate Extent of Municipal Solid Waste (Landfill Site)

▭ Historical Site Feature

- - - Fruitvale Wasteway

- - - North First Lateral Drain

Previous Investigation Location

● Soil Gas Point (To Be Monitored in RI)

Existing Well

⊕ Monitoring Well (To be Sampled in RI)

Proposed Investigation Location

◓ Pond Bottom / Sediment Sample

● Soil Gas Well

⬢ Surface Soil Sample

⊗ Soil Boring

◊ Temporary Well

⊕ Monitoring Well

■ Test Pit

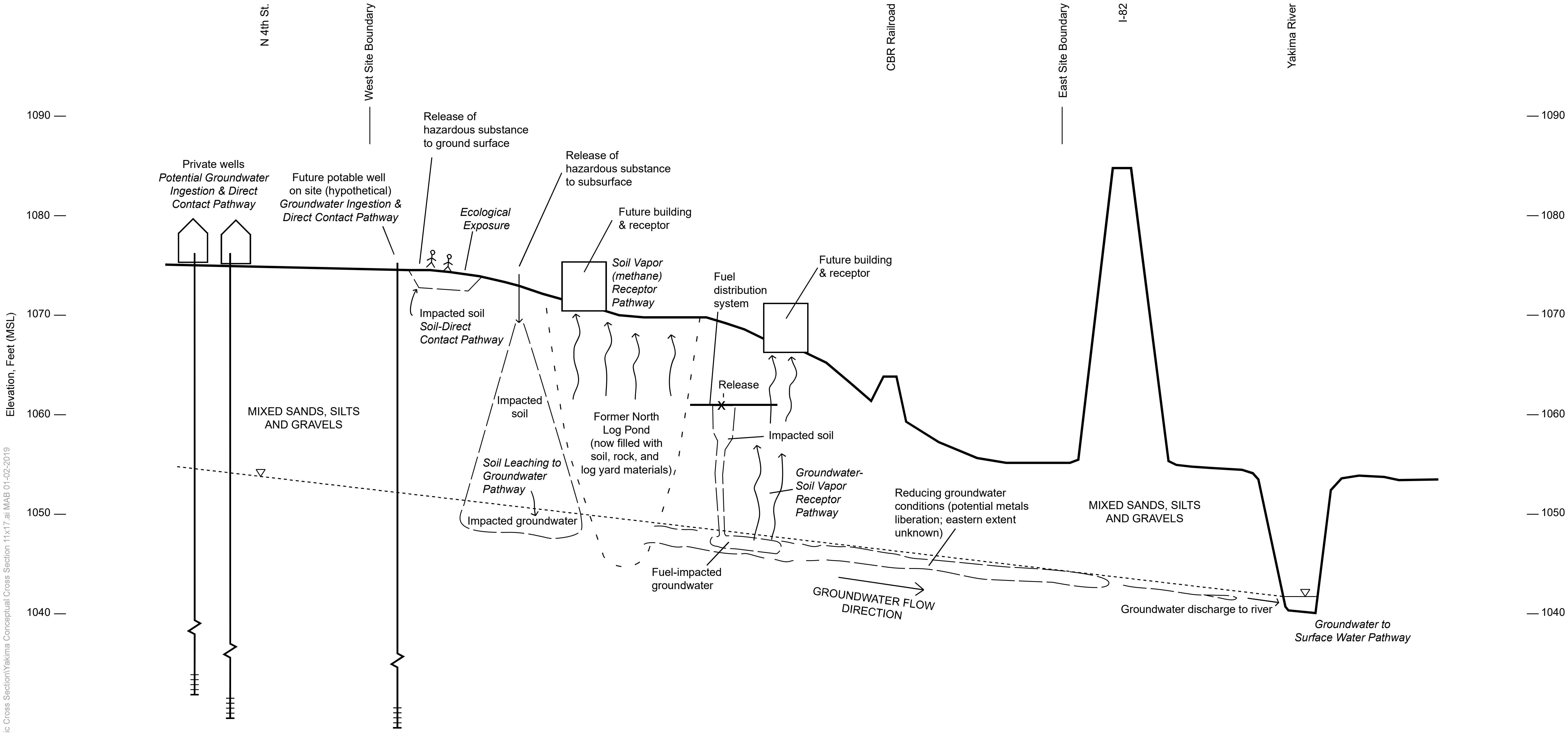
✚ Surface Water Sample

▭ Proposed Roadway Right-of-Way

Background Aerial Imagery Source: City of Yakima (June 2017)

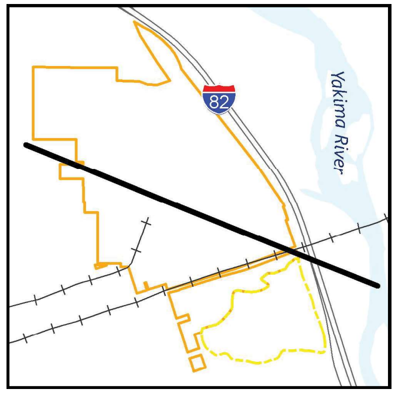
PROPOSED INVESTIGATION SUMMARY
Revised Final RI Work Plan-
January 2019
Yakima Mill Site
Yakima, WA

FIGURE 26



0 1000

Approximate Horizontal Scale in Feet
100x Vertical Exaggeration



Cross Section Location

P:\Mpls\47 WA\39\47391001 Yakima Mill Site\WorkFiles\Graphics\Schematic Cross Section\Yakima Conceptual Cross Section 11x17.ai MAB 01-02-2019

BARR

Figure 27

CONCEPTUAL SITE MODEL
Revised Final RI Work Plan – January 2019
Yakima Mill Site
Yakima, WA

Work Plan Appendices

Appendix A

Response to Ecology Comments to September 2018 Revised Final RI Work Plan

Appendix A
Final Responses to October 12, 2018 and December 20, 2018 Ecology Comments to September 2018 Revised Final RI Work Plan
Yakima Mill Site

This appendix contains final responses to the Department of Ecology's October 12, 2018 and December 20, 2018 comments to the Revised Final Remedial Investigation (RI) Work Plan for the Yakima Mill Site that was submitted on September 17, 2018, on behalf of OfficeMax Incorporated, Dunollie Enterprises, LLC, LeeLynn, Inc., & Wiley Mt., Inc., and Yakima Resources LLC, who are collectively identified as Potentially Liable Persons ("PLPs") for the Site.

For convenience, Ecology's comments are provided in their entirely below (in black text). The PLPs' responses follow (in indented blue text).

RE: Comments on Revised Final Remedial Investigation Work Plan

Site Name :	Boise Cascade Mill
Site Address:	805 North 7th Street, Yakima, WA 98901
Facility/Site ID No.:	450
Cleanup Site ID No.:	12095

The Department of Ecology has reviewed the Revised Final Remedial Investigation (RI) Work Plan for the Yakima Mill Site aka Boise Cascade Mill Site) and has the following comments:.

The word "Site" is used throughout the document when the word "property" is more appropriate. Until the RI process is completed, the project area is designated by parcel boundaries for convenience sake. The word "Site" as defined in the Model Toxics Control Act WAC 173-340-200 is " ... any building, structure, etc ..... where a hazardous substance ... has come to be located." Therefore, the exact boundary of the Site will not be known until after the RI process has been completed, and the nature and extent of the environmental impacts are known. Ecology does not expect the authors of this document to change every mention of the word "Site" to reflect its MTCA meaning; however, an acknowledgement of the MTCA definition of the word "Site" and its intended use in the document within ***Section 2.0 Site Description*** would be appropriate.

> RESPONSE: The first two paragraphs in Section 2.0 – Site Description have been revised as follows in response to this comment:
>
> "The Site is located in Yakima, Washington, west of Interstate 82 (Figure 1) in Range 19 Township 13 Sections 7 and 18. The Site, as generally shown in the Agreed Order, is approximately 171 acres in size and is comprised of 16 parcels (Figure 2). LeeLynn, Inc. and Wiley Mt., Inc. are the owners of 15 of the 16 parcels (Parcel Nos.: 12001, 21003, 22411, 23421, 23427, 24001, 24402, 24419, 24420, 31453, 31539, 42001, 42401, 42404, and 43539) and OfficeMax Incorporated, successor to Boise Cascade Corporation, is the owner of Parcel No. 41001.
>
> Use of the term "Site" throughout this Revised Final RI Work Plan and supporting documents is meant to encompass the term "Site" (or "Facility") as defined under MTCA, which includes "any building, structure, installation . . . ; or any site or area where a hazardous substance, other than a

> consumer product in consumer use, has been deposited, stored, disposed of, or placed, or otherwise come to be located." WAC 173-340-200."

A review of local news reports revealed that there were at least three large fires at the Boise Cascade Mill on September 26, 2009, July 21, 2010, and November 13, 2011. These and any additional fires are not mentioned in this section. Since the chemicals used in firefighting could have a significant environmental impact on the property, Ecology expects a narrative describing these fires to be added to this section before submitting the Final RI Workplan.

> RESPONSE: On October 25, 2018, the PLPs proposed that the following text be added at the end of Section 2.3 – Operational History:
>
> "The Landau 2013 Phase I for the Site completed for the City of Yakima explains that a request was submitted to the Yakima Fire Department for records pertaining to fires, USTs, and hazardous materials storage, incidents, or spills at the subject and adjacent properties. (see Landau 2013a, pp 5-4). In response to this request, the Yakima Fire Department provided Landau with approximately 50 documents dating back to 2005. Records prior to 2005 were not reportedly available.
>
> Landau describes the types of fires in the records provided by the Yakima Fire Department as follows:
>
> - fires involving various types of equipment;
> - a metal hopper fire;
> - bark pile, mulch pile, wood chip, log pile, and log deck fires, including a large log deck fire in September 2009;
> - fires at the plywood plant, SLM, boiler plant ,and planer shed (planer shed fire in July 2010 that resulted in the loss of the building);
> - a fire in a "pit adjacent to equipment and a concrete wall".
>
> Landau did not identify any releases caused by the fires as a recognized environment condition (REC) or an area of concern in the Landau 2013 Phase I ESA."

In response, Ecology provided the following comment on December 20, 2018:

There is a documented history of fires at the site, some of which were significant in scope and level of Fire Department response (e.g., the July 2010 fire). Landau did not identify releases caused by the fires as a recognized environment condition or area of concern. While in Ecology's opinion, the available fire information does not warrant adding any more contaminants of concern to the current analytical suite for the Stage 1 Remedial Investigation, Ecology does recognize that the fire area(s) do have the potential to be recognized environmental conditions or areas of concern and that data from the Stage 1 Remedial Investigation should be evaluated to determine whether it points toward the need for additional contaminant sampling in Stage 2 (e.g., high PAHs in the fire area(s)).

Please amend the paragraph to be inserted at the end of Section 2.3 to read: "However, data from the Stage 1 Remedial Investigation (e.g., high PAHs in the fire area(s)) may warrant sampling for additional fire-related contaminants in a Stage 2 Remedial Investigation."

RESPONSE: In response to this comment, the PLPs agreed to add the additional sentence, so the language to be added at the end of Section 2.3 – Operational History was as follows:

"The Landau 2013 Phase I for the Site completed for the City of Yakima explains that a request was submitted to the Yakima Fire Department for records pertaining to fires, USTs, and hazardous materials storage, incidents, or spills at the subject and adjacent properties. (see Landau 2013a, pp 5-4). In response to this request, the Yakima Fire Department provided Landau with approximately 50 documents dating back to 2005. Records prior to 2005 were not reportedly available.

Landau describes the types of fires in the records provided by the Yakima Fire Department as follows:

- fires involving various types of equipment;
- a metal hopper fire;
- bark pile, mulch pile, wood chip, log pile, and log deck fires, including a large log deck fire in September 2009;
- fires at the plywood plant, SLM, boiler plant ,and planer shed (planer shed fire in July 2010 that resulted in the loss of the building);
- a fire in a "pit adjacent to equipment and a concrete wall".

Landau did not identify any releases caused by the fires as a recognized environment condition (REC) or an area of concern in the Landau 2013 Phase I ESA. However, data from the Stage 1 Remedial Investigation (e.g., high PAHs in the fire area(s)) may warrant sampling for additional fire-related contaminants in a Stage 2 Remedial Investigation."

The detailed schedule for completion of the RI provided in section 8.3 is inconsistent with the language in Agreed Order DE 13959. Ecology expects this entire section be revised to be consistent with Agreed Order DE 13959 before submission of the Final RI Workplan.

RESPONSE: On October 15, 2018, Allan Gebhard of Barr Engineering Co communicated the following to Mary Monahan of Ecology: "… we have completed a side by side comparison between the schedule in Section VII B and C of the Agreed Order and the schedule in Section 8.3 of the Work Plan and believe that they are consistent".

Additional email communications occurred between the PLP's, Ecology and the Attorney General's office regarding the language in Section 8.3 of the September 2018 Revised Final RI Work Plan.

On December 20, 2018 Ecology provided the following additional comments on Section 8.3 - Schedule:

The PLPs have proposed splitting the Remedial Investigation into a Stage 1 and, if necessary, a Stage 2, with a revised work plan to be developed in conjunction with Stage 2. In order to analyze the site characterization and determine whether data gaps actually exist, is vital that Ecology receive data and information from Stage 1 in a format that is informative and efficient to review. Ecology requests that the data/information be presented in a format that includes the following:

Site Characterization Narrative: Discuss current site characterization activities for each site media (surface water/sediments, soils, groundwater systems, air and cultural history/archeology, if applicable). Name site contaminants of concern, discuss why they were chosen for analysis and describe how prior and current work efforts contribute to the understanding of the nature and extent of contamination.

Sampling/Analytical Results: Sampling/analytical results discussion should include contaminants analyzed for in samples from each applicable site media. Include comparison of the results to the applicable cleanup level, sampling method, laboratory method, and any special sampling or analytical protocols (silica gel, filtration). Evaluate the quality of the data (Level 2 EPA is all that is necessary for this stage)

Updated Conceptual Site Model: ***The lateral and vertical extent of contamination, as currently understood, should be clearly conveyed***. Beyond this, it would be helpful to also discuss contaminant release, fate and transport, exposure pathways and potential receptors; describe typical concerns for this type of environmental contamination and include a discussion of site specific concerns (hydrogeologic setting, groundwater/surface water interaction, receptors, current or future site zoning/land use); and provide figures showing contaminant release, transport and fate, exposure pathways, and potential and actual receptors.

Terrestrial Ecological Evaluation (TEE). A TEE should be performed as part of the likely cleanup level identification, or in the alternative, apply default soil terrestrial cleanup levels.

Site Maps: Overall site layout with site features and existing well, boring and sampling locations labeled consistently with current and historical sample names and current site data. A site figure with geologic/hydrogeologic cross sections and water levels.

Tables: Sampling information and laboratory methods, include current methods and numeric cleanup levels, lab methods, reporting limits, and any special sampling protocols. Include raw lab data and raw lab reports in appendices.

RESPONSE: Section 8.2 of the Revised Final RI Work Plan has been revised to acknowledge that the Stage 1 data/information will be presented in formats consistent with Ecology's request.

In Ecology's view, if a Stage 2 Remedial Investigation is determined to be necessary, it will be more efficient to update the original RI work plan rather than requiring the PLPs to produce an entirely new Stage 2 work plan.

RESPONSE: Sections 8.2 and 8.3 of the Revised Final RI Work Plan have been revised in accordance with this comment.

Please update the Section 8.3/Exhibit A (SAP) Stage 1 schedule as follows: 1) to specify that submittal of Stage 1 data and other information be in the format specified above; and 2) to indicate that it may be sufficient for a Stage 2 work plan to be an updated version of this work plan.

RESPONSE: Section 8.3 of the Revised Final RI Work Plan as well as the schedule in the SAP have been revised in accordance with this comment.

Appendix B

Summaries of Site History

(No changes from December 2017 Final RI Work Plan submittal)

Appendix B1

History of Surface Water Features

FULCRUM
environmental consulting

MEMORANDUM

DATE	November 13, 2017
TO	Allan Gebhard, Barr Engineering, Inc.
FROM	Ryan K. Mathews, CIH, CHC, Fulcrum Environmental Consulting, Inc.
RE	**History of Surface Water Features**
SUBJECT	Yakima Mill Property

As directed by the Washington State Department of Ecology, Barr Engineering and Fulcrum Environmental Consulting, Inc. have completed additional research on surface water features present at the former Boise Cascade Lumber Mill and Plywood Plant (Mill Property). The Mill Property includes subareas that include the Yakima Mill Site and Yakima City Landfill Site. Fulcrum reviewed newspaper articles, Sanborn Fire Insurance Maps (Sanborn maps) site photographs, site drawings, and aerial and oblique photographs, to document surface water features over time at the Mill Property. The following periods of interest were established from this review:

- Early Developments (1902 to the 1920s)
- Pre-Interstate 82 Construction (1920s to 1940s and 1940s to 1969/1972)
- Post-Interstate 82 Construction until 1994
- 1994 to 2009
- 2009 to Current

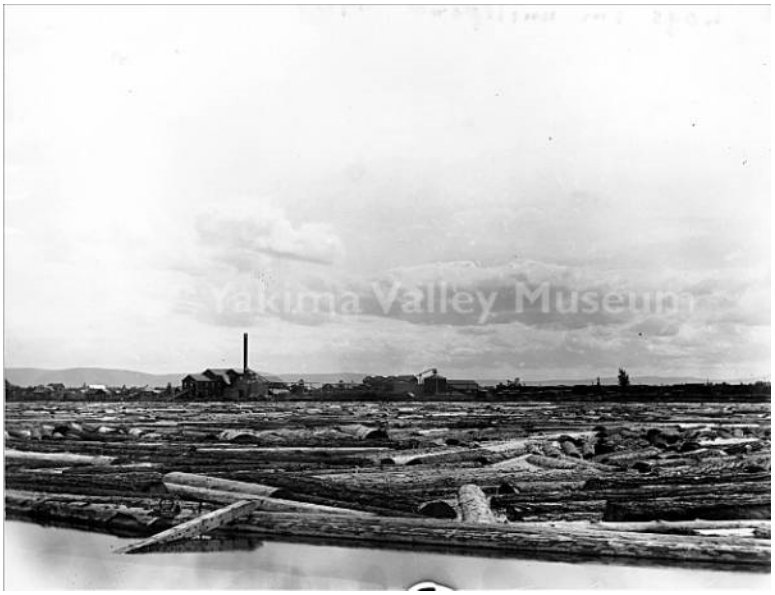
Executive Summary

Surface water has been used at the Mill Property since lumber operations began in 1902. The original sawmill relied on the Yakima River for log delivery. Over time, this was replaced with delivery by rail and truck, reducing the dependence on the Yakima River. From the 1940s until about 1994, log ponds were used but gradually reduced in size, with water delivered in canals or ditches around the Mill Property, and then were eliminated entirely in favor of log deck storage with the logs sprinkled with recycled water to minimize the risk of fire and for other reasons related to sawmill operations. Through a series of continual improvements, log deck sprinkler water that ran off the logs was collected and returned to the recycle pond and settling pond before being reused in the sprinkler system. In 1997, release of water from site ponds into the Yakima River ceased and all irrigation water was captured and recycled for onsite use, or was lost through infiltration to groundwater or evaporation. This system operated until site operations ceased in about 2004. Since 2004, log yard material recovery has occurred with excess water released to the ground.

During site operations, three waterways have transected the site, the North First Lateral (near the north extent of the Mill Property), a so-named spring diversion ditch (north of the sawmill log decks), and the Fruitvale Wasteway (bisects the Mill Property and is generally parallel to the railroad line). These three waterways remain in operation today.

Following is a summary of each of the historical periods listed above in support of the information contained in the executive summary.

Early Development (1902 to the 1920s)



1907 Photograph of Logs in the North Log Pond

Logs guided into log flume enroute to Cascade Lumber Co., Yakima, 1915
Courtesy Yakima: A Centennial Perspective

Water features present at the Mill Property from 1902 until 1908 included a river water connection via a canal and a large log pond. Water conveyance of cut logs occurred during high spring water flows from timberlands in the Teanaway and Yakima River watersheds. The logs were floated down the rivers and stored in one or more large ponds until processed into lumber and related products.

The earliest reference to the development of the Yakima Mill is a July 22, 1902 article in the Yakima Herald newspaper that announced the beginning of the Cascade Lumber Company. The article reports that the company purchased the Springvale dairy farm and, after investment, would manufacture lumber, shingles, and fruit box material. The article says that logs were to be brought down the river and floated into the big canal and pool, until ready for use. The original mill had a two band saw and was supplied with logs originating around Cle Elum and Easton. The article reports that excavation of the large mill log pond was rapidly progressing. The subsequent articles suggest that development continued until spring 1903 when the final machinery was installed and testing was to be completed.

An April 15, 1903 Yakima Herald article announced that “with the rise of the Yakima river… the first float of loags [sic] will be started down the stream and from that time the mill will continue to operate." This log float reportedly occurred at the rate of 1,000 logs per day. A June 8, 1904 article reports that "the mill pond is full of logs and they are now being piled out on the banks."

1908 Photograph captioned "Workers Clearing Area for Cascade Lumber Mill Pond"

A 1905 Sanborn Fire Insurance Map (Sanborn Map) provides limited coverage of the Mill Property. A line consistent with the bank of the north pond is visible east of the sawmill; however this area is not labeled. The only labeled surface water feature shown is the Northwest Light & Water Co. "Waste Ditch", later identified as the PP&L Ditch and the Fruitvale Wasteway. The ditch arrives from the west along "H" Street and then turns south near the future location of the plywood plant. No ponds or other surface water features are shown south of the railroad line.

The northern log ponds prior to construction of the railroad spur

A May 27, 1908 advertisement reports "Lest You Forget. We manufacture and sell. Pine and fir lumber, lath, shingles, boxes, wood."

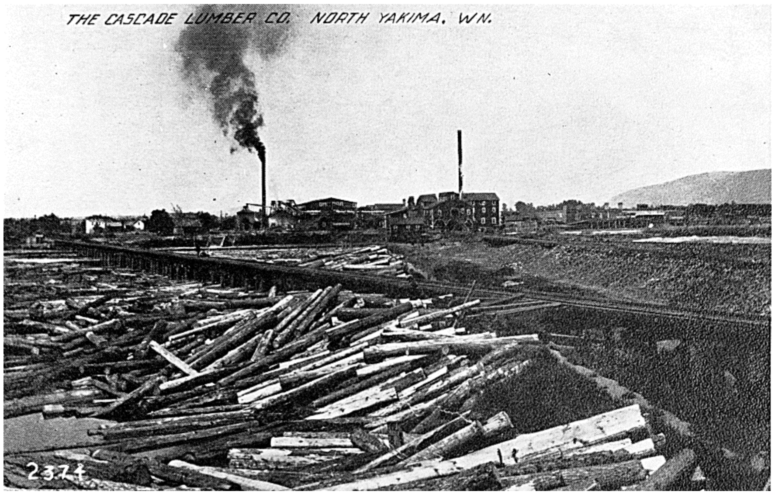
The annual log float was reported in numerous articles in newspapers from Cle Elum to the lower Yakima Valley. Estimates from 15,000,000 board feet to 35,000,000 board feet of sawed lumber were reported annually.

A February 7, 1909 Yakima Herald article reported that the Cascade Lumber Co. "purchased 60 acres adjoining the yards and mill pond on the south and a portion of the newly acquired property will be devoted to an enlarged mill pond. General Manager Huebner stated to the Herald… that the present pond was too small for the winter run of logs and that in time probably the whole area of the newly acquired tract would be necessary for the business of the company." While not specified, it would appear that this acquisition was of property that would become the location of the future plywood plant, south log pond (later the City of Yakima landfill) and other property south of the railroad line.

An article from June 23, 1912 in the Yakima Herald reported that "three or four carloads of logs came to North Yakima… from Easton for the Cascade Lumber company. This is the inception of the carlot log business which the lumber company will do this summer." Separately a photograph from the Yakima Valley Museum identifies a train with railcars in the Teanaway with logs bound for the Cascade Lumber mill and a photograph of logs being dumped from rail cars into the north lop pond (right, top).

Early 1900s dumping of logs from rail cars into the Log Pond

The 1912 article is the first to report the delivery of logs to the property by rail. However, additional improvements were required, including a rail spur extending into the log ponds. Early site photographs and a February 1948 article suggest that the original rail spur was a wood trestle construction.

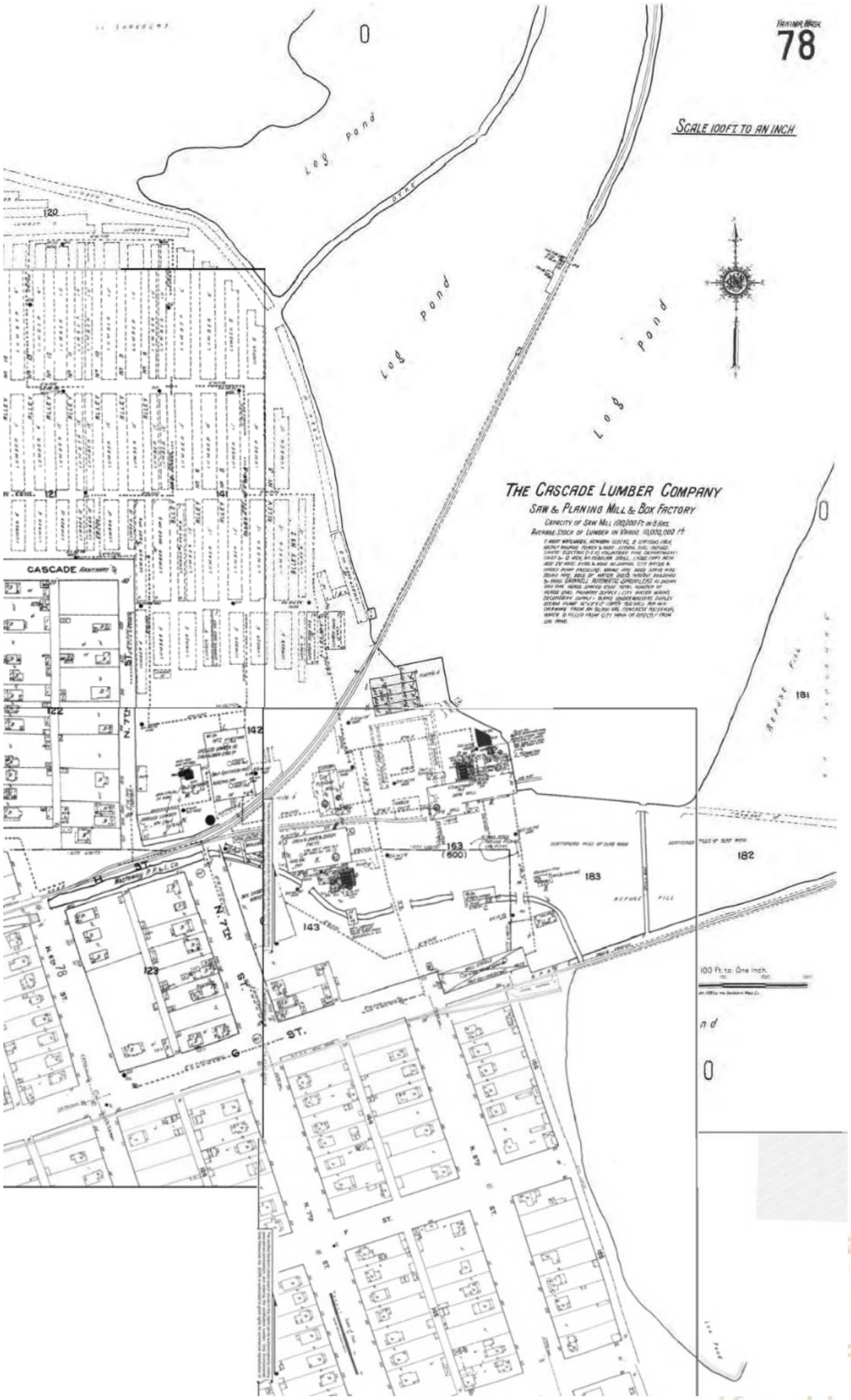


Undated photograph of the Cascade Lumber Company

During this era of operations, the flow of surface water at the Mill Property would appear to be an open canal from the north that flowed into the north ponds (referred to as the north and center log ponds). A wood trestle design would have been effective at confining logs, but would not have limited water flow between the two log ponds.

An early 1900s photograph (right, bottom) illustrates the piling of logs in the log ponds, likely during a period of low water. The photograph also illustrates the division between ponds with a wood trestle rail line. While the orientation and date of the photograph are not provided, it appears as though the photograph was taken at the north extent of the north log pond, with a dike to the right separating the north pond from a natural ponding area further north. Mill site operations are visible in the background with two visible smoke stacks and numerous buildings.

1920s to 1940s



A 1920 Sanborn (right) identifies the Mill Property as “The Cascade Lumber Company, Saw & Planing Mill & Box Factory.” Log ponds are located north and south of the railroad line that divides the Mill Property. Three ponds are shown north of the rail line and are shown to be divided by a “dyke” to the north and a dike and another structure, consistent with the wooden trestle.

A “spill way” is shown between the ponds north of the railroad line and the pond south of the line. The Sanborn map indicates that the P.P & L. Co Wasteway flows directly into the log pond south of the railroad line.

The structure of the south log pond, outfalls from the ponds, and the river water intake are located beyond the coverage of the Sanborn map.

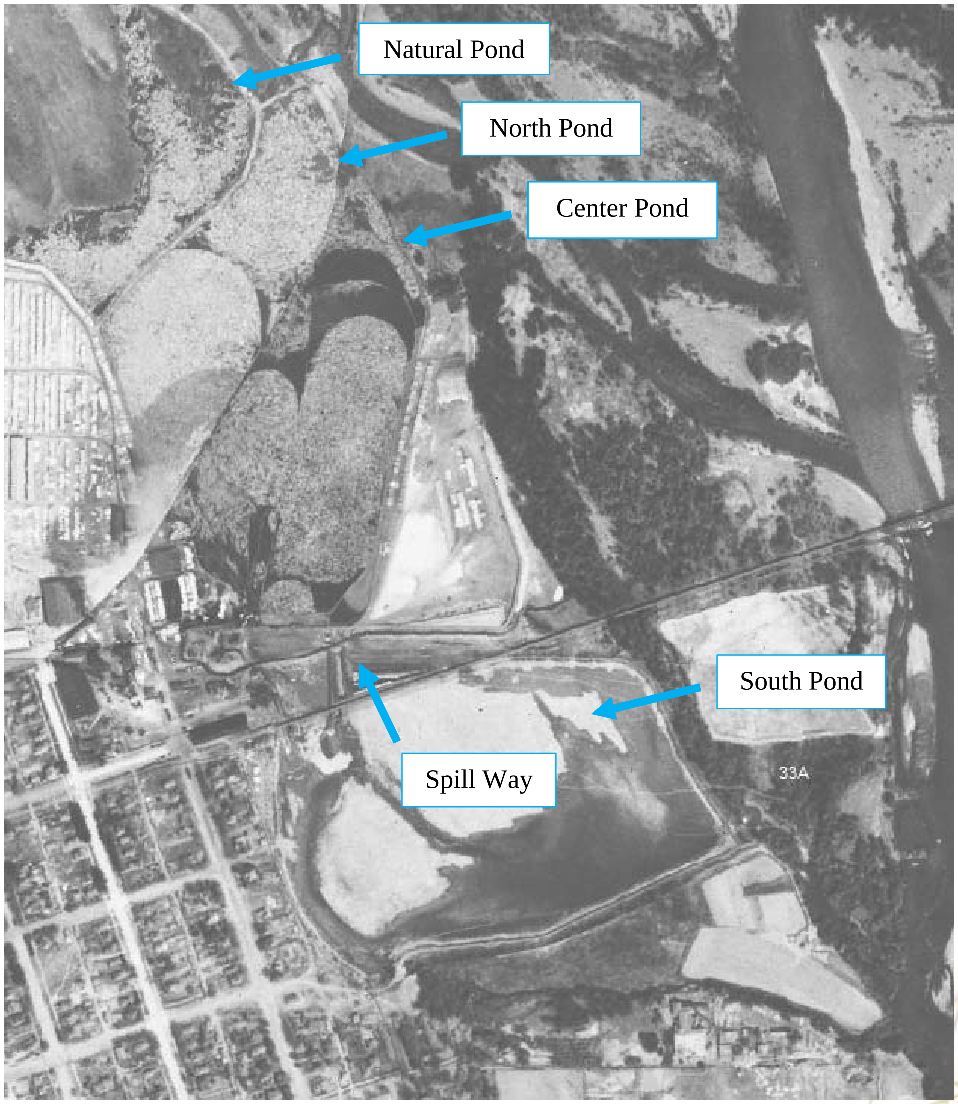
The attached Figure 1 includes the 1927 aerial photograph overlain with the approximate current tax parcel boundaries.

The 1927 aerial photograph (right) indicates three pond areas north of the railroad line and one large pond south of the railroad line. The three north ponds north of the railroad include two larger ponds (north pond and center pond) filled with logs, and a third natural pond, also appearing to have log storage. These two large ponds are bounded by a trestle or dikes and access roads. The natural ponding area at the north is bounded only to the south with the dike or access road. Logs in the north and center ponds have arc shapes suggesting that a log boom or wire system was being used to secure the logs.

The log ponds north of the railroad appear filled with logs, while the south log pond may be partially dry. The ponds shown in this aerial photograph appear to represent the maximum extent of the log ponds associated with the Yakima Mill.

Other than log storage and transport, no operations within the surface water features are visible in the site photographs or aerial photographs.

During this period of operations, logs were held in the ponds until pulled into the sawmill for cutting into lumber. As provided in the February 1909 article announcing the purchase of 60 acres, logs were received during spring high river flows and stored in the log ponds until used. The apparent spill way would have been used to move logs between ponds for storage and then into the sawmill.



1927 Aerial Photograph

Cropped Photograph of Saw Mill

Shown above is a photograph showing the log pond filled with logs and the sawmill in the background. A log intake on the east side of the sawmill is the location from which logs are pulled from the pond up into the mill for processing.

Pre-Interstate 82 Construction (1940s to 1960s)

Prior to construction of Interstate 82, the Mill Property was directly connected to the Yakima River and logs were received from the Yakima River through the intake canal. This practice changed with the introduction of rail delivery of logs and then again by the 1940s, by truck delivery of logs. While the method of delivery changed, the reliance on log ponds for storage of logs prior to processing remained.

Few aerial photographs, site photographs, or maps were located for the 1930s and 1940s. Beginning in the late 1940s, aerial photographs become the primary available references to document surface water conditions at the Mill Property.

12-B YAKIMA SUNDAY HERALD, YAKIMA, WASHINGTON

Yakima Lumber Firm Starts on $100,000 Program

Wooden Trestle Being Removed

Mill Pond Deeper And Levee Built

An improvement program to the Cascade Lumber company mill at Yakima which will cost "more than $100,000" and will remove a 40-year old Yakima valley landmark, is well under way, Stephen B. Moser, general manager and secretary for the firm, said yesterday.

A wooden trestle spanning the upper mill pond is being replaced by a spur track along the north side of the pond, Moser said. When the spur track is in operation—probably in April—the trestle which has stood for four decades will be removed.

Capacity Up

Logs coming into the mill from rail points such as the Teanaway rail point have always been dumped into the upper pond. The new arrangement will make it possible to dump truck logs in the opper pond also if necessary, Moser said. He pointed out that the removal of the trestle bisecting the pond will eliminate the task of poking logs back and forth between the trestle pilings.

In addition to building the new spur tracks, the company has deepened the upper pond. Moser estimated that 15,000 cubic yards of earth were removed from the pond bottom. The pond was deepened about 2½ feet on the average, Moser explained. The spur track is about half a mile long.

Other Betterment Told

Other improvements announced by the company included the installation of a new log slip and a chain saw. Previously, the logs were sawed in two in the water in a separate operation; installation of the chain saw will eliminate this. Logs will come up the slip to the new saw where they will be halved and then scaled.

The unloading dock at the lower pond where trucks dump has been deepened also. A new intake gate for the mill ponds was built on the Yakima river. Moser explained that a levee, being built as a flood control measure, took out the old intake gate. A new gate built inside a wing dam has been installed.

Cascade Lumber Company Removes 4-Year-Old Landmark

A wooden trestle spanning the upper Cascade mill pond is being replaced (top photo) by a spur track, removing a 40-year-old Yakima valley landmark. Lower photos show dredging operations to deepen the upper mill pond, and construction of a levee as a flood control measure.
—Herald photos

White Pass Road Progress Slated

Continued progress on the White Pass highway construction job is promised for this year but no date for completion of the road has been set, the Yakima Chamber of Commerce was informed yesterday.

Chamber Manager L. W. Markham received details of the project's status from H. J. Andrews, regional forester at Portland. Andrews said that 3.6 miles remain to be cleared for a right of way. A contract for building a 2.45 mile stretch of road, let in 1946, is expected to be finished this year, and grading to the summit from the east side has already been completed.

Clearing of the remaining right of way will be the next forest service project. Grading of a 1.8 mile stretch is planned.

Meanwhile, Markham also learned that a 10-year study of all forest highway projects has been made and submitted to the public roads administration as a basis for budget requests. Speed of future forest road work, which

Local Woman's Mother Dies in Portland Home

Mrs. B. A. Farrar of Portland died Thursday morning at her home there. Mrs. Farrar was the mother of Mrs. E. P. Reswick of Yakima. Burial took place Saturday in Portland. Mrs. Reswick was with Mrs. Farrar at the time of her death.

Reserve Officers To Study Armor

"Armor and Armored Weapons" will be the subject of Lt. Col. Alfred H. Hopkins at the organized army reserve meeting Tuesday night at 8 o'clock in the chamber of commerce auditorium, Lt. Victor Mongeau, unit public relations officer, announced yesterday.

Lt. Mongeau said that some of Col. Hopkins' information still has not been released to combat units. One of the weapons he will describe is a four-track tank equipped with a 105 mm. rifle, the heaviest weapon mounted on a tank.

The meeting is open to the public, Lt. Mongeau said, and all veterans and reserves are requested to attend.

Lt. Col. Hopkins was graduated from Washington State college and he served as head football coach at Lincoln high school in Tacoma.

National Forest Here Set Fire Season Dates

The fire season for all national forests in Yakima county will extend from February 15 to October 15, R. D. Ward, district fire warden, said last night. State law requires a permit for all fires, Ward said. Permits may be obtained at the Ahtanum ranger station. Phone number for the station is 24312.

Sulfur is present in every cell of the human body.

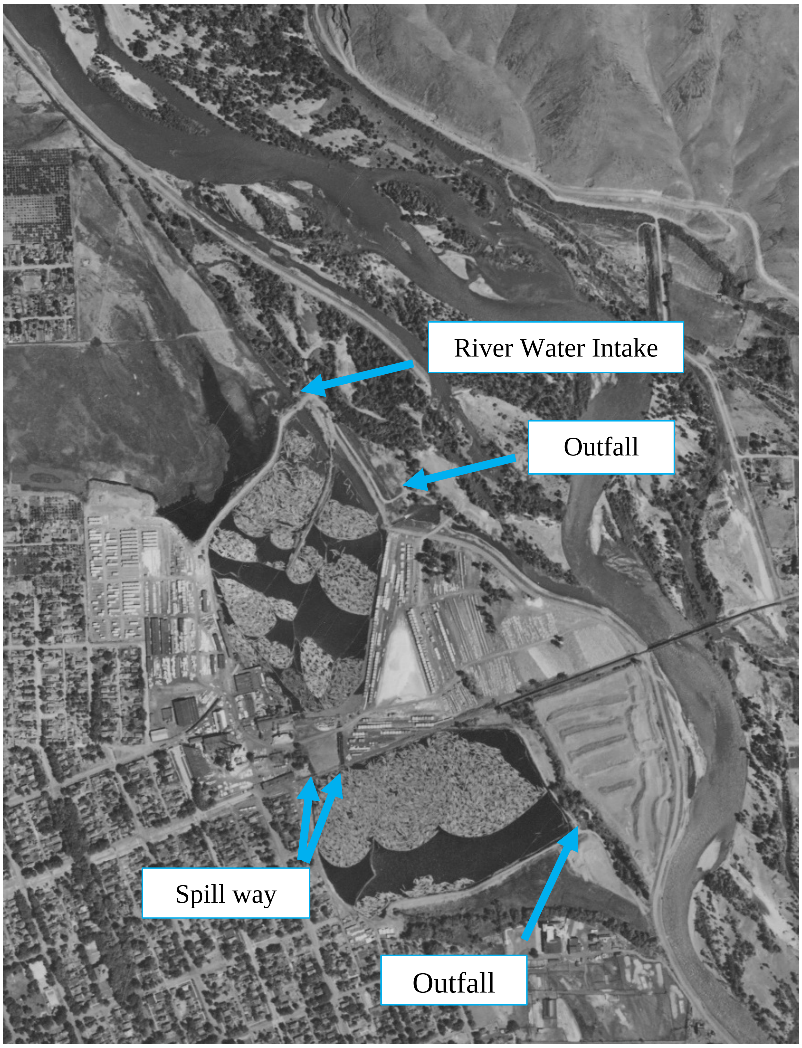
A 1948 newspaper article reports that "a wooden trestle spanning the upper mill pond is being replaced by a spur track along the north side of the pond…the trestle which has stood for four decades will be removed." The article also reports that that upper pond was deepened by about 2 ½ feet and that "the unloading dock at the lower pond where trucks dumped has been deepened also. A new intake gate for the mill ponds was built on the Yakima River."

The 1949 aerial photograph, seen to the right, shows these site improvements. The intake gate is present and appears to connect, likely through a culvert, to the north log pond. In the north log pond, the division in the pond by a trestle or dike is no longer visible across the entire pond. Logs are visible in the north log pond and in the south log pond (future plywood plant and Landfill Site). No logs are visible in the natural pond north of the north log pond, which is bounded to the south by an access road/dike between this pond and the north log pond.

Resolution of the aerial photograph is such that the spill way from the north log pond is visible through the east pond bank into a side channel of the Yakima River (labeled on photograph as an outfall).

Two ditches or canals connect the north log pond and the south log pond as shown on the photograph. It appears likely that logs were floated between the two ponds through these connections.

An outfall from the south log pond appears to be present from the east side of the pond, into what is the Fruitvale Wasteway (labeled on photograph as an outfall). The Fruitvale Wasteway is a consistent feature which the Sanborn maps show was occasionally relocated or modified during mill operations.

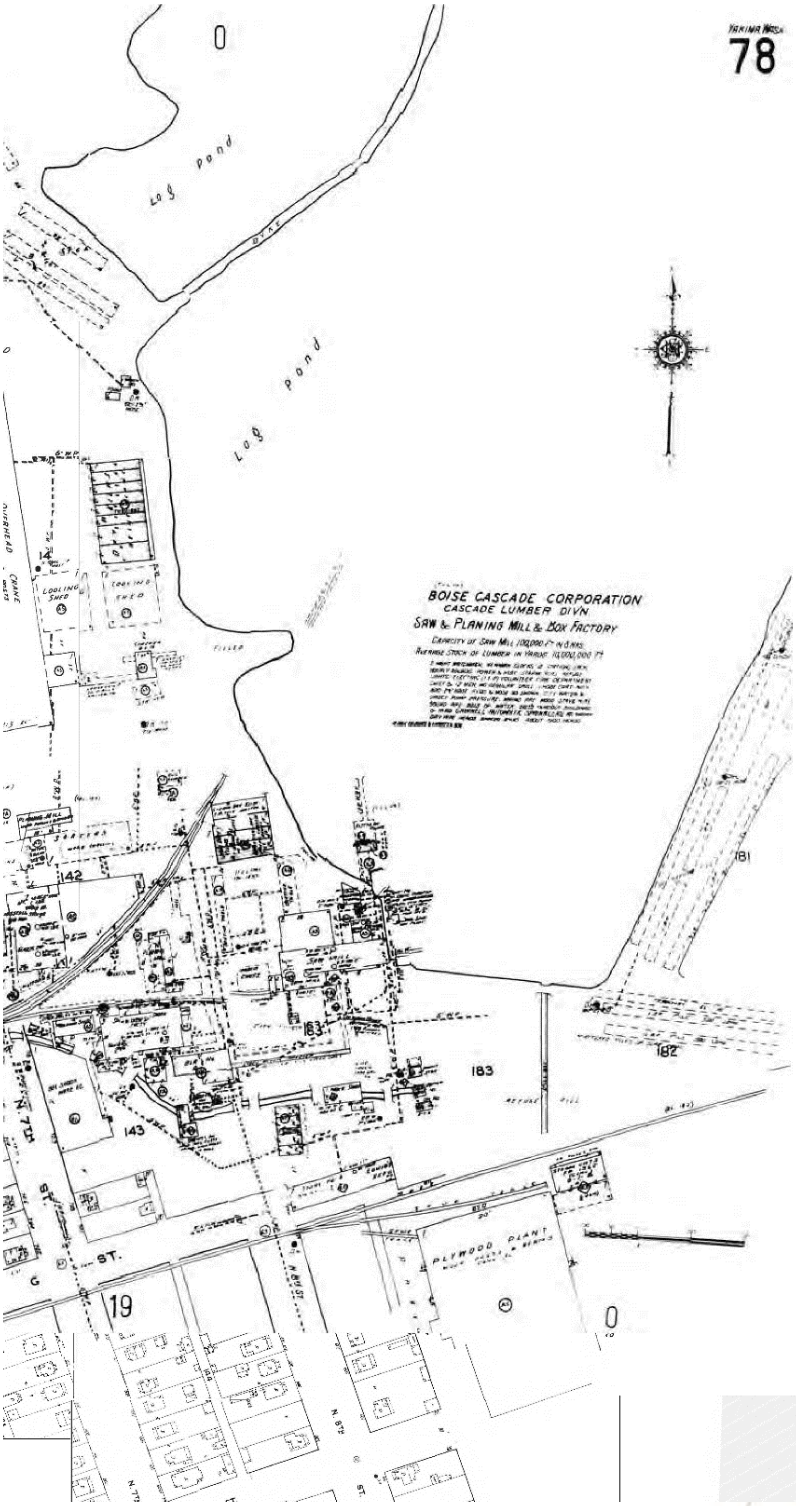


1949 Aerial Photograph

The plywood plant was constructed between 1959 and 1962. This construction required filling of a portion of the south log pond. The plywood plant is not shown in the 1959 Sanborn map, but is shown in the 1962 Sanborn map (right). Two pond structures, the natural pond at the north extent of the Mill Property and the north pond are shown divided by a “dyke” on the Sanborn map. No specific division for a trestle or dike is shown to divide the north log pond.

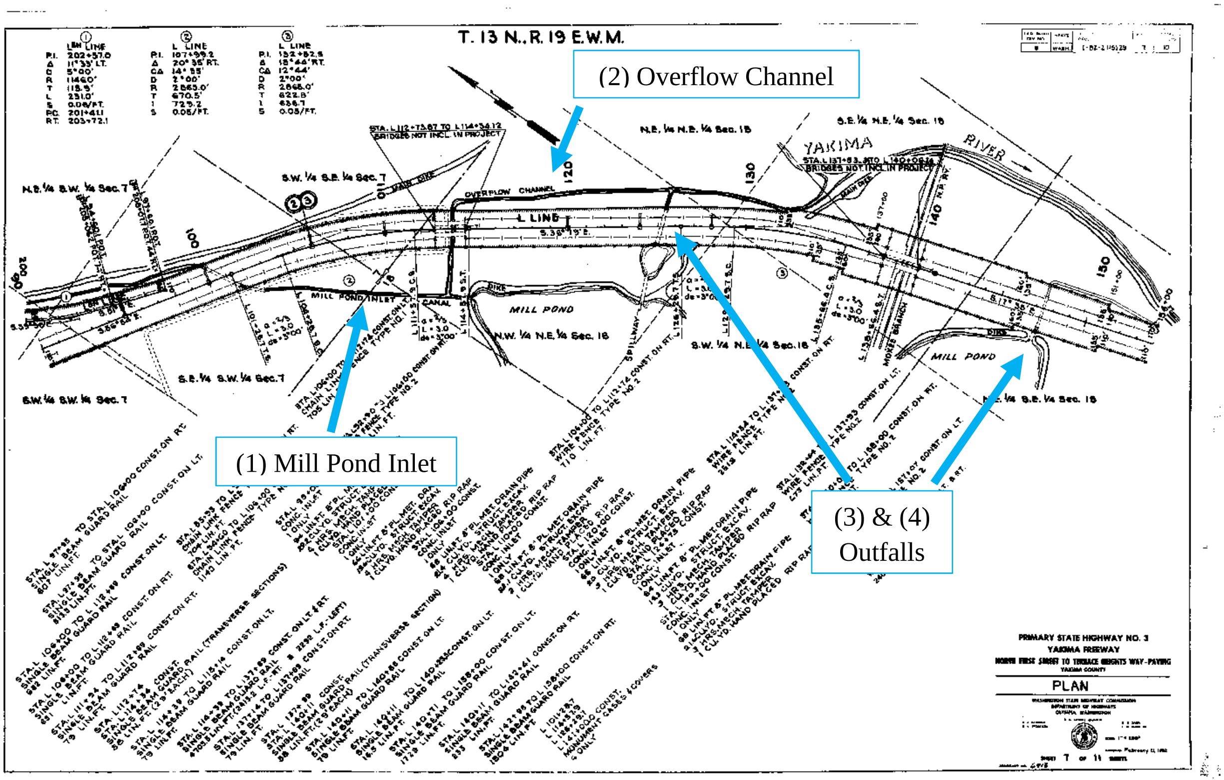
The spill way is shown to remain between the north pond and the plywood plant.

The Fruitvale Wasteway is shown arriving from the west and then is shown to consist of open ditch and culvert sections on the Mill Property. North of the plywood plant and to the east the location and construction of the Fruitvale Wasteway is not shown.



The last reference document during this pre-interstate highway time frame is a 1962 drawing (see below) prepared by the Washington State Department of Transportation for "Primary State Highway No. 3" which would later become a portion of Interstate 82. Two "mill ponds" are shown at the Mill Property with dikes surrounding the ponds.

The plan indicates the presence of four water connections between the Mill Property and the Yakima River, (1) a mill pond inlet canal, (2) an overflow from the mill pond inlet canal to an "overflow channel" and then to the river, (3) a "spillway" from the north mill pond to what was later called the recycle pond, with a discharge from the recycle pond into a pipe beneath the interstate and into the overflow channel and then to the river, and (4) a pipe from the mill pond south of the railroad tracks to a channel that leads to the river.



1962 Washington State Department of Transportation Plan

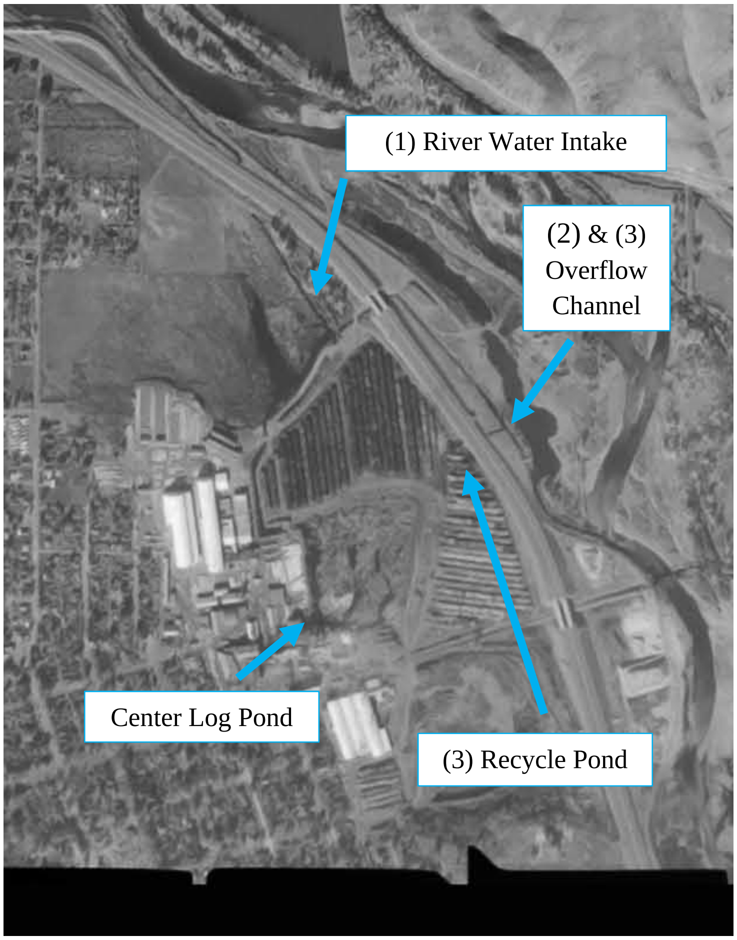
From the 1940s until the 1960s, the principal change to Mill Property operations was construction of state highway (Interstate 82) and separation of mill operations from the Yakima River. While original delivery of logs had been with high water flows in the spring, the introduction of rail and truck delivery eliminated reliance on the Yakima River for log delivery. However the use of large ponds for log storage remained an important feature. The Yakima River water intake location shown on the 1927 aerial photograph has existed since the original development of the Cascade Lumber Company mill in the early 1900s.

Post-Interstate 82 Construction until 1994

The 1964 aerial photograph (right) documents construction of Interstate 82. The presence of log ponds at the Mill Property changed significantly by 1964 with only a much smaller center (north of the railroad) log pond now present. This center log pond is only about 10 acres in size. Most of the former north log pond is being used as a log deck for the storage of logs and associated travel roads. The south log pond is dry and was being used during this time period for the placement of municipal solid waste by the City of Yakima.

Of the four surface water connections to the Yakima River previously discussed, three still appear to be present in 1964 - (1) the river water intake, (2) the overflow from the river water intake into an overflow channel under the interstate and then to the river, and (3) the "spillway" from the recycle pond east into a culvert under the interstate and into the overflow channel continuing to the river.

The river water intake has been reshaped and is a narrow canal that receives river water north of the interstate and conveys the water beneath the interstate, before arriving at the site. Water from this intake appears to be directed into a ditch which flows west into the natural ponding area, north of and parallel to the north log deck and access road, then under the road and south and then east, eventually providing water to the log pond. The natural ponding area to the north in other photographs remains, but is smaller in area in this photograph. In this era of site operations, no logs would have been received by way of the Yakima River.



1964 Aerial Photograph

The overflow is visible at the termination of the river water intake, with a channel leading east beneath the interstate and then south parallel to the interstate, where the "overflow channel" is shown on the 1962 plan.

Similarly, the discharge from the recycle pond, while not readily visible on the photograph, is visible as a ditch east of the intestate where it joins the waters in what has been called the overflow channel form the river water intake as shown in the 1962 WSDOT plan.

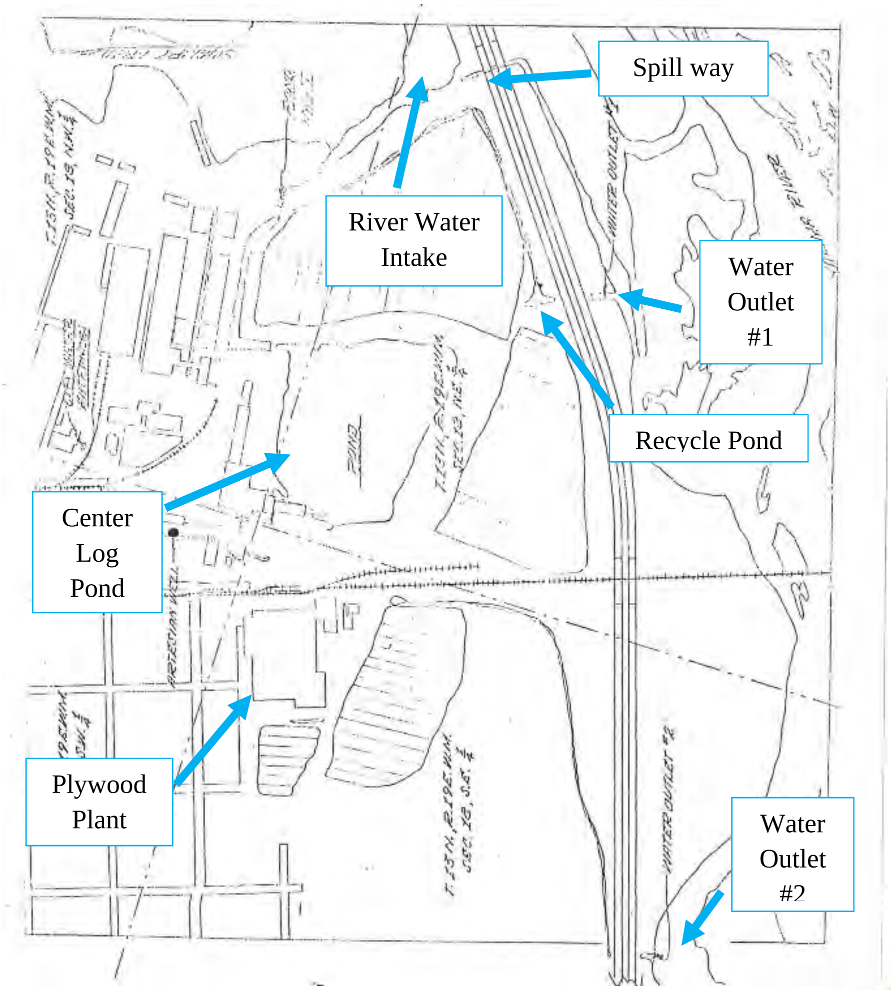
As noted above, the south log pond appears to be dry, with shade from the access road/dike visible along the south boundary. The plywood plant is visible at the northwest corner of the former south log pond. During this period, the former south log pond was used by the City of Yakima as a municipal solid waste landfill.

1971 Aerial Photograph (False Color)

The 1971 false color aerial photograph (above), indicates similar site conditions. The waterways are more clearly shown. However, the natural ponding area to the north is not visible. This area appears to have been graded - perhaps in anticipation of constructing a new log deck. The river water intake is unchanged from the 1964 aerial photograph. After reaching the spillway, the alignment of the ditches appears to have been revised slightly. The water is conveyed in a ditch running to the southwest along the north portion of the north log deck, then south near the kiln buildings and then east into the center log pond. In this photograph, the much smaller center pond appears to consist of two parts separated by a dike or road.

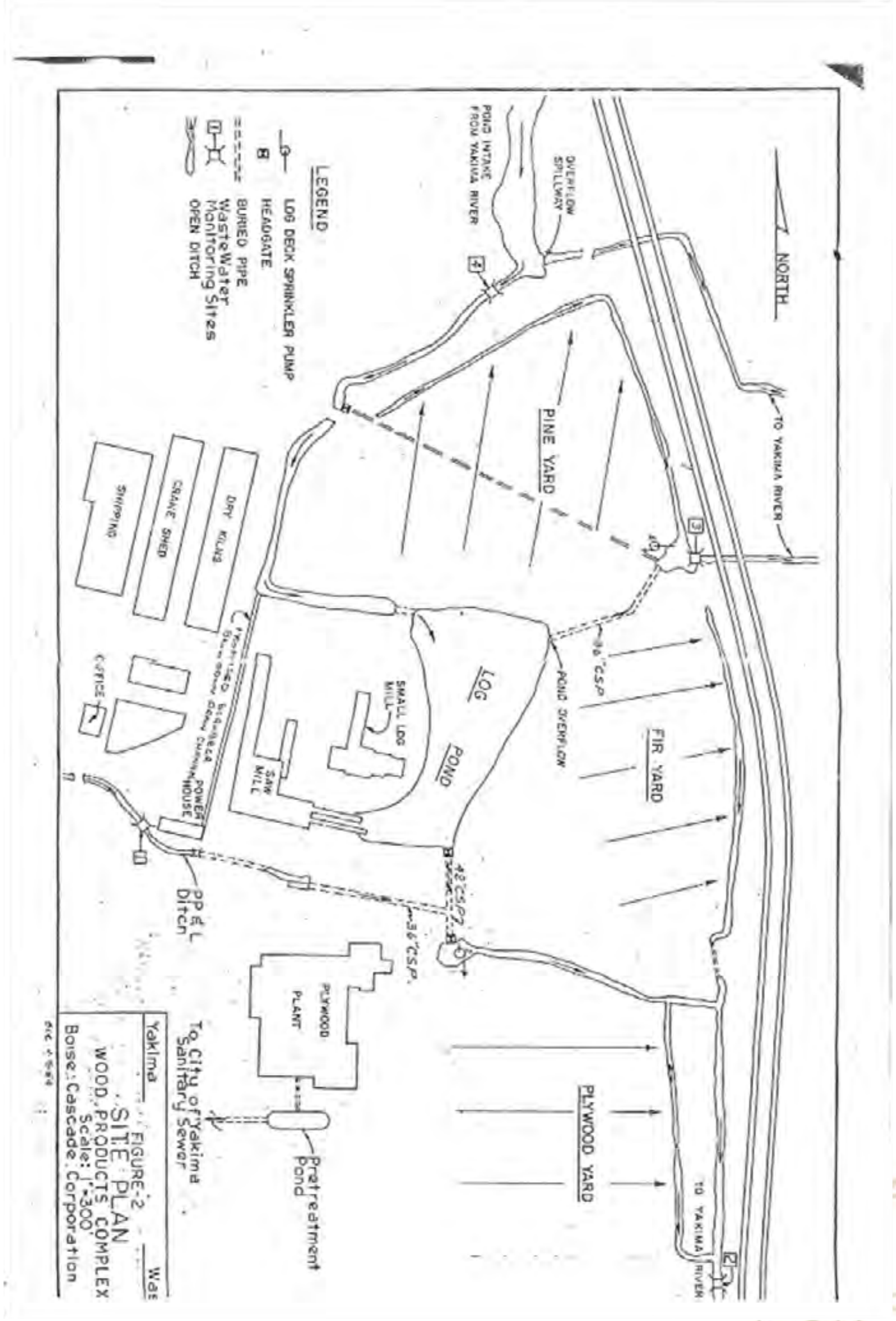
The former extent of the south log pond consists of the plywood plant, area used as a log deck for log storage and areas used by the City of Yakima as a landfill. Roadways at the Mill Property are visible with darkened colors, consistent with application of water for dust abatement. Dark patterns on the log decks consistent with log deck sprinkling use are also present in the photograph.

A 1981 era drawing indicates the presence of the center log pond and water features connected to the Yakima River. The drawing shows two "water outlet" locations. The first location is east, along the north log deck, in the location of the recycle pond discharge, and shown as connecting to the river beneath Interstate 82 (water outlet #1). The second location is at the southeast corner of the plywood log deck (water outlet #2), and is also shown as connecting to the river beneath the interstate.



1981 Site Drawing

A 1984 “Site Plan, Wood Products Complex” provides a layout of the log pond and waterways at the Mill Property at that time. The site plan, as shown below, was present in Ecology’s files Flow direction arrows within the ditches and log decks identify the flow of water. The PP&L Ditch (more commonly referred to as the Fruitvale Wasteway) is shown entering the Mill Property from the west.



1984 Wood Products Complex Site Plan

A small log pond is shown near the center of the Mill Property and receives water from a “pond intake from Yakima River.” Flow direction is indicated in each of the ditches. A “proposed scrubber blowdown channel” from the power house north and into the channel is consistent with features observed at the Mill Property in the 2000s when scrubber water flowed north from the boiler house into the south kiln pond. The river water intake water is shown to either return to the Yakima River by an “overflow spillway” channel before reaching the operating area on the site, or to be conveyed to an open ditch along the northwest and then west side of the “Pine Yard” before flowing east into the small log pond. Water in the log pond is shown to either overflow to the northeast and into the recycle pond, which in turn appears to overflow to the Yakima River, or be released to the south through a buried pipe into a pond and open ditch that is a part of the Fruitvale Wasteway. Two open ditches are shown parallel to and on the west side of Interstate 82 that join near the southeast corner of the plywood log deck. While the figure is cut off, this ditch presumably joined the Fruitvale Wasteway, which flows under Interstate 82 and discharges to the Yakima River.

Two log deck sprinkler pumps are shown at the Mill Property, one at the recycle pond and a second near the center of the Property, east of the plywood plant along the alignment of the Fruitvale Wasteway. The site plan suggests that capture and reuse of water from the north log deck pine yard was part of a recycle system using the log deck sprinkler pump, but that the north log deck fir yard and the plywood yard water was captured in ditches and flowed to the Yakima River. This 1984 sketch shows that water monitoring occurred at the intake from the Yakima River, at the discharge from the recycle pond, in the Fruitvale Wasteway near the power house and where the Fruitvale Wasteway discharged from the site. The nature and the results of the monitoring are unknown.

The only other water feature shown on the 1984 sketch is the equalization pond (referred on the sketch as the pretreatment pond) located south of the plywood plant. This outfall is identified as a buried pipe connected to the City of Yakima sanitary sewer system.

A 1991 aerial photograph (right) provides a picture of the Mill Property. During this period of operation, the south kiln pond, north kiln pond, recycle pond, settling pond, equalization pond and a plywood deck pond are visible. A small log pond remains at the north center of the Mill Property.

At this time, the log pond would have provided logs to the large log mill. A curved track or rail system is visible along the south and southeast portions of the log pond and likely was a portion of the log conveyance system to large log sawmill.

Logs for the small log mill were delivered using a ramp located on the north side of the building.

1991 Aerial Photograph

Log storage at the Mill Property included the north log decks and the plywood log deck. At the time of the photograph, most of the log decks were being sprinkled with water, as evidenced by the dark coloration of the log decks. Exposed lighter logs are likely associated with placement of recently received logs. An irrigation return flow ditch is visible along the perimeter of each of the log decks and is separate from the later discussed “Spring Diversion Ditch”.

The significant vegetation in the north center portion of the plywood log deck indicates that the Fruitvale Wasteway was an open ditch during this period of operations. Other surface water features, including the North First Lateral Drain are visible crossing the Mill Property to the north before connecting to water bodies east of Interstate 82.

1994 to 2009

By 1994, the last log pond was closed. As reported, this log pond was filled with rock quarried from an area near Tieton, Washington. As observed during the City of Yakima’s road right-of-way investigation in 2016, large basalt spalls, measuring between 1 and 3-feet in diameter, are present within the footprint of the final log pond.

Log storage beginning in the 1960s and continuing until closure of Mill Property operations consisted of large stacked rows of logs on the log decks. The decks were constructed primarily of bark with some imported rock and concrete debris. The decks were elevated three to four feet above the perpendicular return flow collection ditches constructed such that the logs did not sit in water. The logs were organized by log deck and purpose with pine yards and fir yards present in the north log decks associated primarily with sawmill use, and a plywood deck to the south for fir log storage for plywood plant use.

As a part of fire prevention, biological growth prevention, checking reduction, and to increase workability of the logs, the decks were regularly watered with hand sprinkler lines placed on the surface of the log decks. Typically, the log sprinklers were used from March until October. Stretching from a main line along the perimeter of the log decks, the sprinklers would operate full-time to saturate the logs with water. Excess water flowed off the logs and was collected in ditches between each row of logs. Water running off the log decks collected into “head ditches” that carried the water to the recycle pond and settling pond for reuse in the sprinkling systems. Sodium hypochlorite was added to the recycle pond and settling pond to inhibit algae growth in the pods. No other chemicals were added to the pond or log sprinkling system.

In an April 10, 1997 letter to Ecology, Boise confirmed that the metal slide gates had been welded closed to effect “permanent closure of gate/flue outfalls at the north and south log yard recycle ponds.” With this change, release of water from site ponds into the Yakima River ceased and all irrigation water was captured and recycled for onsite use of lost through infiltration to groundwater.

Beginning in 1998, Landau Associates, Inc. completed a hydrogeologic study of the Yakima Wood Products Complex. The study included installation of six additional groundwater monitoring wells (MW-

05 through MW-10) to supplement the three existing monitoring wells (MW-01, MW-03 and MW-04). MW-02 had been abandoned in August 1998 due to casing damage. Groundwater monitoring occurred during four monthly events in the summer and fall of 1998. Following issuance of the hydrogeologic investigation report, groundwater sampling continued on a monthly basis from 1999 until about 2006, with samples collected quarterly for laboratory analysis. Quarterly discharge monitoring reports (discharges to the sanitary sewer system) were also submitted to Ecology as required under the National Pollution Discharge Elimination System (NPDES) permit. Permit requirements included quarterly analysis of samples for iron, manganese, and total dissolved solids. A more expansive list of analysis was completed once every five-year permit cycle.

The following series of photographs, collected by Fulcrum from 2004 show the water features during this time period.

The river water intake gate was constructed of concrete and metal. The intake received water from the intake channel to the north. Excess water overflowed to the east at the spillway and into the overflow channel atr ight, beyond the view of the photograph.

Log deck water sprinker equipment consisted of common agricultural aluminum hand lines that were placed a top the log decks. The sprinkler lines were connected to a pressurized aluminum main line along the perimeter of the log decks, visible in the photograph as a long series of piping from the left of the photograph. This photograph was collected south of the river water intake with the former planer building in the background.

A separate drainage ditch (referred to as the “spring diversion ditch” in the 2005 State Waste Discharge Permit sketch discussed below) along the north log deck. The sprinkler return water was a separate system from the ditch shown in the photograph. The sprinkler water collection ditch was located between the main line and the log deck.

As with previous photograph, the former planer building is visible in the background.

Overflow water from the boiler scrubber was released to the concrete and asphalt surface and flowed into an underground trench that conveyed the water to the south kiln pond. Select laboratory analysis as required by the 2004 State Discharge Permit renewal found the scrubber water to have iron (<0.150 to 11.1 mg/L), manganese (0.135 to 3.65 mg/L), and orthophosphate-phosphorus (0.005 to 0.639 mg/L). Field parameters found the water to be 85.3 to 138 degrees Fahrenheit, pH 7.1 and 8.4, conductivity of 327 to 660 µS, total dissolved solids of 219 to 442, and ferrous iron < 2 ppm.

The recycle pond was equipped with two electric motors that pumped water from the pond into the log deck sprinkler system.

Water supply from the pumps could be directed to sprinkler connections to the south and the north main line sections.

Sodium hypochlorite solution being added to the settling pond.

Sodium hypochlorite being added to the recycle pond. Return flow from the sprinkler water return ditch is present at the center of the photograph. The return flow is visibly discharging from a white polyvinyl chloride pipe visible near the center of the photograph,

10/6/04 14:56

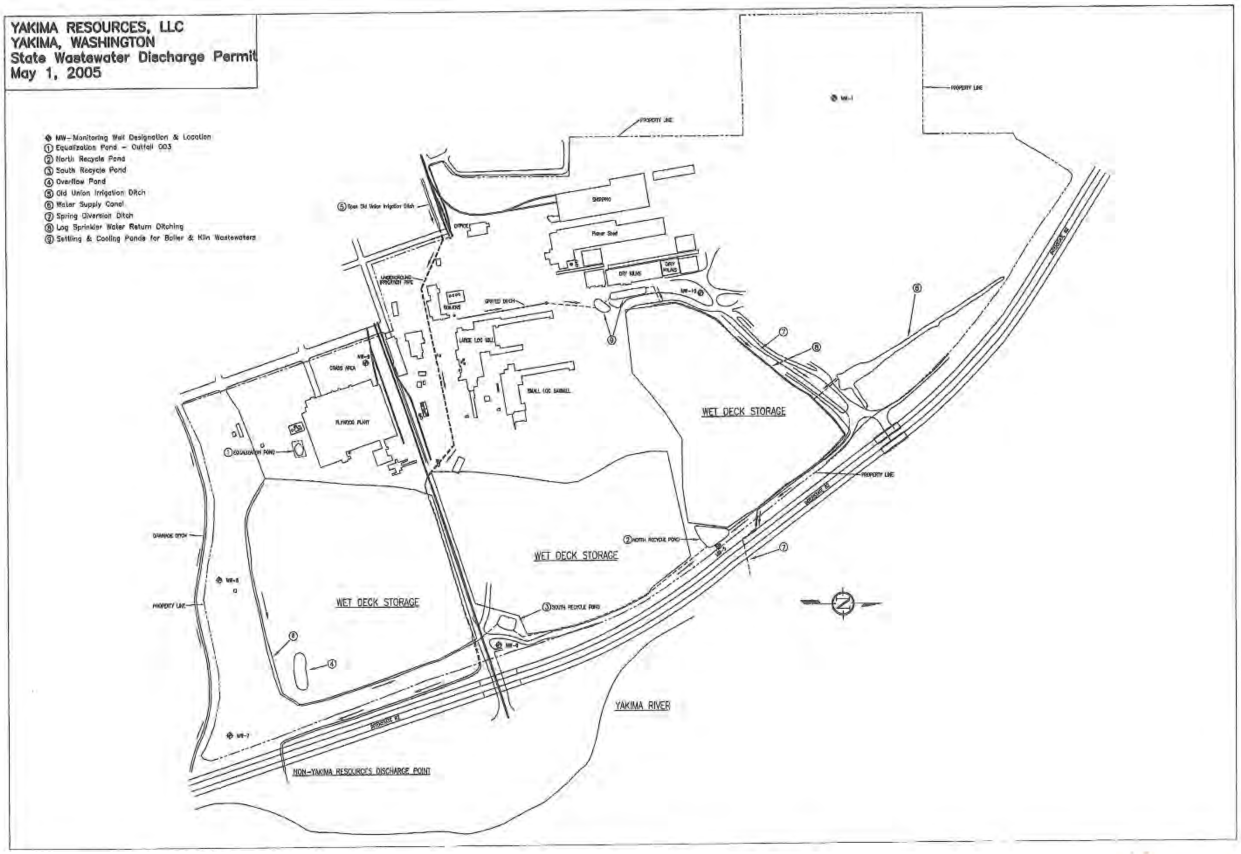
Sodium Hypochlorite Solution

ACTIVE INGREDIENT (NOMINAL CONCENTRATION):
SODIUM HYPOCHLORITE: 12.50%
INERT INGREDIENTS: 87.50%
TOTAL: 100.00%

KEEP OUT OF REACH OF CHILDREN - DANGER

Sodium hypochlorite solution (12.5%) was added to the pond water to assist with control of biological growth.

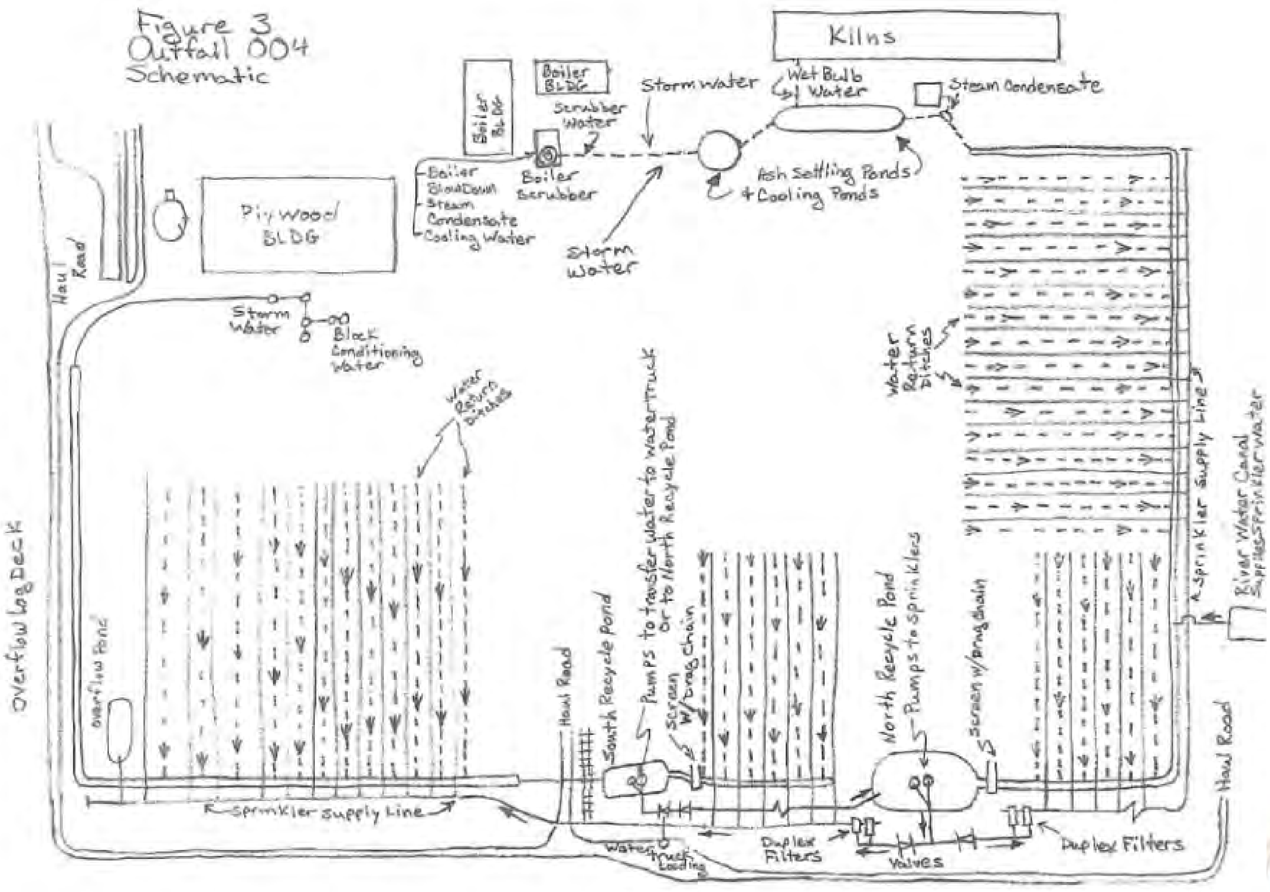
Surface water features identified in the 2005 State Wastewater Discharge Permit field drawing submitted to Ecology included the plywood plant equalization pond (designated Outfall 003), north recycle pond, south recycle pond (referred to now as the settling pond), Overflow Pond (southeast corner of plywood log deck), Old Union Irrigation Ditch (aka the Fruitvale Wasteway), water supply canal (aka river water intake),



spring diversion ditch, log sprinkler water return ditching, and settling & cooling ponds for boiler and kiln wastewaters (aka south and north kiln ponds). The North First Lateral Drain is not shown on this drawing. Discharge connections to the Yakima River include the Fruitvale Wasteway at the southeast corner of the Landfill Site, and the "spring diversion ditch" adjacent to the recycle pond (referred to as #7 in the drawing). The spring diversion ditch is a feature that was identified and named by the mill environmental manager in about 2004. It carries flow from a groundwater "spring" that is present north of the north log deck.

A second hand sketch included in the 2005 O&M Plan (shown below) further illustrates the recycle water flow patterns. The drawing is not to scale or shape but is illustrative of operations.

Water features excluded from the sketch are the Fruitvale Wasteway, the North First Lateral Drain, and the spring diversion ditch.



2009 to Current

Logs were stored at the Mill Property until about 2009, when the final logs were either sold or chipped for paper stock. With the discontinuation of log storage, the log deck irrigation system was dismantled and the pumps were sold. The features that remain include the recycle pond and the settling pond. Piping is visible at the edges of the former ponds/log decks.

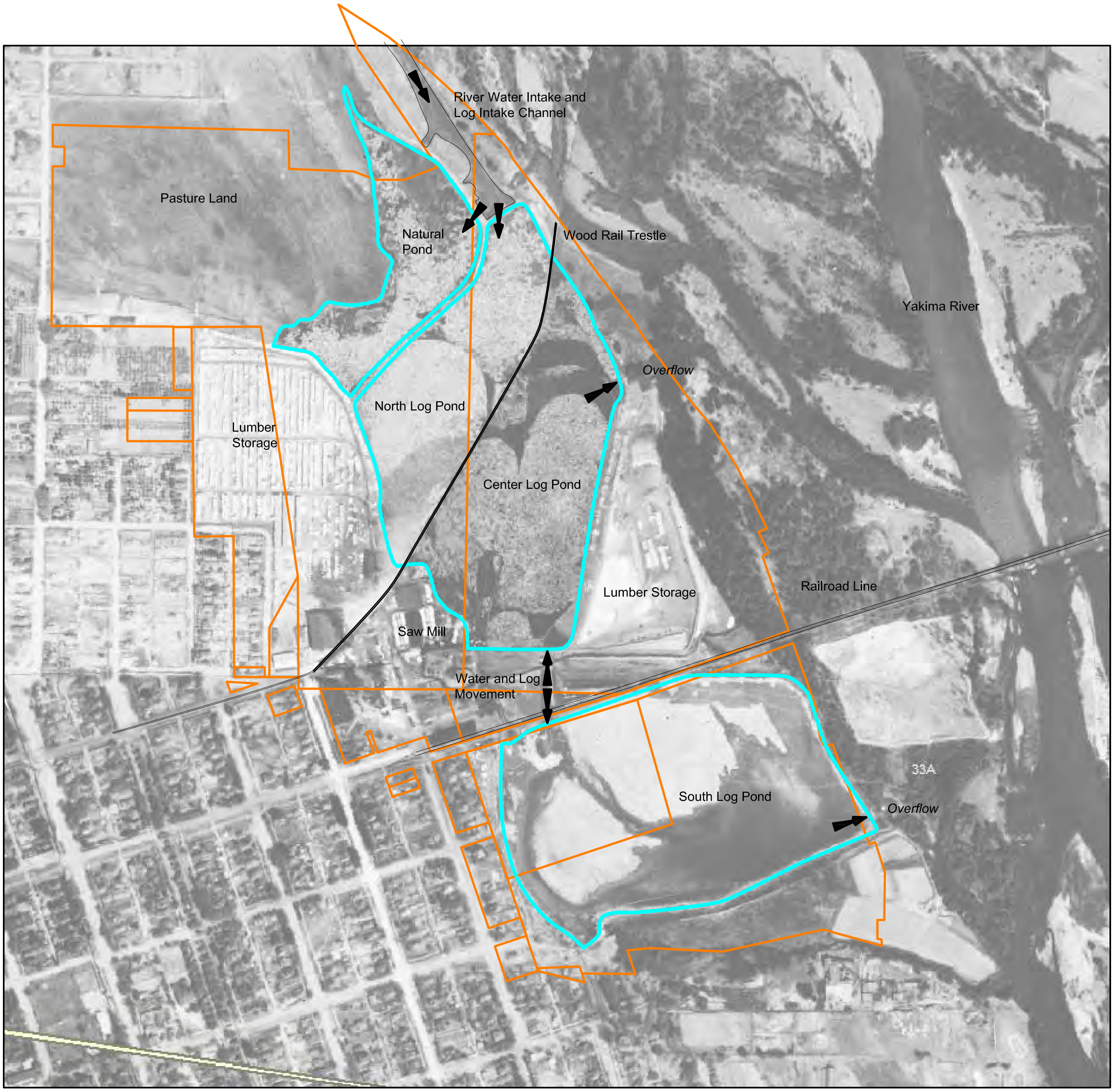
Processing of log yard materials, which consists of sorting log yard bark, bark fines, and rock, has occurred since the mid-2000s. Accessible log yard materials from much of the Mill Property have been recovered, processed, and sold. Generally, log yard material recovery began at the south extent of the Mill Property at the plywood log deck and moved north as recovery was completed.

Depending on the moisture conditions of the log yard materials, the material has been processed either as found or after being watered, and then stockpiled and allowed to dry. Moisture content in the log yard material is important to reduce windborne loss during processing and transport.

Water from the onsite deep production well has been used for both log yard material processing and dust abatement. Excess water from log yard material processing was primarily released to the ground.

No changes to the operation of the North First Lateral Drain, Fruitvale Wasteway, or spring diversion ditch have occurred during this time period.

2012 Aerial Photograph



Legend

— Approximate Present Day Parcel Boundary

— Extent of Ponds

➨ Surface Water Flow Direction

Not to Scale

Fulcrum Environmental Consulting, Inc.
406 North Second Street, Yakima, Washington 98901
p: 509.574.0839 f: 509.575.8453 efulcrum.net
Yakima Mill Site - Southwest Area

Yakima Mill Site
Yakima, Washington

Surface Water
Features 1927

FIGURE
1

Appendix B2

History of Southwest Area

FULCRUM
environmental consulting

MEMORANDUM

DATE	November 6, 2017
TO	Allan Gebhard, Barr Engineering, Inc.
FROM	Ryan K. Mathews, Fulcrum Environmental Consulting, Inc.
RE	**History of Southwest Area**
SUBJECT	Yakima Mill Site

Parcels in the Southwest Area of the former Boise Cascade Lumber and Plywood Mill were evaluated at the direction of the Washington State Department of Ecology (Ecology) to determine the development history and potential for uses with environmental impact. Reviewed documents included Sanborn Fire Insurance Maps, topographic maps, and aerial photographs. Select Sanborn maps and aerial photographs are included in this memorandum. All other referenced documents are available on request.

As defined in this memo, the "Southwest Area" includes parcels 191318-42003, -42401, -42404, -43539, and the southwest corner of parcel -41001 that does not contain municipal solid waste. Parcels -42401, -42404 and -43539 are part of the Yakima Mill Site defined in Agreed Order No. DE 13959. Parcel 191318-42003 and the southwest corner of parcel -41001 are not a part of the Yakima Mill Site as defined in the order. A copy of Exhibit A from the Agreed Order is attached as Figure 1 with a noted added to indicate the presence of parcel -42003.

In recent years, the properties that make up the Southwest Area consisted of asphalt paved access roads, asphalt paved parking lots, landscaping, and a gravel staging yard.

Presently the western tax parcel boundary of the Yakima Mill Site in the Southwest Area is North 8th Street, extending from East G Street on the north, which is the location of the operational railroad line, to the half block between East E Street and East D Street on the south. The portions of E and F Streets that extend east of North 8th Street are identified as owned by the City of Yakima.

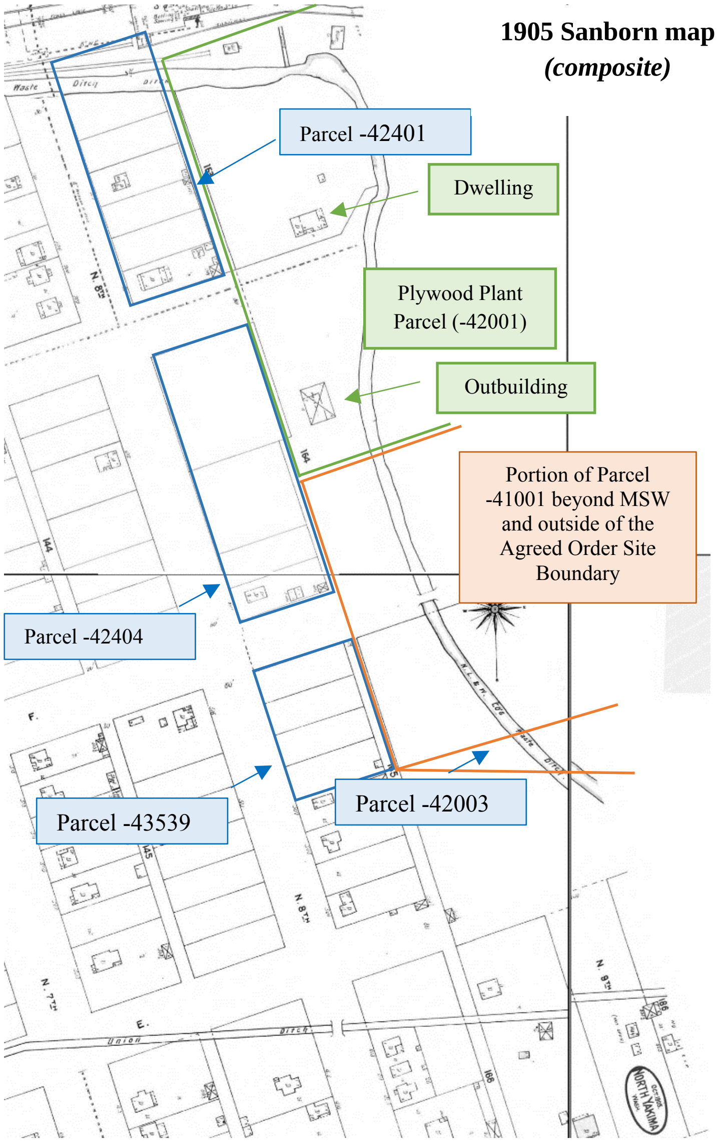
As provided in numerous articles, the Cascade Lumber Company was developed in 1902 and operational in 1903. The articles indicate that cut timber was floated down the Teanaway and Yakima rivers in annual drives during spring high water to a flume that carried the timber into large ponds at the lumber mill. The 1905 Sanborn map indicates that an operational lumber mill was located north of the railroad line.

Provided below is a narrative describing changes in the Southwest Area over time. Generally, some of the parcels in the Southwest Area were developed as residential dwellings from 1905 until early 1970s, when the residences were demolished.

Available Resources

Sanborn Fire Insurance Maps were prepared to assist insurance appraisers in evaluating the fire hazard of a building or set of buildings located many towns or many states away from the insurance company office.

Though a series of colors, symbols, and markings, the building size (floors), construction materials, construction methods, fire protection features, electrical service and maps of other features are provided.



Coverage of Sanborn maps is valuable for commercial and manufacturing properties, as even sites located on the edge of a city or town are often covered as they were routinely insured for loss. Select Sanborn maps are included in Figure 2 with the approximate present day parcel boundaries shown for reference.

Topographic maps assist in developing the use and changes in use at a property.

Generally topographic maps were produced at a scale where fine site details are not indicated.

Aerial photographs were prepared by a number of different providers for a number of purposes. They are routinely prepared by transportation departments, counties, and cities with some agencies collecting photographs yearly to assist with asset evaluation and planning. Some aerial photographs provide exceptionally fine detail, while others have poor resolution as a result of weather conditions, flight elevation, post-processing, or digitizing practices.

Southwest Area – 1900s until About 1960

The 1905 Sanborn maps (right) indicate about 16 separate parcels in the Southwest Area, of which six have one or more dwellings shown. Two of these parcels and a dwelling are located east of North 8th Street on parcel -42001, the future Plywood Plant parcel. No commercial buildings or manufacturing are shown on the 1905 Sanborn in the Southwest Area. The Northwest Light & Water Co. "Waste Ditch", later identified as the PP&L Ditch and the Fruitvale Wasteway is located on tax parcel -41001.

The 1909 Sanborn map identifies additional residential development with the addition of 12 new dwellings and the demolition of the one dwelling located further east of North 8th Street (on parcel -42004) totaling 17 dwellings with associated outbuildings. Additionally the former four parcels located north of F Street have now been divided into a total of seven parcels.

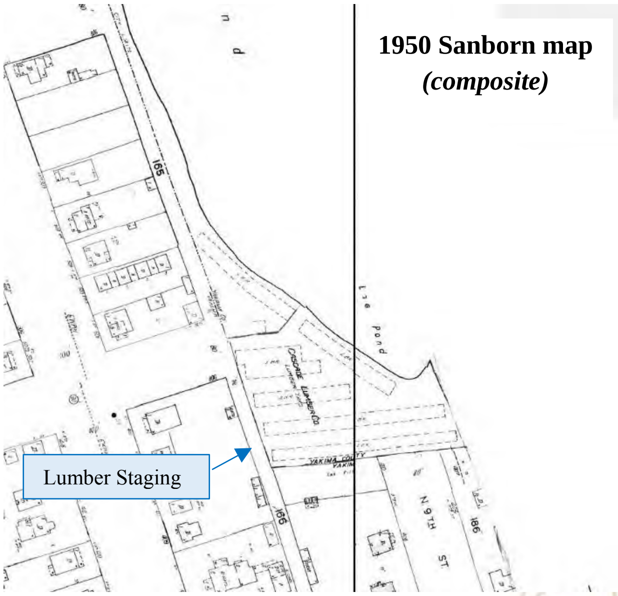
A review of the 1920 Sanborn map identifies the Southwest Area as containing 17 parcels, with 12 shown to have a dwelling. More outbuildings are shown on the parcels than on the 1909 map. No commercial buildings or manufacturing are shown on the 1920 Sanborn map in the Southwest Area. The "Waste Ditch" has been realigned adjacent to the railroad line to the north. The map suggests the presence of a pond and that the previous dwelling and outbuilding in this location are no longer present (see the 1905 Sanborn map for dwelling and outbuilding locations).

1949 Aerial Photograph

A 1941 topographic map of the Yakima East quadrangle provides general information on the mill. A large pond is indicated south of the railroad line. While buildings are not indicated in the Southwest Area, few buildings are shown on the map.

A 1948 topographic map provides similar features to the 1941 map. Numerous structures are indicated along North 8th Street, in the Southwest Area. Use of the structures is not indicated. The large pond filled with timber remains to the east of the Southwest Area.

A June 18, 1949 aerial photograph (right, top) is a high altitude, high resolution, black and white image that depicts the Southwest Area occupied by residential dwellings and associated outbuildings. No commercial buildings or manufacturing are shown on the 1949 aerial photograph in the Southwest Area Lumber products appear to be a staged in the Southwest Area, immediately southwest of the log pond on parcel -41001.



1950 Sanborn map
(composite)

Lumber Staging

A second resource from this time is a 1950 Sanborn map (right, bottom) which provides coverage of the Southwest Area. Dwellings, including single residences, a four-plex type dwelling, and a three-unit apartment, are shown. Outbuildings, including “auto” or an automobile garage are shown associated with the dwellings. No commercial buildings or manufacturing are shown on the 1950 Sanborn map in the Southwest Area. A portion of the Southwest Area is shown as lumber staging and appears to be southwest of the present day extent of municipal solid waste associated with the former City of Yakima Landfill. No building or other structures are shown in the area of lumber staging.

The 1952 Sanborn map shows an additional structure built on the parcel southeast of the intersection of E Street and North 8th Street in the Southwest Area. No commercial buildings or manufacturing are shown in the Southwest Area on the 1952 Sanborn map.

An August 5, 1955 aerial photograph shows no discernable differences from the 1952 Sanborn map.

The property uses in the Southwest Area shown in the 1959 Sanborn map are consistent with the uses shown in the 1952 Sanborn map. Dwellings remain east of 8th Street. A total of 15 parcels are present east of 8th Street between H Street to the north, and the half-block between E Street and D Street to the south. These parcels are shown to be developed with dwellings and apartments. Consistent with the 1950 Sanborn map included above, lumber staging is visible along the southwest portion of the pond (so labeled on this map). No commercial buildings or manufacturing are shown on the 1959 Sanborn map in the Southwest Area.

1960 Until Present

Sanborn maps and aerial photographs provide a timeline of the Southwest Area from the 1960s until the present time.

The Sanborn map from 1962 identifies the construction of the Plywood Plant. Six residential structures remain along 8th Street in the Southwest Area immediately adjacent to the Plywood Plant. An additional nine parcels with dwellings, a four-plex type dwelling, and a three-unit apartment building remain. The log pond to the east of the Southwest Area is not shown. No commercial buildings or manufacturing are shown on the 1962 Sanborn map in the Southwest Area.

A November 2, 1964 aerial photograph is a high altitude, black and white image that shows the Southwest Area occupied by residences. No commercial buildings or manufacturing are shown on the 1964 aerial photograph in the Southwest Area.

1964 Aerial Photograph

The Sanborn map from 1967 is a composite of two maps which shows the block east of North 8th Street and south of G Street as undeveloped in the northern half and as containing three residential parcels with dwellings and associated out buildings in the southern half. South of F Street are residential dwellings and associated out buildings. No commercial buildings or manufacturing are shown on the 1967 Sanborn map in the Southwest Area.

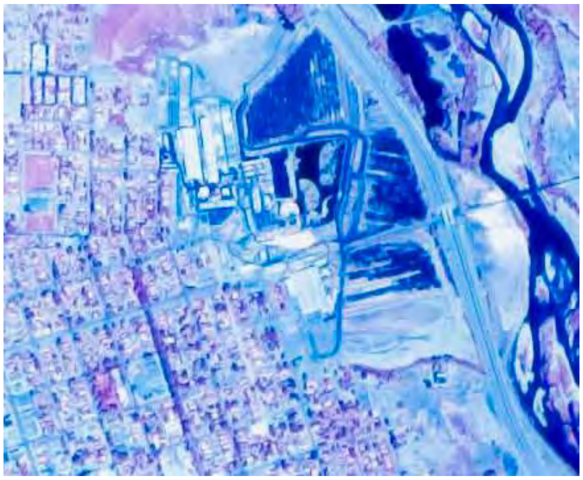
The residential dwellings, apartments, and associated outbuildings remain in the 1969 Sanborn map. A pond is not shown on the 1969 map. However, remnants of the pond remained until the early 1970s when the City of Yakima ceased landfilling operations.

The 1971 aerial photograph (right, top) shows the portion of the Southwest Area that was formerly occupied by residential dwellings as now void of buildings. No commercial buildings or manufacturing are shown on the 1971 aerial photograph in the Southwest Area.

A July 3, 1973 WSDOT aerial photograph (right, middle), shows the Southwest Area with trees and grass in the northern area with primarily empty lots to the south. The empty lots contain some features, likely employee vehicles, as well as small trees and/or structures. No commercial buildings or manufacturing are shown on the 1973 aerial photograph in the Southwest Area.

An August 9, 1974 aerial photograph shows similar landscaping along the north extent of the Southwest Area and the southern portion is an empty lots with no sign of vegetation or structures. No commercial buildings or manufacturing are shown on the 1974 aerial photograph in the Southwest Area.

Corresponding to the 1974 aerial photograph (right, bottom) is a 1974 topographic map. The topographic map identifies the presence of the Plywood Plant and numerous small structures along North 8th Street. Eleven structures are shown in the Southwest Area; an additional 14 structures are located to the south beyond the Southwest Area boundary. An unimproved road is also shown extending from South 9th Street to East F Street, south of the Southwest Area.



1971 Aerial Photograph (False Color)

1973 Aerial Photograph

1974 Aerial Photograph

A July 16, 1979 aerial photograph shows the Southwest Area as unchanged from the 1974 aerial photograph. No commercial buildings or manufacturing are shown on the 1979 aerial photograph in the Southwest Area.

A July 31, 1981 aerial photograph shows no new features or changes in the Southwest Area. No commercial buildings or manufacturing are shown on the 1981 aerial photograph in the Southwest Area.

In a 1985 topographic map, no small structures remain on the parcels in the Southwest Area. The Plywood Plant and the Vat building are the only structures shown south of the railroad line. Unimproved roadways are shown in the south log yard to the east of the Southwest Area.

A 1989 aerial photograph shows a grassy area with trees, a parking lot, and truck-trailer parking area in the Southwest Area. No commercial buildings or manufacturing are shown on the 1989 aerial photograph in the Southwest Area.

The 1991 aerial photograph (right) shows no significant changes from the 1989 aerial photograph but provides improved resolution. Two small buildings, consistent with small offices, are visible south of the Plywood Plant on the Southwest Area. These spaces were used primarily for logging truck driver check-in/out. No manufacturing operations were known to have occurred in these small offices. It is known that portions of the Southwest Area were used during this period for employee vehicle parking and for parking of trailers used to transport wood chips to Boise Cascade paper mills. Dark colors along roadways are consistent with use of water for dust suppression.


1991 Aerial Photograph

The 1996 aerial photograph also shows no significant changes from the 1990 aerial photograph. No commercial buildings or manufacturing are shown on the 1996 aerial photograph in the Southwest Area.

No new structures, developments, or uses have occurred in the Southwest Area since 1996.

Available Soil Gas, Soil, and Groundwater Data

Soil gas, soil and groundwater testing has been completed on the Southwest Area. The locations of these sampling locations are shown on Figure 3 and are included in the Draft RI Work Plan for the Yakima Mill Site.

Reviews of the 2008 Parametrix Phase II, 2013 Phase II investigation, and 2015 Supplemental Remedial Investigation data quality were completed by Barr and are reported under separate cover.

Soil Gas

Five gas probes (GP-14, GP-15, GP-16, GP-17, and GP-18) were installed in the Southwest Area by SLR International in 2009. The locations of these gas probes are shown on the attached figure. These gas probes were monitored during four events (4/17/2009, 11/5/2009, 2/3/2010, and 5/10/2012). No combustible gas (assumed to be methane) was reported in GP-15. In both GP-17 and GP-18, combustible gas concentrations of 0.2 and 0.1 percent were reported during the February 2009 event, respectively. See Table A-4 for the soil gas landfill measurements.

Additional gas probes (GP-5 and GP-12) are located in close proximity to the MSW and exhibit higher levels of combustible gas. As such, they are impacted by the MSW and are a portion of the Landfill Site. No other investigation of the Southwest Area was reported by SLR International.

Soil

Landau Associates, Inc.'s 2013 Phase II investigation of the Plywood and Triangular Parcels included three borings (FPP-B21, FPP-B22, and FPP-B23) in the Southwest Area to evaluate soil conditions. The locations of the borings are shown on the attached figure. The basis for investigation of these areas was "no previous analytical data available." Sample depths ranged from 11.5 to 14 feet below ground surface (bgs). The soil samples were analyzed for total petroleum hydrocarbons - diesel range organics and metals (arsenic, cadmium, chromium, iron, lead, manganese, and mercury).

Laboratory analysis of samples from the three borings identified typical background concentrations of arsenic (1.9 to 2.1 milligrams per kilogram (mg/Kg)), chromium (11 to 15 mg/Kg), iron (22,000 to 24,000 mg/Kg), lead (2.9 to 3.3 mg/Kg), manganese (310 to 370 mg/Kg), and mercury (0.024 to 0.031 mg/Kg). Cadmium was not present at or above the reporting limit of 0.50 mg/Kg in any of the samples and no chromium speciation was completed. No diesel range or oil range petroleum hydrocarbons were reported at or above the method reporting limits of 25 mg/Kg and 50 mg/Kg, respectfully. See Table A-6 for the associated laboratory results.

Landau's field notes reported a slight petroleum-like odor in FPP-B22 in near surface soils (0.8 to 1.3 feet bgs) and from 6 to 15 feet bgs. No petroleum hydrocarbons were present in the soils at or above the method reporting limit. "Wood waste" was also reported in the near surface sample in FPP-B22. No other indications of impacts are provided in the field notes for these borings.

During Landau's 2015 Supplemental Remedial Investigation, one soil sample was collected from SB-100 at a depth of 13.5 to 14 feet below ground surface prior to the installation of MW-100. The lcoation of this sample is shown in Figure 3. Landau indicates that SB-100 is north/relatively upgradient of the municipal solid waste in the former City of Yakima Landfill. For reference, the soil sample collected at SB-100 is referenced as MW-100 in the Supplemental Remedial Investigation. The sample was analyzed for metals, chlorinated pesticides, PCBs, VOCs, SVOCs, petroleum hydrocarbons by HCID, and other conventional parameters. Laboratory analysis did not identify any chlorinated pesticides, PCBs, VOCs, SVOCs or petroleum hydrocarbons other than the presence of bis(2-Ethylhexyl)Phthalate at a concentration of 110 micrograms per kilograms (µg/Kg). Metals reported in SB-100 included arsenic (1.4 mg/Kg), barium (58 mg/Kg), chromium (23 mg/Kg), iron (25,000 mg/Kg), lead (2.9 mg/Kg), manganese (380 mg/Kg), and sodium (750 mg/Kg). Hexavalent chromium and mercury was not present at or above the reporting limit. See Table 8 for the associated laboratory results.

Groundwater

Three monitoring wells are present in the Southwest Area, MW-09, MW-09A, and MW-100. MW-09 was installed during the original site hydrogeologic study in 1997 and was used from that time until 2008 to represent groundwater conditions upgradient of the portion of the site south of the railroad line.

MW-09A was installed by Parametrix during completion of the Phase II investigation of the former City of Yakima Landfill. One sampling event was completed on March 25, 2008 from which groundwater was analyzed for gasoline range hydrocarbons, diesel range hydrocarbons, volatile organic compounds (including vinyl chloride by selective ion monitoring methods), semi-volatile organic compounds, PCBs, metals, and other conventional analytes. Parametrix reported no analytes from MW-09A at levels above the MTCA Method A or Method B standard cleanup levels. Only chloroform and bis(2-Ethylhexyl)phthalate were present above the method reporting limit for VOC, SVOC, and PCB analysis. Presence of dissolved metals in groundwater include, but are not limited to, barium (13 µg/L), iron (270 µg/L), manganese (872 µg/L), and other analytes. See Table A-2 for Parametrix groundwater results of MW-09A.

SLR International utilized MW-09A during four events from 2009 and 2012. Generally laboratory analysis was limited to select metals, vinyl chloride, and other conventional analytes. Results include, but are not limited to, arsenic (0.64 to 1.0 µg/L), barium (11.3 µg/L), magnesium (8,020 to 8,920 µg/L), manganese (11.4 to 13.3 µg/L), nickel (1.47 µg/L), and zinc (1.25 µg/L). Cadmium, chromium, iron, and lead, were not present at or above the method reporting limits. See Table A-3 for results from MW-09 for samples collected by SLR International.

Landau completed monitoring of MW-09A during four events as reported in the Supplemental Remedial Investigation for the former City of Yakima Landfill. Selected analysis included dissolved and total metals, chlorinated pesticides, PCBs, VOCs, VOCs by Selective Ion Monitoring, SVOCs, PAHs, and other conventional analytes. Except for metals and conventional analytes, little was identified in the laboratory analysis. Endosulfan II was identified below the investigation screening level in March 2015 (0.012 µg/L), chloroform was identified during three of the four events (1.7 to 22 µg/L), and fluorene was present, well below the investigation screening level, at 0.0092 µg/L in December 2014. No other chlorinated pesticides were reported in groundwater from MW-09A. See Table 9 for Landau's groundwater results.

MW-100 was installed by Landau in 2014 during the supplemental investigation of the former City of Yakima Landfill and monitored for four quarters. Analyses of groundwater included dissolved and total metals, chlorinated pesticides, PCBs, VOCs, VOCs by Selective Ion Monitoring, SVOCs, PAHs, and other conventional analytes. Except for metals and conventional analytes, little was identified in the laboratory analysis. Endosulfan II was identified, below the investigation screening level during two events December 2014 and March 2015, at 0.014 µg/L and 0.017 µg/L, respectfully. No other chlorinated pesticides were reported in groundwater from MW-100. Chloroform was identified below the investigation screening level during three of the four events (1.1 to 1.2 µg/L). Naphthalene was identified below the investigation screening level during the March 2015 monitoring event at 0.02 µg/L. No petroleum hydrocarbons were present at or above the method reporting limit. See Table 9 for Landau's groundwater results.

Conclusions

In summary, a review of the available information for the Southwest Area identified no evidence of manufacturing use of the parcels. Sanborn maps indicate the presence of lumber storage in the 1950s on a portion of the Southwest Area. Development in the Southwest Area has been limited to residential development of select parcels between 1905 and 1971, after which the residences were removed and the parcels were used for vehicle parking or were vacant.

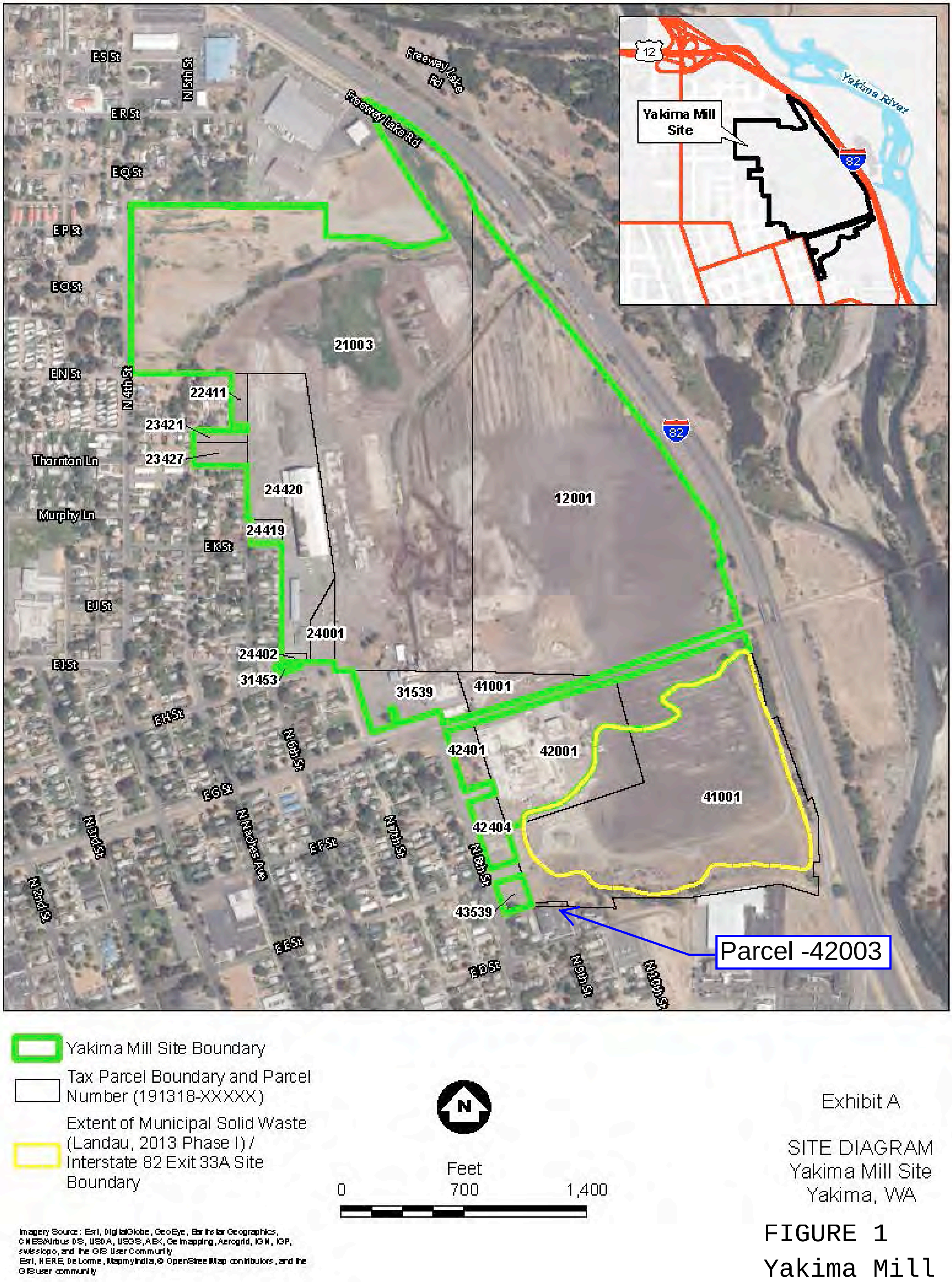
Soil gas, soil, and groundwater investigations have been conducted in the Southwest Area. Results indicate that methane was not present in the five gas probes located on the Southwest Area above 0.2 percent. No metals were identified at concentrations of concern, and neither diesel range nor oil range petroleum hydrocarbons were detected above laboratory reporting limits. Similarly, no chlorinated pesticides were detected in any soil samples. And, groundwater sampling has identified low and inconsistent presence of a few organic compounds, including Endosulfan II, chloroform, and naphthalene, with no metals at concentrations of concern.

The operational history described above does not support the need to conduct further sampling of the Southwest Area, including the area outside the Mill Site boundaries as defined in the Agreed Order.

Attachment A

Figures

EXHIBIT A
SITE DIAGRAM



Imagery Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community
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Exhibit A

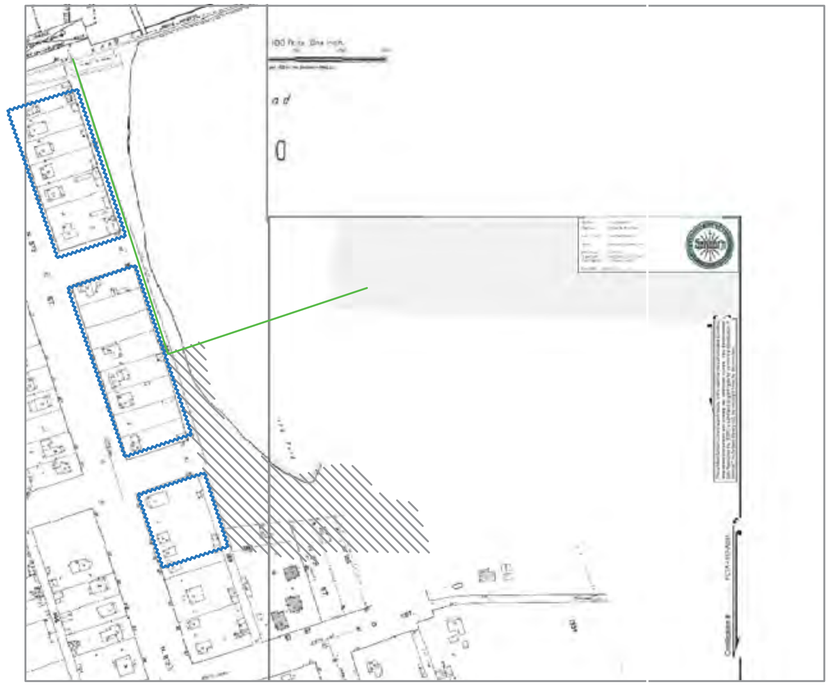
SITE DIAGRAM
Yakima Mill Site
Yakima, WA

FIGURE 1
Yakima Mill Site
Southwest Area Memo

FULCRUM
environmental consulting

1905 Sanborn Map

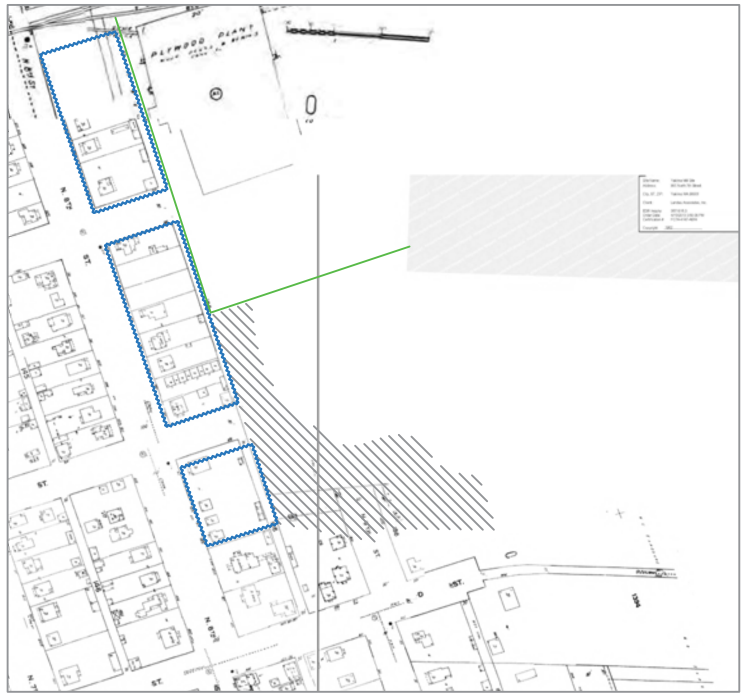
1920 Sanborn Map



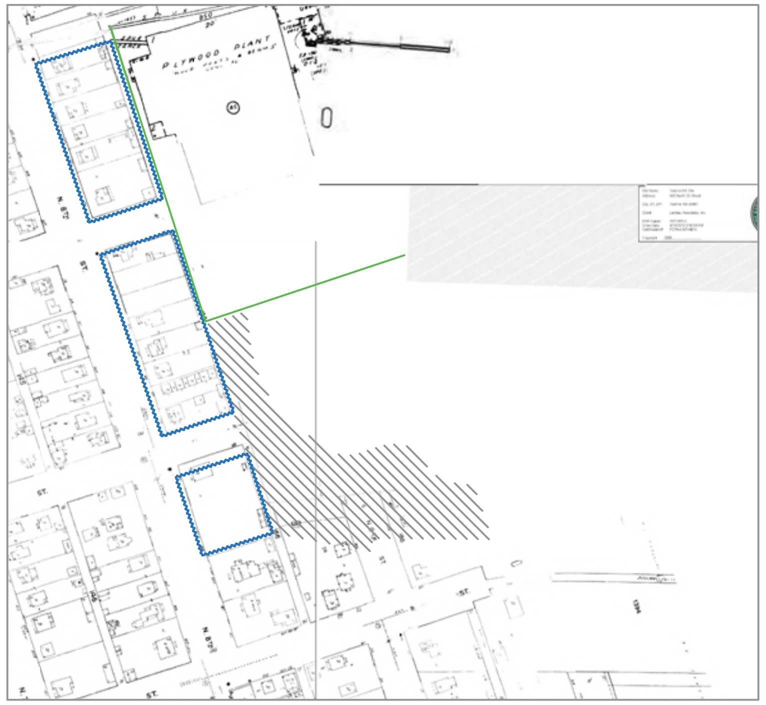
1950 Sanborn Map

1959 Sanborn Map

1962 Sanborn Map



1969 Sanborn Map



Legend:
— Approximate Parcel Boundary
〰 Areas included in Agreed Order Site Definition
▨ Southwest Area beyond Agreed Order Site Definition

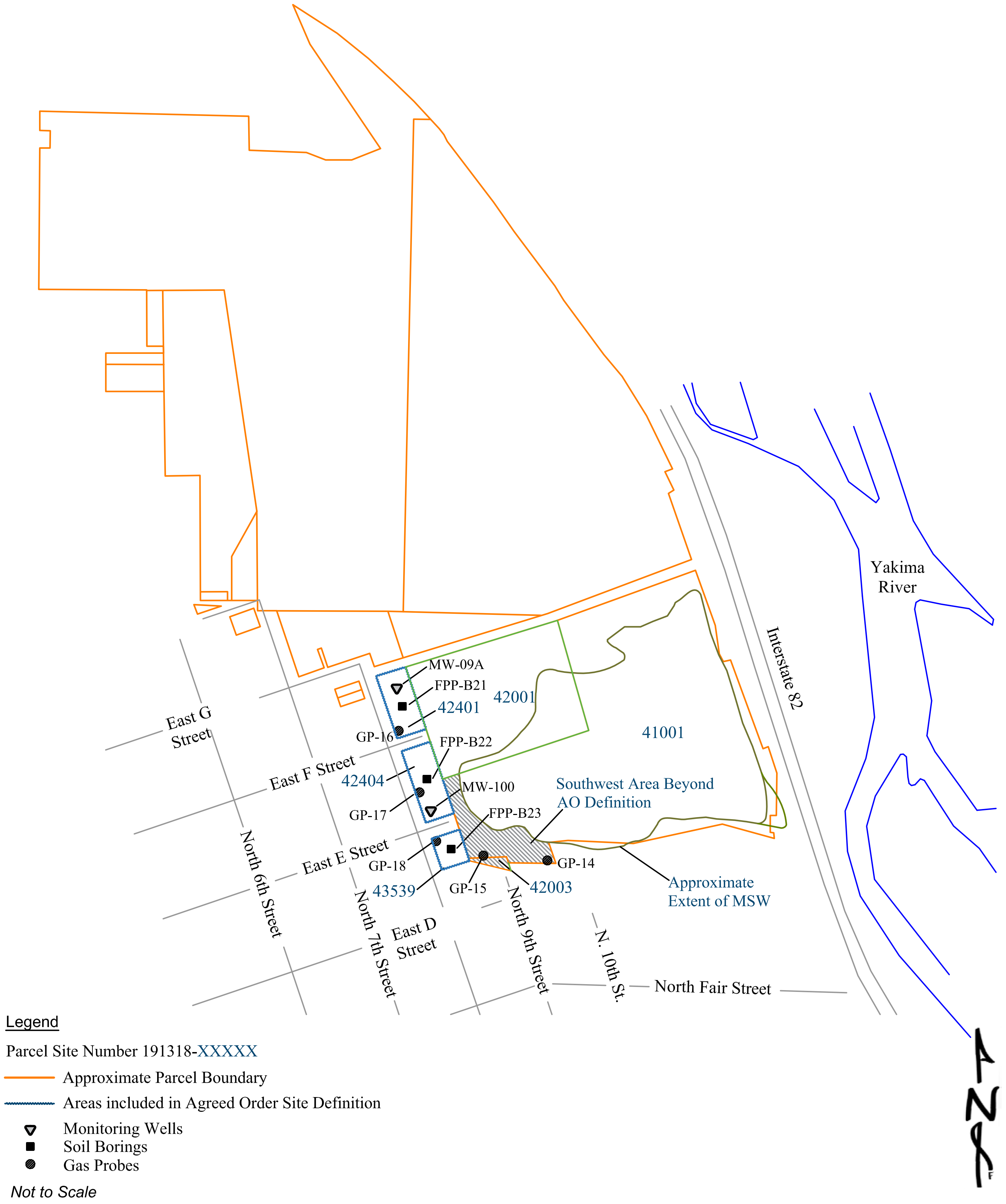
Fulcrum Environmental Consulting, Inc.
406 North Second Street, Yakima, Washington 98901
p: 509.574.0839 f: 509.575.8453 efulcrum.net
Yakima Mill Site - Southwest Area

Yakima Mill Site
Yakima, Washington

Sanborn Map Composites (1905 to 1969)

FIGURE
2

FULCRUM
environmental consulting



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Yakima Mill Site - Southwest Area

Yakima Mill Site
Yakima, Washington

Southwest Area

FIGURE
3

Attachment B

Soil Gas, Soil, and Groundwater Results

TABLE A-4
HISTORICAL LANDFILL GAS MEASUREMENTS
YAKIMA MILL SITE AND CLOSED CITY OF YAKIMA LANDFILL SITE
YAKIMA, WASHINGTON

Soil Vapor Probe ID	Date Collected	% Methane	% CO_2	% Oxygen
GP-12	2/25/2009	15.4	18.8	0.0
	4/17/2009	21.3	21.1	0.0
	11/5/2009	24.2	24.8	3.2
	2/3/2010	28.1	23.3	0.0
	5/10/2012	13.9	17.1	4.9
GP-13	2/25/2009	51.6	40.1	0.0
	4/17/2009	53.7	43.1	0.0
	11/5/2009	41.9	40.8	0.0
	2/3/2010	45.4	39.9	0.0
	5/10/2012	14.3	23.4	4.6
GP-14	4/17/2009	0.0	3.9	15.0
	11/5/2009	0.0	4.2	16.3
	2/3/2010	0.0	3.3	16.5
	5/10/2012	0.0	2.0	18.2
GP-15	4/17/2009	0.0	2.0	18.5
	11/5/2009	0.0	0.7	20.2
	2/3/2010	0.0	1.1	19.4
	5/10/2012	0.0	0.1	20.0
GP-16	4/17/2009	0.0	1.7	19.0
	11/5/2009	0.0	1.3	19.7
	2/3/2010	0.0	1.8	18.8
	5/10/2012	0.0	0.5	19.4
GP-17	4/17/2009	0.2	1.5	19.6
	11/5/2009	0.0	1.9	17.3
	2/3/2010	0.0	1.3	19.1
	5/10/2012	0.0	2.2	17.7
GP-18	4/17/2009	0.1	0.5	21.0
	11/5/2009	0.0	0.7	20.4
	2/3/2010	0.0	0.7	20.0
	5/10/2012	0.0	0.9	19.1
GP-19	11/5/2009	61.3	39.8	0.0
	2/3/2010	69.5	35.5	0.0
	5/10/2012	62.6	34.9	0.4
GP-20	11/5/2009	65.9	35.8	0.0
	2/3/2010	77.7	26.0	0.0
	5/10/2012	53.1	30.2	2.6
GP-21	11/5/2009	69.3	25.7	0.0
	2/3/2010	75.7	24.8	0.0
	5/10/2012	Not measured. Probe had been destroyed.		
GP-22	11/5/2009	43.1	43.2	0.0
	2/3/2010	Not measured. Probe had been destroyed.		

The Lower Explosive Limit (LEL) and Upper Explosive Limit (UEL) for methane are 5 percent by volume and 15 percent by volume, respectively.

TABLE A-6
SOIL ANALYTICAL RESULTS
YAKIMA MILL SITE
FORMER PLYWOOD PLANT AND TRIANGULAR PARCELS
YAKIMA, WASHINGTON

		Former Plywood Plant Parcels Initial Investigation									Former Plywood Plant Parcels Supplemental Investigation				
Location:		FPP-B17	FPP-B17	FPP-B18	FPP-B19	FPP-B20	FPP-B21	FPP-B22	FPP-B23	FPP-B24	FPP-B25-S	FPP-B26-S	FPP-B27-S	FPP-B28-S	FPP-B29a-S
Depth	MTCA Method A	(0.5-1.5)	(16-17)	(16.5-17.5)	(11-12)	(10-11)	(13-14)	(12.5-13.5)	(11.5-12.5)	(15-16.5)	(15-16)	(15-16)	(5-6)	(15-16)	(15-16)
Lab ID:	Soil Cleanup Levels for	EV13060128-46	EV13060128-45	EV13060128-27	EV13060128-28	EV13060128-33	EV13060128-31	EV13060128-30	EV13060128-29	EV13060128-32	EV13080134-26	EV13080134-22	EV13080134-17	EV13080134-52	EV13080134-44
Date Collected:	Unrestricted Land Uses	06/21/2013	06/21/2013	06/19/2013	06/19/2013	06/20/2013	06/20/2013	06/20/2013	06/20/2013	06/20/2013	08/21/2013	08/21/2013	08/21/2013	08/23/2013	08/22/2013
TOTAL METALS (mg/kg) EPA Methods 6020/7471/7196															
Arsenic	20	2.5	2.1	1.9	NA	2.4	2.1	2.0	1.9	2.4	2.0	1.9	1.0 U	2.0	3.7
Cadmium	2	0.50 U	0.50 U	0.50 U	NA	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U
Chromium	2000	21	19	28	NA	9.3	11	15	12	17	110	25	19	17	20
Chromium (VI)	19	NA	NA	NA	NA	NA	NA	NA	NA	5.0 U	NA	NA	NA	NA	NA
Iron		27,000	23,000	23,000	NA	31,000	22,000	22,000	24,000	24,000	40,000	21,000	20,000	21,000	31,000
Lead	250	10	5.0	6.3	NA	30	3.0	3.3	2.9	6.7	3.8	3.3	11	4.2	5.3
Manganese		320	240	290	NA	560	340	310	370	250	320	250	300	220	570
Mercury	2	0.055	0.047	0.027	NA	0.079	0.025	0.024	0.031	0.028	0.020 U	0.023	0.15	0.021	0.092
TOTAL PETROLEUM HYDROCARBONS (mg/kg) NWTPH-DX															
TPH-Diesel Range	2000	25 U	25 U	25 U	25 U	25 U	25 U	25 U	25 U	25 U	25 U	44	50 U	250 U	120 U
TPH-Oil Range	2000	87	88	190	140	130	50 U	50 U	50 U	440	50 U	140	1300	**6100**	2000
NWTPH-GX															
TPH-Gasoline Range	100 (a)	NA	3.0 U	NA	3.0 U	3.0 U	NA	NA	NA	3.0 U	NA	NA	NA	NA	NA
VOLATILES (µg/kg) Method EPA-8260															
Dichlorodifluoromethane		NA	10 U	10 U	10 U	10 U	NA	NA	NA	10 U	NA	NA	NA	NA	NA
Chloromethane		NA	10 U	10 U	10 U	10 U	NA	NA	NA	10 U	NA	NA	NA	NA	NA
Vinyl Chloride		NA	10 U	10 U	10 U	10 U	NA	NA	NA	10 U	NA	NA	NA	NA	NA
Bromomethane		NA	10 U	10 U	10 U	10 U	NA	NA	NA	10 U	NA	NA	NA	NA	NA
Chloroethane		NA	10 U	10 U	10 U	10 U	NA	NA	NA	10 U	NA	NA	NA	NA	NA
Carbon Tetrachloride		NA	10 U	10 U	10 U	10 U	NA	NA	NA	10 U	NA	NA	NA	NA	NA
Trichlorofluoromethane		NA	10 U	10 U	10 U	10 U	NA	NA	NA	10 U	NA	NA	NA	NA	NA
Carbon Disulfide		NA	10 U	10 U	10 U	10 U	NA	NA	NA	10 U	NA	NA	NA	NA	NA
Acetone		NA	50 U	50 U	50 U	50 U	NA	NA	NA	50 U	NA	NA	NA	NA	NA
1,1-Dichloroethene		NA	10 U	10 U	10 U	10 U	NA	NA	NA	10 U	NA	NA	NA	NA	NA
Methylene Chloride	20	NA	20 U	20 U	20 U	20 U	NA	NA	NA	20 U	NA	NA	NA	NA	NA
Acrylonitrile		NA	50 U	50 U	50 U	50 U	NA	NA	NA	50 U	NA	NA	NA	NA	NA
Methyl T-Butyl Ether		NA	10 U	10 U	10 U	10 U	NA	NA	NA	10 U	NA	NA	NA	NA	NA
Trans-1,2-Dichloroethene		NA	10 U	10 U	10 U	10 U	NA	NA	NA	10 U	NA	NA	NA	NA	NA
1,1-Dichloroethane		NA	10 U	10 U	10 U	10 U	NA	NA	NA	10 U	NA	NA	NA	NA	NA
2-Butanone		NA	50 U	50 U	50 U	50 U	NA	NA	NA	50 U	NA	NA	NA	NA	NA
Cis-1,2-Dichloroethene		NA	10 U	10 U	10 U	10 U	NA	NA	NA	10 U	NA	NA	NA	NA	NA
2,2-Dichloropropane		NA	10 U	10 U	10 U	10 U	NA	NA	NA	10 U	NA	NA	NA	NA	NA
Bromochloromethane		NA	10 U	10 U	10 U	10 U	NA	NA	NA	10 U	NA	NA	NA	NA	NA
Chloroform		NA	10 U	10 U	10 U	10 U	NA	NA	NA	10 U	NA	NA	NA	NA	NA
1,1,1-Trichloroethane	2000	NA	10 U	10 U	10 U	10 U	NA	NA	NA	10 U	NA	NA	NA	NA	NA
1,1-Dichloropropene		NA	10 U	10 U	10 U	10 U	NA	NA	NA	10 U	NA	NA	NA	NA	NA
1,2-Dichloroethane		NA	10 U	10 U	10 U	10 U	NA	NA	NA	10 U	NA	NA	NA	NA	NA
Benzene	30	NA	5.0 U	5.0 U	5.0 U	5.0 U	NA	NA	NA	5.0 U	NA	NA	NA	NA	NA
Trichloroethene	30	NA	10 U	10 U	10 U	10 U	NA	NA	NA	10 U	NA	NA	NA	NA	NA
1,2-Dichloropropane		NA	10 U	10 U	10 U	10 U	NA	NA	NA	10 U	NA	NA	NA	NA	NA
Dibromomethane		NA	10 U	10 U	10 U	10 U	NA	NA	NA	10 U	NA	NA	NA	NA	NA
Bromodichloromethane		NA	10 U	10 U	10 U	10 U	NA	NA	NA	10 U	NA	NA	NA	NA	NA
Trans-1,3-Dichloropropene		NA	10 U	10 U	10 U	10 U	NA	NA	NA	10 U	NA	NA	NA	NA	NA
4-Methyl-2-Pentanone		NA	50 U	50 U	50 U	50 U	NA	NA	NA	50 U	NA	NA	NA	NA	NA
Toluene	7000	NA	10 U	10 U	10 U	10 U	NA	NA	NA	10 U	NA	NA	NA	NA	NA
Cis-1,3-Dichloropropene		NA	10 U	10 U	10 U	10 U	NA	NA	NA	10 U	NA	NA	NA	NA	NA
1,1,2-Trichloroethane		NA	10 U	10 U	10 U	10 U	NA	NA	NA	10 U	NA	NA	NA	NA	NA
2-Hexanone		NA	50 U	50 U	50 U	50 U	NA	NA	NA	50 U	NA	NA	NA	NA	NA
1,3-Dichloropropane		NA	10 U	10 U	10 U	10 U	NA	NA	NA	10 U	NA	NA	NA	NA	NA
Tetrachloroethylene	50	NA	10 U	10 U	10 U	10 U	NA	NA	NA	10 U	NA	NA	NA	NA	NA
Dibromochloromethane		NA	10 U	10 U	10 U	10 U	NA	NA	NA	10 U	NA	NA	NA	NA	NA
1,2-Dibromoethane	5	NA	5.0 U	5.0 U	5.0 U	5.0 U	NA	NA	NA	5.0 U	NA	NA	NA	NA	NA
Chlorobenzene		NA	10 U	10 U	10 U	10 U	NA	NA	NA	10 U	NA	NA	NA	NA	NA
1,1,1,2-Tetrachloroethane		NA	10 U	10 U	10 U	10 U	NA	NA	NA	10 U	NA	NA	NA	NA	NA
Ethylbenzene	6000	NA	10 U	10 U	10 U	10 U	NA	NA	NA	10 U	NA	NA	NA	NA	NA
m,p-Xylene	9000 (c)	NA	20 U	20 U	20 U	20 U	NA	NA	NA	20 U	NA	NA	NA	NA	NA
Styrene		NA	10 U	10 U	10 U	10 U	NA	NA	NA	10 U	NA	NA	NA	NA	NA
o-Xylene	9000 (c)	NA	10 U	10 U	10 U	10 U	NA	NA	NA	10 U	NA	NA	NA	NA	NA
Bromoform		NA	10 U	10 U	10 U	10 U	NA	NA	NA	10 U	NA	NA	NA	NA	NA
Isopropylbenzene		NA	10 U	10 U	10 U	10 U	NA	NA	NA	10 U	NA	NA	NA	NA	NA
1,1,2,2-Tetrachloroethane		NA	10 U	10 U	10 U	10 U	NA	NA	NA	10 U	NA	NA	NA	NA	NA

TABLE A-6
SOIL ANALYTICAL RESULTS
YAKIMA MILL SITE
FORMER PLYWOOD PLANT AND TRIANGULAR PARCELS
YAKIMA, WASHINGTON

		Former Plywood Plant Parcels Initial Investigation									Former Plywood Plant Parcels Supplemental Investigation				
Location:		FPP-B17	FPP-B17	FPP-B18	FPP-B19	FPP-B20	FPP-B21	FPP-B22	FPP-B23	FPP-B24	FPP-B25-S	FPP-B26-S	FPP-B27-S	FPP-B28-S	FPP-B29a-S
Depth	MTCA Method A	(0.5-1.5)	(16-17)	(16.5-17.5)	(11-12)	(10-11)	(13-14)	(12.5-13.5)	(11.5-12.5)	(15-16.5)	(15-16)	(15-16)	(5-6)	(15-16)	(15-16)
Lab ID:	Soil Cleanup Levels for	EV13060128-46	EV13060128-45	EV13060128-27	EV13060128-28	EV13060128-33	EV13060128-31	EV13060128-30	EV13060128-29	EV13060128-32	EV13080134-26	EV13080134-22	EV13080134-17	EV13080134-52	EV13080134-44
Date Collected:	Unrestricted Land Uses	06/21/2013	06/21/2013	06/19/2013	06/19/2013	06/20/2013	06/20/2013	06/20/2013	06/20/2013	06/20/2013	08/21/2013	08/21/2013	08/21/2013	08/23/2013	08/22/2013
1,2,3-Trichloropropane		NA	10 U	10 U	10 U	10 U	NA	NA	NA	10 U	NA	NA	NA	NA	NA
Bromobenzene		NA	10 U	10 U	10 U	10 U	NA	NA	NA	10 U	NA	NA	NA	NA	NA
N-Propyl Benzene		NA	10 U	10 U	10 U	10 U	NA	NA	NA	10 U	NA	NA	NA	NA	NA
2-Chlorotoluene		NA	10 U	10 U	10 U	10 U	NA	NA	NA	10 U	NA	NA	NA	NA	NA
1,3,5-Trimethylbenzene		NA	10 U	10 U	10 U	10 U	NA	NA	NA	10 U	NA	NA	NA	NA	NA
4-Chlorotoluene		NA	10 U	10 U	10 U	10 U	NA	NA	NA	10 U	NA	NA	NA	NA	NA
T-Butyl Benzene		NA	10 U	10 U	10 U	10 U	NA	NA	NA	10 U	NA	NA	NA	NA	NA
1,2,4-Trimethylbenzene		NA	10 U	10 U	10 U	10 U	NA	NA	NA	10 U	NA	NA	NA	NA	NA
S-Butyl Benzene		NA	10 U	10 U	10 U	10 U	NA	NA	NA	10 U	NA	NA	NA	NA	NA
P-Isopropyltoluene		NA	10 U	10 U	10 U	10 U	NA	NA	NA	10 U	NA	NA	NA	NA	NA
1,3 Dichlorobenzene		NA	10 U	10 U	10 U	10 U	NA	NA	NA	10 U	NA	NA	NA	NA	NA
1,4-Dichlorobenzene		NA	10 U	10 U	10 U	10 U	NA	NA	NA	10 U	NA	NA	NA	NA	NA
N-Butylbenzene		NA	10 U	10 U	10 U	10 U	NA	NA	NA	10 U	NA	NA	NA	NA	NA
1,2-Dichlorobenzene		NA	10 U	10 U	10 U	10 U	NA	NA	NA	10 U	NA	NA	NA	NA	NA
1,2-Dibromo 3-Chloropropane		NA	50 U	50 U	50 U	50 U	NA	NA	NA	50 U	NA	NA	NA	NA	NA
1,2,4-Trichlorobenzene		NA	10 U	10 U	10 U	10 U	NA	NA	NA	10 U	NA	NA	NA	NA	NA
Hexachlorobutadiene		NA	10 U	10 U	10 U	10 U	NA	NA	NA	10 U	NA	NA	NA	NA	NA
Naphthalene		NA	10 U	10 U	10 U	10 U	NA	NA	NA	10 U	NA	NA	NA	NA	NA
1,2,3-Trichlorobenzene		NA	10 U	10 U	10 U	10 U	NA	NA	NA	10 U	NA	NA	NA	NA	NA
SEMIVOLATILES (µg/kg) **Method EPA-8270**															
Pyridine		NA	200 U	NA	NA	200 U	NA	NA	NA	200 U	NA	NA	NA	NA	NA
N-Nitrosodimethylamine		NA	100 U	NA	NA	100 U	NA	NA	NA	100 U	NA	NA	NA	NA	NA
Phenol		NA	100 U	NA	NA	100 U	NA	NA	NA	100 U	NA	NA	NA	NA	NA
Aniline		NA	100 U	NA	NA	100 U	NA	NA	NA	100 U	NA	NA	NA	NA	NA
Bis(2-Chloroethyl)Ether		NA	100 U	NA	NA	100 U	NA	NA	NA	100 U	NA	NA	NA	NA	NA
2-Chlorophenol		NA	100 U	NA	NA	100 U	NA	NA	NA	100 U	NA	NA	NA	NA	NA
1,3-Dichlorobenzene		NA	100 U	NA	NA	100 U	NA	NA	NA	100 U	NA	NA	NA	NA	NA
1,4-Dichlorobenzene		NA	100 U	NA	NA	100 U	NA	NA	NA	100 U	NA	NA	NA	NA	NA
Benzyl Alcohol		NA	100 U	NA	NA	100 U	NA	NA	NA	100 U	NA	NA	NA	NA	NA
1,2-Dichlorobenzene		NA	100 U	NA	NA	100 U	NA	NA	NA	100 U	NA	NA	NA	NA	NA
2-Methylphenol		NA	100 U	NA	NA	100 U	NA	NA	NA	100 U	NA	NA	NA	NA	NA
Bis(2-Chloroisopropyl)Ether		NA	100 U	NA	NA	100 U	NA	NA	NA	100 U	NA	NA	NA	NA	NA
3&4-Methylphenol		NA	100 U	NA	NA	100 U	NA	NA	NA	100 U	NA	NA	NA	NA	NA
N-Nitroso-Di-N-Propylamine		NA	100 U	NA	NA	100 U	NA	NA	NA	100 U	NA	NA	NA	NA	NA
Hexachloroethane		NA	100 U	NA	NA	100 U	NA	NA	NA	100 U	NA	NA	NA	NA	NA
Nitrobenzene		NA	100 U	NA	NA	100 U	NA	NA	NA	100 U	NA	NA	NA	NA	NA
Isophorone		NA	100 U	NA	NA	100 U	NA	NA	NA	100 U	NA	NA	NA	NA	NA
2-Nitrophenol		NA	250 U	NA	NA	250 U	NA	NA	NA	250 U	NA	NA	NA	NA	NA
2,4-Dimethylphenol		NA	100 U	NA	NA	100 U	NA	NA	NA	100 U	NA	NA	NA	NA	NA
Benzoic Acid		NA	1000 U	NA	NA	1000 U	NA	NA	NA	1000 U	NA	NA	NA	NA	NA
Bis(2-Chloroethoxy)Methane		NA	100 U	NA	NA	100 U	NA	NA	NA	100 U	NA	NA	NA	NA	NA
2,4-Dichlorophenol		NA	100 U	NA	NA	100 U	NA	NA	NA	100 U	NA	NA	NA	NA	NA
1,2,4-Trichlorobenzene		NA	100 U	NA	NA	100 U	NA	NA	NA	100 U	NA	NA	NA	NA	NA
4-Chloroaniline		NA	100 U	NA	NA	100 U	NA	NA	NA	100 U	NA	NA	NA	NA	NA
2,6-Dichlorophenol		NA	100 U	NA	NA	100 U	NA	NA	NA	100 U	NA	NA	NA	NA	NA
Hexachlorobutadiene		NA	100 U	NA	NA	100 U	NA	NA	NA	100 U	NA	NA	NA	NA	NA
4-Chloro-3-Methylphenol		NA	100 U	NA	NA	100 U	NA	NA	NA	100 U	NA	NA	NA	NA	NA
Hexachlorocyclopentadiene		NA	500 U	NA	NA	500 U	NA	NA	NA	500 U	NA	NA	NA	NA	NA
2,4,6-Trichlorophenol		NA	100 U	NA	NA	100 U	NA	NA	NA	100 U	NA	NA	NA	NA	NA
2,4,5-Trichlorophenol		NA	100 U	NA	NA	100 U	NA	NA	NA	100 U	NA	NA	NA	NA	NA
2-Chloronaphthalene		NA	100 U	NA	NA	100 U	NA	NA	NA	100 U	NA	NA	NA	NA	NA
2-Nitroaniline		NA	250 U	NA	NA	250 U	NA	NA	NA	250 U	NA	NA	NA	NA	NA
Dimethylphthalate		NA	100 U	NA	NA	100 U	NA	NA	NA	100 U	NA	NA	NA	NA	NA
2,6-Dinitrotoluene		NA	250 U	NA	NA	250 U	NA	NA	NA	250 U	NA	NA	NA	NA	NA
3-Nitroaniline		NA	250 U	NA	NA	250 U	NA	NA	NA	250 U	NA	NA	NA	NA	NA
2,4-Dinitrophenol		NA	250 U	NA	NA	250 U	NA	NA	NA	250 U	NA	NA	NA	NA	NA
4-Nitrophenol		NA	500 U	NA	NA	500 U	NA	NA	NA	500 U	NA	NA	NA	NA	NA
Dibenzofuran		NA	100 U	NA	NA	100 U	NA	NA	NA	100 U	NA	NA	NA	NA	NA
2,4-Dinitrotoluene		NA	250 U	NA	NA	250 U	NA	NA	NA	250 U	NA	NA	NA	NA	NA
2,3,4,6-Tetrachlorophenol		NA	250 U	NA	NA	250 U	NA	NA	NA	250 U	NA	NA	NA	NA	NA
Diethylphthalate		NA	100 U	NA	NA	100 U	NA	NA	NA	100 U	NA	NA	NA	NA	NA
4-Chlorophenyl-Phenylether		NA	100 U	NA	NA	100 U	NA	NA	NA	100 U	NA	NA	NA	NA	NA
4-Nitroaniline		NA	250 U	NA	NA	250 U	NA	NA	NA	250 U	NA	NA	NA	NA	NA
4,6-Dinitro-2-Methylphenol		NA	100 U	NA	NA	100 U	NA	NA	NA	100 U	NA	NA	NA	NA	NA
N-Nitrosodiphenylamine		NA	100 U	NA	NA	100 U	NA	NA	NA	100 U	NA	NA	NA	NA	NA
Azobenzene		NA	100 U	NA	NA	100 U	NA	NA	NA	100 U	NA	NA	NA	NA	NA
4-Bromophenyl-Phenylether		NA	100 U	NA	NA	100 U	NA	NA	NA	100 U	NA	NA	NA	NA	NA

TABLE A-6
SOIL ANALYTICAL RESULTS
YAKIMA MILL SITE
FORMER PLYWOOD PLANT AND TRIANGULAR PARCELS
YAKIMA, WASHINGTON

		Former Plywood Plant Parcels Initial Investigation									Former Plywood Plant Parcels Supplemental Investigation				
Location:		FPP-B17	FPP-B17	FPP-B18	FPP-B19	FPP-B20	FPP-B21	FPP-B22	FPP-B23	FPP-B24	FPP-B25-S	FPP-B26-S	FPP-B27-S	FPP-B28-S	FPP-B29a-S
Depth	MTCA Method A	(0.5-1.5)	(16-17)	(16.5-17.5)	(11-12)	(10-11)	(13-14)	(12.5-13.5)	(11.5-12.5)	(15-16.5)	(15-16)	(15-16)	(5-6)	(15-16)	(15-16)
Lab ID:	Soil Cleanup Levels for	EV13060128-46	EV13060128-45	EV13060128-27	EV13060128-28	EV13060128-33	EV13060128-31	EV13060128-30	EV13060128-29	EV13060128-32	EV13080134-26	EV13080134-22	EV13080134-17	EV13080134-52	EV13080134-44
Date Collected:	Unrestricted Land Uses	06/21/2013	06/21/2013	06/19/2013	06/19/2013	06/20/2013	06/20/2013	06/20/2013	06/20/2013	06/20/2013	08/21/2013	08/21/2013	08/21/2013	08/23/2013	08/22/2013
Hexachlorobenzene		NA	100 U	NA	NA	100 U	NA	NA	NA	100 U	NA	NA	NA	NA	NA
Pentachlorophenol		NA	500 U	NA	NA	500 U	NA	NA	NA	500 U	NA	NA	NA	NA	NA
Carbazole		NA	100 U	NA	NA	100 U	NA	NA	NA	100 U	NA	NA	NA	NA	NA
Di-N-Butylphthalate		NA	130 U	NA	NA	130 U	NA	NA	NA	130 U	NA	NA	NA	NA	NA
Butylbenzylphthalate		NA	100 U	NA	NA	100 U	NA	NA	NA	100 U	NA	NA	NA	NA	NA
3,3-Dichlorobenzidine		NA	250 U	NA	NA	250 U	NA	NA	NA	250 U	NA	NA	NA	NA	NA
Bis(2-Ethylhexyl)Phthalate		NA	130 U	NA	NA	150	NA	NA	NA	130 U	NA	NA	NA	NA	NA
Di-N-Octylphthalate		NA	100 U	NA	NA	100 U	NA	NA	NA	100 U	NA	NA	NA	NA	NA
PAHs (mg/kg) **Method EPA-8270 SIM**															
Naphthalene		NA	0.030	NA	NA	0.010 U	NA	NA	NA	0.014	NA	NA	NA	NA	NA
2-Methylnaphthalene		NA	0.010 U	NA	NA	0.010 U	NA	NA	NA	0.010 U	NA	NA	NA	NA	NA
1-Methylnaphthalene		NA	0.010 U	NA	NA	0.010 U	NA	NA	NA	0.010 U	NA	NA	NA	NA	NA
Total Naphthalenes	5 (b)	NA	0.030	NA	NA	0.010 U	NA	NA	NA	0.014	NA	NA	NA	NA	NA
Acenaphthylene		NA	0.011	NA	NA	0.010 U	NA	NA	NA	0.010 U	NA	NA	NA	NA	NA
Acenaphthene		NA	0.010 U	NA	NA	0.010 U	NA	NA	NA	0.010 U	NA	NA	NA	NA	NA
Fluorene		NA	0.010 U	NA	NA	0.010 U	NA	NA	NA	0.010 U	NA	NA	NA	NA	NA
Phenanthrene		NA	0.018	NA	NA	0.012	NA	NA	NA	0.015	NA	NA	NA	NA	NA
Anthracene		NA	0.010 U	NA	NA	0.010 U	NA	NA	NA	0.010 U	NA	NA	NA	NA	NA
Fluoranthene		NA	0.016	NA	NA	0.011	NA	NA	NA	0.012	NA	NA	NA	NA	NA
Pyrene		NA	0.020	NA	NA	0.013	NA	NA	NA	0.015	NA	NA	NA	NA	NA
Benzo[A]Anthracene		NA	0.010 U	NA	NA	0.010 U	NA	NA	NA	0.010 U	NA	NA	NA	NA	NA
Chrysene		NA	0.010 U	NA	NA	0.010 U	NA	NA	NA	0.010 U	NA	NA	NA	NA	NA
Benzo[B]Fluoranthene		NA	0.010 U	NA	NA	0.010 U	NA	NA	NA	0.010 U	NA	NA	NA	NA	NA
Benzo[K]Fluoranthene		NA	0.010 U	NA	NA	0.010 U	NA	NA	NA	0.010 U	NA	NA	NA	NA	NA
Benzo[A]Pyrene		NA	0.010 U	NA	NA	0.010 U	NA	NA	NA	0.010 U	NA	NA	NA	NA	NA
Indeno[1,2,3-Cd]Pyrene		NA	0.010 U	NA	NA	0.010 U	NA	NA	NA	0.010 U	NA	NA	NA	NA	NA
Dibenz[A,H]Anthracene		NA	0.010 U	NA	NA	0.010 U	NA	NA	NA	0.010 U	NA	NA	NA	NA	NA
Benzo[G,H,I]Perylene		NA	0.010 U	NA	NA	0.010 U	NA	NA	NA	0.010 U	NA	NA	NA	NA	NA
cPAH TEQ	0.1	NA	ND	NA	NA	ND	NA	NA	NA	ND	NA	NA	NA	NA	NA
PCBs (mg/kg) **Method EPA-8082**															
PCB-1016		NA	NA	NA	NA	0.10 U	NA	NA	NA	0.10 U	NA	NA	NA	NA	0.10 U
PCB-1268		NA	NA	NA	NA	0.10 U	NA	NA	NA	0.10 U	NA	NA	NA	NA	0.10 U
PCB-1221		NA	NA	NA	NA	0.10 U	NA	NA	NA	0.10 U	NA	NA	NA	NA	0.10 U
PCB-1232		NA	NA	NA	NA	0.10 U	NA	NA	NA	0.10 U	NA	NA	NA	NA	0.10 U
PCB-1242		NA	NA	NA	NA	0.10 U	NA	NA	NA	0.10 U	NA	NA	NA	NA	0.10 U
PCB-1248		NA	NA	NA	NA	0.10 U	NA	NA	NA	0.10 U	NA	NA	NA	NA	0.10 U
PCB-1254		NA	NA	NA	NA	0.10 U	NA	NA	NA	0.10 U	NA	NA	NA	NA	0.10 U
PCB-1260		NA	NA	NA	NA	0.10 U	NA	NA	NA	0.10 U	NA	NA	NA	NA	0.10 U
Total PCBs	1	NA	NA	NA	NA	0.10 U	NA	NA	NA	0.10 U	NA	NA	NA	NA	0.10 U
CONVENTIONALS															
Total Organic Carbon (%) (EPA-9060)		NA	NA	NA	NA	NA	NA	0.10 U	NA	2.2	NA	0.14	NA	NA	NA
pH (SU) (EPA-9045)		NA	NA	NA	NA	7.89	NA	8.33	NA	8.10	NA	NA	NA	NA	NA
Percent Solids (%) (EPA-160.3)		NA	NA	NA	NA	NA	NA	93.2	NA	78.1	NA	NA	NA	NA	NA

TABLE 8
SOIL ANALYTICAL RESULTS
CLOSED CITY OF YAKIMA LANDFILL SITE

Location:		MW-100	MW-101	MW-102	MW-102	MW-103	MW-104	MW-104	MW-105	MW-105	MW-106	MW-106	MW-107	MW-107
Depth:		(13.5-14)	(17.5-18.5)	(4-5)	(15-15.5)	(20.5-21.5)	(2.5-3)	(19-20)	(2.5-3.5)	(17.5-19)	(2.5-3.5)	(13.5-14.5)	(2.5-3.5)	(16-17)
Laboratory ID:	Screening	EV14090067-02	EV14090040-04	EV14090051-01	EV14090051-02	EV14090040-03	EV14090022-03	EV14090022-04	EV14090022-01	EV14090022-02	EV14090051-05	EV14090067-01	EV14090051-03	EV14090051-04
Sample Date:	Levels	9/11/2014	9/5/2014	9/8/2014	9/8/2014	9/5/2014	9/3/2014	9/3/2014	9/2/2014	9/2/2014	9/9/2014	9/10/2014	9/9/2014	9/9/2014
TOTAL PETROLEUM HYDROCARBONS (mg/kg)														
HCID														
Gas Range	--	20 U	20 U	20 U	25 U	20 U	20 U	20 U	20 U	20 U	**>20**	20 U	20 U	20 U
Diesel Range	--	50 U	50 U	50 U	61 U	50 U	50 U	50 U	50 U	50 U	**>50**	50 U	50 U	50 U
Oil Range	--	100 U	100 U	**>100**	120 U	100 U	**>100**	100 U	**>100**	100 U	**>100**	100 U	**>100**	100 U
NWTPH-Gx														
Gasoline Range	30/100 (a)	NA	NA	NA	NA	NA	NA	NA	NA	NA	**35**	NA	NA	NA
NWTPH-Dx														
Diesel Range (w/SGC)	2,000	NA	NA	25 U	NA	NA	25 U	NA	25 U	NA	**87** J	NA	**250**	NA
Diesel Range (wo/SGC)	2,000	NA	NA	25 U	NA	NA	46 U	NA	25 U	NA	**150** J	NA	**300**	NA
Oil Range (w/SGC)	2,000	NA	NA	**260**	NA	NA	**300**	NA	**380**	NA	**380**	NA	**820**	NA
Oil Range (wo/SGC)	2,000	NA	NA	**330**	NA	NA	**450**	NA	**510**	NA	**560**	NA	**990**	NA
TOTAL METALS (mg/kg)														
Methods EPA-6020/EPA-7471														
Arsenic	20	**1.4**	**1.4**	**1.9**	**2.2**	**1.8**	**2.2**	**1.5**	**3.6**	**2.7**	**2.6**	**2.1**	**1.7**	**2.6**
Barium	824	**58**	**70**	**82**	**84**	**56**	**91**	**76**	**140**	**79**	**100**	**94**	**88**	**190**
Cadmium	2.0	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.25 U	0.26 U	**1.3**	0.27 U	0.50 U	**1.1**	0.50 U	0.50 U
Chromium	2,000	**23**	**14**	**7.9**	**15**	**14**	**12**	**19**	**24**	**18**	**13**	**16**	**8.9**	**21**
Chromium (VI) (EPA-7196)	19	5.0 U	5.0 U	NA	5.0 U	5.0 U	NA	5.0 U	NA	5.0 U	NA	5.0 U	NA	5.0 U
Iron	151	**25,000**	**22,000**	**17,000**	**24,000**	**23,000**	**20,000**	**22,000**	**35,000**	**21,000**	**25,000**	**24,000**	**27,000**	**40,000**
Lead	250	**2.9**	**3.7**	**39**	**6.0**	**3.1**	**56**	**3.3**	**190**	**4.7**	**51**	**11**	**68**	**9.6**
Manganese	11,000	**380**	**240**	**200**	**250**	**250**	**330**	**240**	**330**	**350**	**520**	**210**	**470**	**320**
Selenium	400	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
Silver	400	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	**3.5**	0.26 U	0.28 U	0.27 U	0.50 U	0.50 U	0.50 U	0.50 U
Sodium	--	**750**	**380**	**340**	**440**	**530**	**540**	**540**	**490**	**1200**	**560**	**490**	**520**	**1200**
Mercury	2.0	0.020 U	**0.036**	**0.060**	**0.049**	**0.028**	**0.090**	**0.23**	**0.18**	**0.023**	**0.11**	**0.035**	**0.038**	**0.073**
CONVENTIONALS (mg/kg)														
Fluoride (EPA-300.0M)	3,200	1.6 U	1.6 U	1.6 U	1.6 U	1.6 U	1.6 U	1.6 U	**1.7**	1.6 U	**3.3**	1.6 U	**2.0**	1.6 U
Nitrate as N (EPA-300.0M)	130,000	**0.87**	0.50 UJ	0.50 UJ	0.50 UJ	0.5 UJ	0.50 UJ	**0.91** J	**63** J	0.50 UJ	**15** J	**26**	0.50 UJ	0.50 UJ
Nitrite as N (EPA-300.0M)	8,000	0.50 U	0.50 UJ	0.50 UJ	0.50 UJ	0.5 UJ	0.50 UJ	0.50 UJ	0.50 UJ	0.50 UJ	**1.7** J	0.50 U	0.50 UJ	0.50 UJ
pH (lab)	--	8.62	6.71	NA	7.43	7.53	NA	7.51	NA	7.87	NA	7.17	NA	7.23
PESTICIDES (mg/kg)														
Method EPA-8081														
A-BHC	0.16	0.0026 U	0.0029 U	NA	0.0031 U	0.0028 U	NA	0.0031 U	NA	0.0029 U	NA	0.0032 U	NA	0.0036 U
G-BHC (Lindane)	0.01	0.0026 U	0.0029 U	NA	0.0031 U	0.0028 U	NA	0.0031 U	NA	0.0029 U	NA	0.0032 U	NA	0.0036 U
B-BHC	0.56	0.0026 U	0.0029 U	NA	0.0031 U	0.0028 U	NA	0.0031 U	NA	0.0029 U	NA	0.0032 U	NA	0.0036 U
Heptachlor	0.22	0.0026 U	0.0029 U	NA	0.0031 U	0.0028 U	NA	0.0031 U	NA	0.0029 U	NA	0.0032 U	NA	0.0036 U
D-BHC	--	0.0026 U	0.0029 U	NA	0.0031 U	0.0028 U	NA	0.0031 U	NA	0.0029 U	NA	0.0032 U	NA	0.0036 U
Aldrin	0.059	0.0026 U	0.0029 U	NA	0.0031 U	0.0028 U	NA	0.0031 U	NA	0.0029 U	NA	**0.0094**	NA	0.0036 U
Heptachlor Epoxide	0.11	0.0026 U	0.0029 U	NA	0.0031 U	0.0028 U	NA	0.0031 U	NA	0.0029 U	NA	0.0032 U	NA	0.0036 U
Chlordane	2.9	0.0026 U	0.0029 U	NA	0.0031 U	0.0028 U	NA	0.0031 U	NA	0.0029 U	NA	0.0032 U	NA	0.0036 U
Endosulfan I (b)	0.003	0.0026 U	0.0029 U	NA	0.0031 U	0.0028 U	NA	0.0031 U	NA	0.0029 U	NA	0.0032 U	NA	0.0036 U
4,4'-DDE	2.9	0.0026 U	0.0029 U	NA	0.0031 U	0.0028 U	NA	0.0031 U	NA	0.0029 U	NA	0.0032 U	NA	0.0036 U
Dieldrin	0.063	0.0026 U	0.0029 U	NA	0.0031 U	0.0028 U	NA	0.0031 U	NA	0.0029 U	NA	0.0032 U	NA	0.0036 U
Endrin (c)	24	0.0026 U	0.0029 U	NA	0.0031 U	0.0028 U	NA	0.0031 U	NA	0.0029 U	NA	0.0032 U	NA	0.0036 U
4,4'-DDD	0.009	0.0026 U	0.0029 U	NA	0.0031 U	**0.012**	NA	0.0031 U	NA	0.0029 U	NA	0.0032 U	NA	0.0036 U
Endosulfan II (b)	0.003	0.0026 U	0.0029 U	NA	0.0031 U	0.0028 U	NA	0.0031 U	NA	0.0029 U	NA	0.0032 U	NA	0.0036 U
4,4'-DDT	3.0	0.0026 U	0.0029 U	NA	0.0031 U	**0.0069**	NA	0.0031 U	NA	0.0029 U	NA	0.0032 U	NA	0.0036 U
Endrin Aldehyde (c)	24	0.0026 U	0.0029 U	NA	0.0031 U	0.0028 U	NA	0.0031 U	NA	0.0029 U	NA	0.0032 U	NA	0.0036 U
Endosulfan Sulfate (b)	0.003	0.0026 U	0.0029 U	NA	0.0031 U	0.0028 U	NA	0.0031 U	NA	0.0029 U	NA	0.0032 U	NA	0.0036 U
Methoxychlor	400	0.0026 U	0.0029 U	NA	0.0031 U	0.0028 U	NA	0.0031 U	NA	0.0029 U	NA	0.0032 U	NA	0.0036 U
Hexachlorobenzene	630	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Toxaphene	0.91	0.13 U	0.15 U	NA	0.16 U	0.14 U	NA	0.16 U	NA	0.15 U	NA	0.16 U	NA	0.18 U

TABLE 8
SOIL ANALYTICAL RESULTS
CLOSED CITY OF YAKIMA LANDFILL SITE

Location: Depth: Laboratory ID: Sample Date:	Screening Levels	MW-100 (13.5-14) EV14090067-02 9/11/2014	MW-101 (17.5-18.5) EV14090040-04 9/5/2014	MW-102 (4-5) EV14090051-01 9/8/2014	MW-102 (15-15.5) EV14090051-02 9/8/2014	MW-103 (20.5-21.5) EV14090040-03 9/5/2014	MW-104 (2.5-3) EV14090022-03 9/3/2014	MW-104 (19-20) EV14090022-04 9/3/2014	MW-105 (2.5-3.5) EV14090022-01 9/2/2014	MW-105 (17.5-19) EV14090022-02 9/2/2014	MW-106 (2.5-3.5) EV14090051-05 9/9/2014	MW-106 (13.5-14.5) EV14090067-01 9/10/2014	MW-107 (2.5-3.5) EV14090051-03 9/9/2014	MW-107 (16-17) EV14090051-04 9/9/2014
PCBs (mg/kg) **Method EPA-8082**														
PCB-1016	5.6	0.0052 U	0.0059 U	NA	0.0061 U	0.0056 U	NA	0.0061 U	NA	0.0057 U	NA	0.0064 U	NA	0.0074 U
PCB-1221	--	0.011 U	0.012 U	NA	0.013 U	0.012 U	NA	0.013 U	NA	0.012 U	NA	0.013 U	NA	0.015 U
PCB-1232	--	0.0052 U	0.0059 U	NA	0.0061 U	0.0056 U	NA	0.0061 U	NA	0.0057 U	NA	0.0064 U	NA	0.0074 U
PCB-1242	--	0.0052 U	0.0059 U	NA	0.0061 U	0.0056 U	NA	0.0061 U	NA	**0.0059**	NA	**0.028**	NA	0.0074 U
PCB-1248	--	0.0052 U	0.0059 U	NA	0.0061 U	0.0056 U	NA	0.0061 U	NA	0.0057 U	NA	0.0064 U	NA	0.0074 U
PCB-1254	0.50	0.0052 U	0.0059 U	NA	0.0061 U	0.0056 U	NA	0.0061 U	NA	0.0057 U	NA	0.0064 U	NA	0.0074 U
PCB-1260	0.50	0.0052 U	0.0059 U	NA	0.0061 U	0.0056 U	NA	0.0061 U	NA	0.0057 U	NA	0.0064 U	NA	0.0074 U
Total PCBs	1.0	ND	ND	ND	ND	ND	ND	ND	ND	**0.0059**	ND	**0.028**	ND	ND
VOCs (µg/kg) **Method EPA-8260**														
Dichlorodifluoromethane	16,000,000	10 U	10 U	NA	10 U	10 U	NA	10 U	NA	10 U	NA	10 U	NA	10 U
Chloromethane	--	10 U	10 U	NA	10 U	10 U	NA	10 U	NA	10 U	NA	10 U	NA	10 U
Vinyl Chloride	0.2	0.033 U	0.042 U	NA	0.037 U	0.033 U	NA	0.035 U	NA	0.034 U	NA	0.034 U	NA	0.051 U
Bromomethane	110,000	10 U	10 U	NA	10 U	10 U	NA	10 U	NA	10 U	NA	10 U	NA	10 U
Chloroethane	--	10 U	10 U	NA	10 U	10 U	NA	10 U	NA	10 U	NA	10 U	NA	10 U
Carbon Tetrachloride	14,000	10 U	10 U	NA	10 U	10 U	NA	10 U	NA	10 U	NA	10 U	NA	10 U
Trichlorofluoromethane	24,000,000	10 U	10 U	NA	10 U	10 U	NA	10 U	NA	10 U	NA	10 U	NA	10 U
Carbon Disulfide	8,000,000	10 U	10 U	NA	10 U	10 U	NA	10 U	NA	10 U	NA	10 U	NA	10 U
Acetone	72,000,000	50 U	50 U	NA	50 U	50 U	NA	50 U	NA	50 U	NA	50 U	NA	50 U
1,1-Dichloroethene	4,000,000	10 U	10 U	NA	10 U	10 U	NA	10 U	NA	10 U	NA	10 U	NA	10 U
Methylene Chloride	20	20 U	20 U	NA	20 U	20 U	NA	20 U	NA	20 U	NA	20 U	NA	20 U
Acrylonitrile	1,900	50 U	50 U	NA	50 U	50 U	NA	50 U	NA	50 U	NA	50 U	NA	50 U
Methyl T-Butyl Ether (MTBE)	100	10 U	10 U	NA	10 U	10 U	NA	10 U	NA	10 U	NA	10 U	NA	10 U
Trans-1,2-Dichloroethene	1,600,000	10 U	10 U	NA	10 U	10 U	NA	10 U	NA	10 U	NA	10 U	NA	10 U
1,1-Dichloroethane	180,000	10 U	10 U	NA	10 U	10 U	NA	10 U	NA	10 U	NA	10 U	NA	10 U
2-Butanone (MEK)	48,000,000	50 U	50 U	NA	50 U	50 U	NA	50 U	NA	50 U	NA	50 U	NA	50 U
Cis-1,2-Dichloroethene	160,000	10 U	10 U	NA	10 U	10 U	NA	10 U	NA	10 U	NA	10 U	NA	10 U
2,2-Dichloropropane	--	10 U	10 U	NA	10 U	10 U	NA	10 U	NA	10 U	NA	10 U	NA	10 U
Bromochloromethane	--	10 U	10 U	NA	10 U	10 U	NA	10 U	NA	10 U	NA	10 U	NA	10 U
Chloroform	8	8.0 U	8.0 U	NA	8.0 U	8.0 U	NA	8.0 U	NA	8.0 U	NA	8.0 U	NA	8.0 U
1,1,1-Trichloroethane	2,000	10 U	10 U	NA	10 U	10 U	NA	10 U	NA	10 U	NA	10 U	NA	10 U
1,1-Dichloropropene	--	10 U	10 U	NA	10 U	10 U	NA	10 U	NA	10 U	NA	10 U	NA	10 U
1,2-Dichloroethane	11,000	10 U	10 U	NA	10 U	10 U	NA	10 U	NA	10 U	NA	10 U	NA	10 U
Benzene	30	5.0 U	5.0 U	NA	5.0 U	5.0 U	NA	5.0 U	NA	5.0 U	NA	5.0 U	NA	5.0 U
Trichloroethene	30	10 U	10 U	NA	10 U	10 U	NA	10 U	NA	10 U	NA	10 U	NA	10 U
1,2-Dichloropropane	28,000	10 U	10 U	NA	10 U	10 U	NA	10 U	NA	10 U	NA	10 U	NA	10 U
Dibromomethane	--	10 U	10 U	NA	10 U	10 U	NA	10 U	NA	10 U	NA	10 U	NA	10 U
Bromodichloromethane	16,000	0.81 U	1.0 U	NA	0.91 U	0.79 U	NA	0.84 U	NA	0.82 U	NA	0.84 U	NA	1.2 U
Trans-1,3-Dichloropropene	10,000	10 U	10 U	NA	10 U	10 U	NA	10 U	NA	10 U	NA	10 U	NA	10 U
4-Methyl-2-Pentanone (MIBK)	6,400,000	50 U	50 U	NA	50 U	50 U	NA	50 U	NA	50 U	NA	50 U	NA	50 U
Toluene	7,000	10 U	10 U	NA	10 U	10 U	NA	10 U	NA	10 U	NA	10 U	NA	10 U
Cis-1,3-Dichloropropene	--	10 U	10 U	NA	10 U	10 U	NA	10 U	NA	10 U	NA	10 U	NA	10 U
1,1,2-Trichloroethane	18,000	0.86 U	1.1 U	NA	0.96 U	0.84 U	NA	0.90 U	NA	0.87 U	NA	0.89 U	NA	1.3 U
2-Hexanone	--	50 U	50 U	NA	50 U	50 U	NA	50 U	NA	50 U	NA	50 U	NA	50 U
1,3-Dichloropropane	--	10 U	10 U	NA	10 U	10 U	NA	10 U	NA	10 U	NA	10 U	NA	10 U
Tetrachloroethene (PCE)	50	10 U	10 U	NA	10 U	10 U	NA	10 U	NA	10 U	NA	10 U	NA	10 U
Dibromochloromethane	12,000	10 U	10 U	NA	10 U	10 U	NA	10 U	NA	10 U	NA	10 U	NA	10 U
1,2-Dibromoethane (EDB)	5.0	5.0 U	5.0 U	NA	5.0 U	5.0 U	NA	5.0 U	NA	5.0 U	NA	5.0 U	NA	5.0 U
Chlorobenzene	1,600,000	10 U	10 U	NA	10 U	10 U	NA	10 U	NA	10 U	NA	10 U	NA	10 U
1,1,1,2-Tetrachloroethane	38,000	10 U	10 U	NA	10 U	10 U	NA	10 U	NA	10 U	NA	10 U	NA	10 U
Ethylbenzene	6,000	10 U	10 U	NA	10 U	10 U	NA	10 U	NA	10 U	NA	10 U	NA	10 U
m,p-Xylene (d)	16,000,000	20 U	20 U	NA	20 U	20 U	NA	20 U	NA	20 U	NA	20 U	NA	20 U
Styrene	16,000,000	10 U	10 U	NA	10 U	10 U	NA	10 U	NA	10 U	NA	10 U	NA	10 U
o-Xylene	16,000,000	10 U	10 U	NA	10 U	10 U	NA	10 U	NA	10 U	NA	10 U	NA	10 U
Bromoform	130,000	10 U	10 U	NA	10 U	10 U	NA	10 U	NA	10 U	NA	10 U	NA	10 U

TABLE 8
SOIL ANALYTICAL RESULTS
CLOSED CITY OF YAKIMA LANDFILL SITE

Location: Depth: Laboratory ID: Sample Date:	Screening Levels	MW-100 (13.5-14) EV14090067-02 9/11/2014	MW-101 (17.5-18.5) EV14090040-04 9/5/2014	MW-102 (4-5) EV14090051-01 9/8/2014	MW-102 (15-15.5) EV14090051-02 9/8/2014	MW-103 (20.5-21.5) EV14090040-03 9/5/2014	MW-104 (2.5-3) EV14090022-03 9/3/2014	MW-104 (19-20) EV14090022-04 9/3/2014	MW-105 (2.5-3.5) EV14090022-01 9/2/2014	MW-105 (17.5-19) EV14090022-02 9/2/2014	MW-106 (2.5-3.5) EV14090051-05 9/9/2014	MW-106 (13.5-14.5) EV14090067-01 9/10/2014	MW-107 (2.5-3.5) EV14090051-03 9/9/2014	MW-107 (16-17) EV14090051-04 9/9/2014
Isopropylbenzene (cumene)	8,000,000	10 U	10 U	NA	10 U	10 U	NA	10 U	NA	10 U	NA	10 U	NA	10 U
1,1,2,2-Tetrachloroethane	5,000	0.89 U	1.1 U	NA	1.0 U	0.87 U	NA	0.93 U	NA	0.91 U	NA	0.92 U	NA	1.4 U
1,2,3-Trichloropropane	33	0.94 U	1.2 U	NA	1.0 U	0.92 U	NA	0.98 U	NA	0.95 U	NA	0.97 U	NA	1.4 U
Bromobenzene	--	10 U	10 U	NA	10 U	10 U	NA	10 U	NA	10 U	NA	10 U	NA	10 U
N-Propyl Benzene	8,000,000	10 U	10 U	NA	10 U	10 U	NA	10 U	NA	10 U	NA	10 U	NA	10 U
2-Chlorotoluene	--	10 U	10 U	NA	10 U	10 U	NA	10 U	NA	10 U	NA	10 U	NA	10 U
1,3,5-Trimethylbenzene	800,000	10 U	10 U	NA	10 U	10 U	NA	10 U	NA	10 U	NA	10 U	NA	10 U
4-Chlorotoluene	--	10 U	10 U	NA	10 U	10 U	NA	10 U	NA	10 U	NA	10 U	NA	10 U
T-Butyl Benzene	8,000,000	10 U	10 U	NA	10 U	10 U	NA	10 U	NA	10 U	NA	10 U	NA	10 U
1,2,4-Trimethylbenzene	--	10 U	10 U	NA	10 U	10 U	NA	10 U	NA	10 U	NA	10 U	NA	10 U
S-Butyl Benzene	8,000,000	10 U	10 U	NA	10 U	10 U	NA	10 U	NA	10 U	NA	10 U	NA	10 U
P-Isopropyltoluene	--	10 U	10 U	NA	10 U	10 U	NA	10 U	NA	10 U	NA	10 U	NA	10 U
1,3 Dichlorobenzene	--	10 U	10 U	NA	10 U	10 U	NA	10 U	NA	10 U	NA	10 U	NA	10 U
1,4-Dichlorobenzene	190,000	10 U	10 U	NA	10 U	10 U	NA	10 U	NA	10 U	NA	10 U	NA	10 U
N-Butylbenzene	--	10 U	10 U	NA	10 U	10 U	NA	10 U	NA	10 U	NA	10 U	NA	10 U
1,2-Dichlorobenzene	7,200,000	10 U	10 U	NA	10 U	10 U	NA	10 U	NA	10 U	NA	10 U	NA	10 U
1,2-Dibromo 3-Chloropropane	1,300	50 U	50 U	NA	50 U	50 U	NA	50 U	NA	50 U	NA	50 U	NA	50 U
1,2,4-Trichlorobenzene	56	10 U	10 U	NA	10 U	10 U	NA	10 U	NA	10 U	NA	10 U	NA	10 U
Hexachlorobutadiene	13,000	10 U	10 U	NA	10 U	10 U	NA	10 U	NA	10 U	NA	10 U	NA	10 U
1,2,3-Trichlorobenzene	--	10 U	10 U	NA	10 U	10 U	NA	10 U	NA	10 U	NA	10 U	NA	10 U
SVOCs (µg/kg) **Method EPA-8270**														
Pyridine	80,000	200 U	200 U	NA	200 U	200 U	NA	200 U	NA	200 U	NA	200 U	NA	200 U
N-Nitrosodimethylamine	20	26 U	25 U	NA	29 U	23 U	NA	29 U	NA	31 U	NA	29 U	NA	35 U
Phenol	24,000,000	100 U	100 U	NA	100 U	100 U	NA	100 U	NA	100 U	NA	100 U	NA	100 U
Aniline	180,000	45 U	42 U	NA	51 U	40 U	NA	50 U	NA	53 U	NA	50 U	NA	61 U
Bis(2-Chloroethyl)Ether	910	93 U	89 U	NA	110 U	83 U	NA	100 U	NA	110 U	NA	100 U	NA	130 U
2-Chlorophenol	400,000	250 U	250 U	NA	250 U	250 U	NA	250 U	NA	250 U	NA	250 U	NA	250 U
Benzyl Alcohol	8,000,000	100 U	100 U	NA	100 U	100 U	NA	100 U	NA	100 U	NA	100 U	NA	100 U
2-Methylphenol	4,000,000	100 U	100 U	NA	100 U	100 U	NA	100 U	NA	100 U	NA	100 U	NA	100 U
Bis(2-Chloroisopropyl)Ether	--	250 U	250 U	NA	250 U	250 U	NA	250 U	NA	250 U	NA	250 U	NA	250 U
3&4-Methylphenol	2,000	100 U	**400**	NA	100 U	100 U	NA	100 U	NA	100 U	NA	100 U	NA	100 U
N-Nitroso-Di-N-Propylamine	140	90 U	86 U	NA	100 U	80 U	NA	100 U	NA	110 U	NA	100 U	NA	120 U
Hexachloroethane	25,000	100 U	100 U	NA	100 U	100 U	NA	100 U	NA	100 U	NA	100 U	NA	100 U
Nitrobenzene	160,000	100 U	100 U	NA	100 U	100 U	NA	100 U	NA	100 U	NA	100 U	NA	100 U
Isophorone	1,050,000	100 U	100 U	NA	100 U	100 U	NA	100 U	NA	100 U	NA	100 U	NA	100 U
2-Nitrophenol	--	100 U	100 U	NA	100 U	100 U	NA	100 U	NA	100 U	NA	100 U	NA	100 U
2,4-Dimethylphenol	1,600,000	100 U	100 U	NA	100 U	100 U	NA	100 U	NA	100 U	NA	100 U	NA	100 U
Benzoic Acid	320,000,000	1000 U	1000 U	NA	1000 U	1000 U	NA	1000 U	NA	1000 U	NA	1000 U	NA	1000 U
Bis(2-Chloroethoxy)Methane	--	250 U	250 U	NA	250 U	250 U	NA	250 U	NA	250 U	NA	250 U	NA	250 U
2,4-Dichlorophenol	240,000	240 U	230 U	NA	270 U	210 U	NA	270 U	NA	280 U	NA	260 U	NA	320 U
4-Chloroaniline	5,000	1000 U	1000 U	NA	1000 U	1000 U	NA	1000 U	NA	1000 U	NA	1000 U	NA	1000 U
2,6-Dichlorophenol	--	250 U	250 U	NA	250 U	250 U	NA	250 U	NA	250 U	NA	250 U	NA	250 U
4-Chloro-3-Methylphenol	--	500 U	500 U	NA	500 U	500 U	NA	500 U	NA	500 U	NA	500 U	NA	500 U
Hexachlorocyclopentadiene	480,000	100 U	100 U	NA	100 U	100 U	NA	100 U	NA	100 U	NA	100 U	NA	100 U
2,4,6-Trichlorophenol	80,000	38 U	36 U	NA	43 U	34 U	NA	43 U	NA	46 U	NA	43 U	NA	52 U
2,4,5-Trichlorophenol	8,000,000	100 U	100 U	NA	100 U	100 U	NA	100 U	NA	100 U	NA	100 U	NA	100 U
2-Chloronaphthalene	--	100 U	100 U	NA	100 U	100 U	NA	100 U	NA	100 U	NA	100 U	NA	100 U
2-Nitroaniline	800,000	100 U	100 U	NA	100 U	100 U	NA	100 U	NA	100 U	NA	100 U	NA	100 U
Dimethylphthalate	--	100 U	100 U	NA	100 U	100 U	NA	100 U	NA	100 U	NA	100 U	NA	100 U
2,6-Dinitrotoluene	670	36 U	34 U	NA	41 U	32 U	NA	40 U	NA	43 U	NA	40 U	NA	49 U
3-Nitroaniline	--	1000 U	1000 U	NA	1000 U	1000 U	NA	1000 U	NA	1000 U	NA	1000 U	NA	1000 U
2,4-Dinitrophenol	160,000	100 U	100 U	NA	100 U	100 U	NA	100 U	NA	100 U	NA	100 U	NA	100 U
4-Nitrophenol	--	100 U	100 U	NA	100 U	100 U	NA	100 U	NA	100 U	NA	100 U	NA	100 U
Dibenzofuran	80,000	100 U	100 U	NA	100 U	100 U	NA	100 U	NA	100 U	NA	100 U	NA	100 U
2,4-Dinitrotoluene	3,200	21 U	20 U	NA	24 U	19 U	NA	23 U	NA	25 U	NA	23 U	NA	28 U
2,3,4,6-Tetrachlorophenol	2,400,000	100 U	100 U	NA	100 U	100 U	NA	100 U	NA	100 U	NA	100 U	NA	100 U
Diethylphthalate	64,000,000	100 U	100 U	NA	100 U	100 U	NA	100 U	NA	100 U	NA	100 U	NA	100 U

TABLE 8
SOIL ANALYTICAL RESULTS
CLOSED CITY OF YAKIMA LANDFILL SITE

Location:	Screening Levels	MW-100	MW-101	MW-102	MW-102	MW-103	MW-104	MW-104	MW-105	MW-105	MW-106	MW-106	MW-107	MW-107
Depth:		(13.5-14)	(17.5-18.5)	(4-5)	(15-15.5)	(20.5-21.5)	(2.5-3)	(19-20)	(2.5-3.5)	(17.5-19)	(2.5-3.5)	(13.5-14.5)	(2.5-3.5)	(16-17)
Laboratory ID:		EV14090067-02	EV14090040-04	EV14090051-01	EV14090051-02	EV14090040-03	EV14090022-03	EV14090022-04	EV14090022-01	EV14090022-02	EV14090051-05	EV14090067-01	EV14090051-03	EV14090051-04
Sample Date:		9/11/2014	9/5/2014	9/8/2014	9/8/2014	9/5/2014	9/3/2014	9/3/2014	9/2/2014	9/2/2014	9/9/2014	9/10/2014	9/9/2014	9/9/2014
4-Chlorophenyl-Phenylether	--	100 U	100 U	NA	100 U	100 U	NA	100 U	NA	100 U	NA	100 U	NA	100 U
4-Nitroaniline	--	250 U	250 U	NA	250 U	250 U	NA	250 U	NA	250 U	NA	250 U	NA	250 U
4,6-Dinitro-2-Methylphenol	--	100 U	100 U	NA	100 U	100 U	NA	100 U	NA	100 U	NA	100 U	NA	100 U
N-Nitrosodiphenylamine	100	100 U	100 U	NA	100 U	100 U	NA	100 U	NA	100 U	NA	**110**	NA	100 U
Azobenzene	9,100	100 U	100 U	NA	100 U	100 U	NA	100 U	NA	100 U	NA	100 U	NA	100 U
4-Bromophenyl-Phenylether	--	100 U	100 U	NA	100 U	100 U	NA	100 U	NA	100 U	NA	100 U	NA	100 U
Hexachlorobenzene	630	100 U	100 U	NA	100 U	100 U	NA	100 U	NA	100 U	NA	100 U	NA	100 U
Carbazole	--	250 U	250 U	NA	250 U	250 U	NA	250 U	NA	250 U	NA	250 U	NA	250 U
Di-N-Butylphthalate	8,000,000	100 U	100 U	NA	100 U	100 U	NA	100 U	NA	100 U	NA	100 U	NA	100 U
Butylbenzylphthalate	530,000	100 U	100 U	NA	100 U	100 U	NA	100 U	NA	100 U	NA	100 U	NA	100 U
3,3'-Dichlorobenzidine	213	170 U	160 U	NA	190 U	150 U	NA	180 U	NA	200 U	NA	180 U	NA	230 U
Bis(2-Ethylhexyl)Phthalate	2,600	**110**	**140**	NA	**110**	100 U	NA	**120**	NA	100 U	NA	**820**	NA	**540**
Di-N-Octylphthalate	800,000	100 U	100 U	NA	100 U	100 U	NA	100 U	NA	100 U	NA	100 U	NA	100 U
PAHs (µg/kg) **Method EPA-8270 SIM**														
Naphthalene	5,000	20 U	20 U	**36**	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U
2-Methylnaphthalene	320,000	20 U	20 U	**26**	20 U	20 U	20 U	20 U	20 U	20 U	20 U	**95**	20 U	20 U
1-Methylnaphthalene	35,000	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	**61**	20 U	20 U
Acenaphthylene	--	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U
Acenaphthene	66,000	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U
Fluorene	101,000	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U
Pentachlorophenol	76.9	48 U	58 U	54 U	61 U	61 U	63 U	62 U	69 U	59 U	53 U	55 U	57 U	76 U
Phenanthrene	--	20 U	20 U	**23**	20 U	20 U	**28**	20 U	**78**	20 U	**21**	**29**	20 U	20 U
Anthracene	2,275,000	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U
Fluoranthene	85,000	20 U	20 U	**31**	20 U	20 U	**170**	20 U	**240**	20 U	20 U	**28**	20 U	20 U
Pyrene	655,000	20 U	20 U	**33**	20 U	20 U	**45**	20 U	**120**	20 U	20 U	**24**	20 U	20 U
Benzo[a]Anthracene	1,400	20 U	20 U	20 U	20 U	20 U	**21**	20 U	**99**	20 U	20 U	20 U	20 U	20 U
Chrysene	140,000	20 U	20 U	20 U	20 U	20 U	20 U	20 U	**63**	20 U	20 U	20 U	20 U	20 U
Benzo[b]Fluoranthene	180	20 U	20 U	20 U	20 U	20 U	**30**	20 U	**110**	20 U	**21**	20 U	20 U	20 U
Benzo[k]Fluoranthene	570	20 U	20 U	20 U	20 U	20 U	20 U	20 U	**31**	20 U	20 U	20 U	20 U	20 U
Benzo[a]Pyrene	100	20 U	20 U	20 U	20 U	20 U	**22**	20 U	**71**	20 U	20 U	20 U	20 U	20 U
Indeno[1,2,3-cd]Pyrene	1,400	20 U	20 U	20 U	20 U	20 U	20 U	20 U	**38**	20 U	20 U	20 U	20 U	20 U
Dibenz[a,h]Anthracene	140	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U
Benzo[g,h,i]Perylene	--	20 U	20 U	20 U	20 U	20 U	**25**	20 U	**64**	20 U	20 U	20 U	20 U	20 U
cPAH TEQ	100	ND	ND	ND	ND	ND	**27.1**	ND	**99.4**	ND	**2.1**	ND	ND	ND

Table F-1. Former Boise Cascade Mill Site 2008 Groundwater and Surface Water Data

TABLE A-2
2008 Groundwater and Surface Water Data

			Groundwater Regulatory Standards																			
PARAMETERS	**Units**	**Analytical Method**	**MCL**		**MTCA A**		**MTCA B carcin.**	**non-carc.**	MW-7 02/06/08		MW-7D 02/06/08		MW-8 02/06/08		MW-8D**** 8/13/2008	MW-9A 03/25/08		TRIP BLANK 02/05/08		TRIP BLANK 03/25/08		TRIP BLANK 08/13/08
FIELD DATA																				- -		- -
Conductivity	µmhos/cm		700	**					561		- -		681		- -	319		- -		- -		- -
pH (units)	std units		6.5-8.5	**					NA		- -		NA		- -	6.79		- -		- -		- -
Temperature (C)	Celsius								15.77		- -		15.23		- -	14.70		- -		- -		- -
Dissolved Oxygen (mg/L)	mg/L								0.9		- -		3.61		- -	3.12		- -		- -		- -
TOTAL PETROLEUM HYDROCARBONS																						
Diesel Range Hydrocarbons	mg/L	NWTPH-Dx			0.5				0.25	U	0.25	U	0.25	U	- -	0.25	U	- -		- -		- -
Motor Oil	mg/L	NWTPH-Dx			0.5				0.50	U	0.50	U	0.50	U	- -	0.50	U	- -		- -		- -
Gasoline Range Hydrocarbons	mg/L	NWTPH-Gx			1				0.25	U	0.25	U	0.25	U	- -	0.25	U	0.25	U	0.25	U	- -
Benzene	µg/L	SW8021BMod	5		5		0.795	32	1.0	U	1.0	U	1.0	U	- -	1.0	U	1.0	U	1.0	U	- -
Toluene	µg/L	SW8021BMod	1000		1000			640	1.0	U	1.0	U	1.0	U	- -	1.0	U	1.0	U	1.0	U	- -
Ethylbenzene	µg/L	SW8021BMod	700		700			800	1.0	U	1.0	U	1.0	U	- -	1.0	U	1.0	U	1.0	U	- -
m,p-Xylene	µg/L	SW8021BMod	10000	*XY	1000	*XY		1600	1.0	U	1.0	U	1.0	U	- -	1.0	U	1.0	U	1.0	U	- -
o-Xylene	µg/L	SW8021BMod	10000	*XY	1000	*XY		1600	1.0	U	1.0	U	1.0	U	- -	1.0	U	1.0	U	1.0	U	- -
CONVENTIONALS																						
pH	std units	EPA 150.1	6.5-8.5	**					6.49		6.50		6.76		- -	6.77		- -		- -		- -
Alkalinity	mg/L CaCO3	SM 2320							274		274		306		- -	127		- -		- -		- -
Carbonate	mg/L CaCO3	SM 2320							1.0	U	1.0	U	1.0	U	- -	- -		- -		- -		- -
Bicarbonate	mg/L CaCO3	SM 2320							274		274		306		- -	- -		- -		- -		- -
Total Dissolved Solids	mg/L	EPA 160.1	500	**					336		318		333		- -	210		- -		- -		- -
Hydroxide	mg/L CaCO3	SM 2320							1.0	U	1.0	U	1.0	U	- -	- -		- -		- -		- -
Chloride	mg/L	EPA 325.2	250	**					19.4		19.0		32.8		- -	15.6		- -		- -		- -
N-Ammonia	mg-N/L	EPA 350.1M							6.35		6.18		21.2		- -	0.038		- -		- -		- -
N-Nitrate	mg-N/L	Calculated	10						0.050	U	0.050	U	0.196		- -	1.41		- -		- -		- -
N-Nitrite	mg-N/L	EPA 353.2	1						0.050	U	0.050	U	0.019		- -	0.223		- -		- -		- -
Nitrate + Nitrite	mg-N/L	EPA 353.2							0.050	U	0.050	U	0.215		- -	1.63		- -		- -		- -
Sulfate	mg/L	EPA 375.2	250	**					5.5		5.5		5.6		- -	17.9		- -		- -		- -
Total Organic Carbon	mg/L	EPA 415.1							6.51		6.47		8.77		- -	1.50	U	- -		- -		- -
TOTAL METALS																						
Arsenic	mg/L	SW6010B-Total	0.01		0.005		0.000058	0.0048	0.05	U	0.05	U	0.05	U	- -	0.05	U	- -		- -		- -
Barium	mg/L	SW6010B-Total	2					3.2	0.062		0.064		0.068		- -	0.404		- -		- -		- -
Cadmium	mg/L	SW6010B-Total	0.005		0.005			0.008	0.002	U	0.002	U	0.002	U	- -	0.002	U	- -		- -		- -
Calcium	mg/L	SW6010B-Total							43.3		45.5		37.2		- -	51.5		- -		- -		- -
Chromium	mg/L	SW6010B-Total	0.1	***	0.05			0.048	0.005	U	0.005	U	0.005	U	- -	0.278		- -		- -		- -
Iron	mg/L	SW6010B-Total	0.3	**					33.6		35.1		11.5		- -	96.8		- -		- -		- -
Lead	mg/L	SW6010B-Total	0.015		0.015				0.02	U	0.02	U	0.02	U	- -	0.02	U	- -		- -		- -
Manganese	mg/L	SW6010B-Total	0.05	**				2.2	2.26		2.36		2.24		- -	3.24		- -		- -		- -
Mercury	mg/L	SW7470A-Total	0.002		0.002			0.0048	0.0001	U	0.0001	U	0.0001	U	- -	0.0002		- -		- -		- -
Potassium	mg/L	SW6010B-Total							10.3		10.7		29.0		- -	10.3		- -		- -		- -
Selenium	mg/L	SW6010B-Total	0.05					0.08	0.05	U	0.05	U	0.05	U	- -	0.05	U	- -		- -		- -
Silver	mg/L	SW6010B-Total						0.08	0.003	U	0.003	U	0.003	U	- -	0.003	U	- -		- -		- -
Sodium	mg/L	SW6010B-Total							20.5		21.2		32.5		- -	21.1		- -		- -		- -
DISSOLVED METALS																						
Arsenic	mg/L	SW6010B-Diss	0.01		0.005		0.000058	0.0048	0.05	U	0.05	U	0.05	U	- -	0.05	U	- -		- -		- -
Barium	mg/L	SW6010B-Diss	2					3.2	0.069		0.071		0.072		- -	0.013		- -		- -		- -
Cadmium	mg/L	SW6010B-Diss	0.005		0.005			0.008	0.002	U	0.002	U	0.002	U	- -	0.002	U	- -		- -		- -
Calcium	mg/L	SW6010B-Diss							48.1		48.5		39.1		- -	29.4		- -		- -		- -
Chromium	mg/L	SW6010B-Diss	0.1	***	0.05			0.048	0.005	U	0.005	U	0.005	U	- -	0.005	U	- -		- -		- -
Iron	mg/L	SW6010B-Diss	0.3	**					37.5		37.7		12.2		- -	0.27		- -		- -		- -
Lead	mg/L	SW6010B-Diss	0.015		0.015				0.02	U	0.02	U	0.02	U	- -	0.02	U	- -		- -		- -
Manganese	mg/L	SW6010B-Diss	0.05	**				2.2	2.52		2.53		2.34		- -	0.872		- -		- -		- -
Mercury	mg/L	SW7470A-Diss	0.002		0.002			0.0048	0.0001	U	0.0001	U	0.0001	U	- -	0.0001	U	- -		- -		- -
Potassium	mg/L	SW6010B-Diss							11.4		11.3		29.9		- -	4.4		- -		- -		- -
Selenium	mg/L	SW6010B-Diss	0.05					0.08	0.05	U	0.05	U	0.05	U	- -	0.05	U	- -		- -		- -
Silver	mg/L	SW6010B-Diss						0.08	0.003	U	0.003	U	0.003	U	- -	0.003	U	- -		- -		- -
Sodium	mg/L	SW6010B-Diss							22.9		22.9		33.8		- -	15.7		- -		- -		- -
VOLATILE ORGANICS																						
Chloromethane	µg/L	SW8260					3.37		1.0	U	1.0	U	1.0	U	- -	1.0	U	1.0	U	1.0	U	- -
Bromomethane	µg/L	SW8260						11.2	1.0	U	1.0	U	1.0	U	- -	1.0	U	1.0	U	1.0	U	- -
Vinyl Chloride	µg/L	SW8260	2		0.2		0.0292	24	1.0	U	1.0	U	1.0	U	- -	1.0	U	1.0	U	1.0	U	- -
Chloroethane	µg/L	SW8260							1.0	U	1.0	U	1.0	U	- -	1.0	U	1.0	U	1.0	U	- -
Methylene Chloride	µg/L	SW8260			5				2.0	U	2.0	U	2.0	U	- -	2.0	U	2.0	U	2.0	U	- -
Acetone	µg/L	SW8260						800	5.0	U	5.0	U	5.0	U	- -	5.0	U	5.0	U	5.0	U	- -
Carbon Disulfide	µg/L	SW8260						800	1.0	U	1.0	U	1.0	U	- -	1.0	U	1.0	U	1.0	U	- -
1,1-Dichloroethene	µg/L	SW8260	7					400	1.0	U	1.0	U	1.0	U	- -	1.0	U	1.0	U	1.0	U	- -
1,1-Dichloroethane	µg/L	SW8260						800	1.0	U	1.0	U	**2.4**		- -	1.0	U	1.0	U	1.0	U	- -
trans-1,2-Dichloroethene	µg/L	SW8260						160	1.0	U	1.0	U	1.0	U	- -	1.0	U	1.0	U	1.0	U	- -
cis-1,2-Dichloroethene	µg/L	SW8260						80	1.0	U	1.0	U	1.0	U	- -	1.0	U	1.0	U	1.0	U	- -
Chloroform	µg/L	SW8260	100	*TH			7.17	80	1.0	U	1.0	U	1.0	U	- -	**3.3**		1.0	U	1.0	U	- -

Table F-1. Former Boise Cascade Mill Site 2008 Groundwater and Surface Water Data

TABLE A-2
2008 Groundwater and Surface Water Data

			Groundwater Regulatory Standards																					
PARAMETERS	Units	Analytical Method	MCL		MTCA A		MTCA B carcin.	non-carc.	MW-7 02/06/08		MW-7D 02/06/08		MW-8 02/06/08		MW-8D**** 8/13/2008		MW-9A 03/25/08		TRIP BLANK 02/05/08		TRIP BLANK 03/25/08		TRIP BLANK 08/13/08	
1,2-Dichloroethane	µg/L	SW8260	5		5		0.481	160	1.0	U	1.0	U	1.0	U	- -		1.0	U	1.0	U	1.0	U	- -	
2-Butanone	µg/L	SW8260							5.0	U	5.0	U	5.0	U	- -		5.0	U	5.0	U	5.0	U	- -	
1,1,1-Trichloroethane	µg/L	SW8260	200		200			7200	1.0	U	1.0	U	1.0	U	- -		1.0	U	1.0	U	1.0	U	- -	
Carbon Tetrachloride	µg/L	SW8260	5				0.337	5.6	1.0	U	1.0	U	1.0	U	- -		1.0	U	1.0	U	1.0	U	- -	
Vinyl Acetate	µg/L	SW8260						8000	5.0	U	5.0	U	5.0	U	- -		5.0	U	5.0	U	5.0	U	- -	
Bromodichloromethane	µg/L	SW8260	100	*TH			0.706	160	1.0	U	1.0	U	1.0	U	- -		1.0	U	1.0	U	1.0	U	- -	
1,2-Dichloropropane	µg/L	SW8260					0.643		1.0	U	1.0	U	1.0	U	- -		1.0	U	1.0	U	1.0	U	- -	
cis-1,3-Dichloropropene	µg/L	SW8260					0.24	240	1.0	U	1.0	U	1.0	U	- -		1.0	U	1.0	U	1.0	U	- -	
Trichloroethene	µg/L	SW8260	5		5		0.11	2.4	1.0	U	1.0	U	1.0	U	- -		1.0	U	1.0	U	1.0	U	- -	
Dibromochloromethane	µg/L	SW8260					0.521	160	1.0	U	1.0	U	1.0	U	- -		1.0	U	1.0	U	1.0	U	- -	
1,1,2-Trichloroethane	µg/L	SW8260	5				0.768	32	1.0	U	1.0	U	1.0	U	- -		1.0	U	1.0	U	1.0	U	- -	
Benzene	µg/L	SW8260	5		5		0.795	32	1.0	U	1.0	U	1.0	U	- -		1.0	U	1.0	U	1.0	U	- -	
trans-1,3-Dichloropropene	µg/L	SW8260					0.24	240	1.0	U	1.0	U	1.0	U	- -		1.0	U	1.0	U	1.0	U	- -	
2-Chloroethylvinylether	µg/L	SW8260							- -		- -		- -		- -		5.0	U	- -		5.0	U	- -	
Bromoform	µg/L	SW8260	100	*TH			5.54	160	1.0	U	1.0	U	1.0	U	- -		1.0	U	1.0	U	1.0	U	- -	
4-Methyl-2-Pentanone (MIBK)	µg/L	SW8260							5.0	U	5.0	U	5.0	U	- -		5.0	U	5.0	U	5.0	U	- -	
2-Hexanone	µg/L	SW8260							5.0	U	5.0	U	5.0	U	- -		5.0	U	5.0	U	5.0	U	- -	
Tetrachloroethene	µg/L	SW8260	5		5		0.081	80	1.0	U	1.0	U	1.0	U	- -		1.0	U	1.0	U	1.0	U	- -	
1,1,2,2-Tetrachloroethane	µg/L	SW8260					0.219		1.0	U	1.0	U	1.0	U	- -		1.0	U	1.0	U	1.0	U	- -	
Toluene	µg/L	SW8260	1000		1000			640	1.0	U	1.0	U	1.0	U	- -		1.0	U	1.0	U	1.0	U	- -	
Chlorobenzene	µg/L	SW8260						160	1.0	U	1.0	U	1.0	U	- -		1.0	U	1.0	U	1.0	U	- -	
Ethylbenzene	µg/L	SW8260	700		700			800	1.0	U	1.0	U	1.0	U	- -		1.0	U	1.0	U	1.0	U	- -	
Styrene	µg/L	SW8260	100				1.46	1600	1.0	U	1.0	U	1.0	U	- -		1.0	U	1.0	U	1.0	U	- -	
Trichlorofluoromethane	µg/L	SW8260						2400	1.0	U	1.0	U	1.0	U	- -		1.0	U	1.0	U	1.0	U	- -	
m,p-Xylene	µg/L	SW8260	10000	*XY	1000	*XY		1600	1.0	U	1.0	U	1.0	U	- -		1.0	U	1.0	U	1.0	U	- -	
o-Xylene	µg/L	SW8260	10000	*XY	1000	*XY		1600	1.0	U	1.0	U	1.0	U	- -		1.0	U	1.0	U	1.0	U	- -	
1,2-Dichlorobenzene	µg/L	SW8260						720	1.0	U	1.0	U	1.0	U	- -		1.0	U	1.0	U	1.0	U	- -	
1,4-Dichlorobenzene	µg/L	SW8260					1.8		1.0	U	1.0	U	1.0	U	- -		1.0	U	1.0	U	1.0	U	- -	
Methyl Iodide	µg/L	SW8260							1.0	U	1.0	U	1.0	U	- -		1.0	U	1.0	U	1.0	U	- -	
Acrylonitrile	µg/L	SW8260					0.081	8	5.0	U	5.0	U	5.0	U	- -		5.0	U	5.0	U	5.0	U	- -	
Dibromomethane	µg/L	SW8260							1.0	U	1.0	U	1.0	U	- -		1.0	U	1.0	U	1.0	U	- -	
1,1,1,2-Tetrachloroethane	µg/L	SW8260					1.7	240	1.0	U	1.0	U	1.0	U	- -		1.0	U	1.0	U	1.0	U	- -	
1,2-Dibromo-3-chloropropane	µg/L	SW8260					0.031		5.0	U	5.0	U	5.0	U	- -		5.0	U	5.0	U	5.0	U	- -	
1,2,3-Trichloropropane	µg/L	SW8260					0.0063	48	2.0	U	2.0	U	2.0	U	- -		2.0	U	2.0	U	2.0	U	- -	
trans-1,4-Dichloro-2-butene	µg/L	SW8260							5.0	U	5.0	U	5.0	U	- -		5.0	U	5.0	U	5.0	U	- -	
Ethylene Dibromide	µg/L	SW8260	0.05		0.01		0.000515		1.0	U	1.0	U	1.0	U	- -		1.0	U	1.0	U	1.0	U	- -	
Bromochloromethane	µg/L	SW8260							1.0	U	1.0	U	1.0	U	- -		- -		1.0	U	- -		- -	
Vinyl Chloride	µg/L	SW8260 SIM	2		0.2		0.0292	24	**0.060**		**0.063**		**0.034**		- -		- -		- -		- -		- -	
Vinyl Chloride*	µg/L	SW8260 SIM	2		0.2		0.0292	24	0.020	U	- -		0.027		0.028		0.020	U	- -		- -		0.020	U
POLYCHLORINATED BIPHENYLS																								
Aroclor 1016	µg/L	SW8082	0.5		0.1		0.044		1.0	U	1.0	U	1.0	U	- -		1.0	U	- -		- -		- -	
Aroclor 1242	µg/L	SW8082	0.5		0.1		0.044		1.0	U	1.0	U	1.0	U	- -		1.0	U	- -		- -		- -	
Aroclor 1248	µg/L	SW8082	0.5		0.1		0.044		1.0	U	1.0	U	1.0	U	- -		1.0	U	- -		- -		- -	
Aroclor 1254	µg/L	SW8082	0.5		0.1		0.044		1.0	U	1.0	U	1.0	U	- -		1.0	U	- -		- -		- -	
Aroclor 1260	µg/L	SW8082	0.5		0.1		0.044		1.0	U	1.0	U	1.0	U	- -		1.0	U	- -		- -		- -	
Aroclor 1221	µg/L	SW8082	0.5		0.1		0.044		1.0	U	1.0	U	1.0	U	- -		1.0	U	- -		- -		- -	
Aroclor 1232	µg/L	SW8082	0.5		0.1		0.044		1.0	U	1.0	U	1.0	U	- -		1.0	U	- -		- -		- -	
SEMIVOLATILE ORGANICS																								
Phenol	µg/L	SW8270D						4800	1.0	U	1.0	U	1.0	U	- -		1.0	U	- -		- -		- -	
Bis-(2-Chloroethyl) Ether	µg/L	SW8270D					0.04		1.0	U	1.0	U	1.0	U	- -		1.0	U	- -		- -		- -	
2-Chlorophenol	µg/L	SW8270D						40	1.0	U	1.0	U	1.0	U	- -		1.0	U	- -		- -		- -	
1,3-Dichlorobenzene	µg/L	SW8270D							1.0	U	1.0	U	1.0	U	- -		1.0	U	- -		- -		- -	
1,4-Dichlorobenzene	µg/L	SW8270D	75				1.8		1.0	U	1.0	U	1.0	U	- -		1.0	U	- -		- -		- -	
Benzyl Alcohol	µg/L	SW8270D						2400	5.0	U	5.0	U	5.0	U	- -		5.0	U	- -		- -		- -	
1,2-Dichlorobenzene	µg/L	SW8270D	600					720	1.0	U	1.0	U	1.0	U	- -		1.0	U	- -		- -		- -	
2-Methylphenol	µg/L	SW8270D							1.0	U	1.0	U	1.0	U	- -		1.0	U	- -		- -		- -	
2,2'-Oxybis(1-Chloropropane)	µg/L	SW8270D							1.0	U	1.0	U	1.0	U	- -		1.0	U	- -		- -		- -	
4-Methylphenol	µg/L	SW8270D							1.0	U	1.0	U	1.0	U	- -		1.0	U	- -		- -		- -	
N-Nitroso-Di-N-Propylamine	µg/L	SW8270D							5.0	U	5.0	U	5.0	U	- -		5.0	U	- -		- -		- -	
Hexachloroethane	µg/L	SW8270D					3.1	8	1.0	U	1.0	U	1.0	U	- -		1.0	U	- -		- -		- -	
Nitrobenzene	µg/L	SW8270D						4	1.0	U	1.0	U	1.0	U	- -		1.0	U	- -		- -		- -	
Isophorone	µg/L	SW8270D					46	1600	1.0	U	1.0	U	1.0	U	- -		1.0	U	- -		- -		- -	
2-Nitrophenol	µg/L	SW8270D							5.0	U	5.0	U	5.0	U	- -		5.0	U	- -		- -		- -	
2,4-Dimethylphenol	µg/L	SW8270D						160	1.0	U	1.0	U	1.0	U	- -		1.0	U	- -		- -		- -	
Benzoic Acid	µg/L	SW8270D						64000	10	U	10	U	10	U	- -		10	U	- -		- -		- -	
bis(2-Chloroethoxy) Methane	µg/L	SW8270D							1.0	U	1.0	U	1.0	U	- -		1.0	U	- -		- -		- -	
2,4-Dichlorophenol	µg/L	SW8270D						24	5.0	U	5.0	U	5.0	U	- -		5.0	U	- -		- -		- -	
1,2,4-Trichlorobenzene	µg/L	SW8270D						80	1.0	U	1.0	U	1.0	U	- -		1.0	U	- -		- -		- -	
Naphthalene	µg/L	SW8270D			160			160	1.0	U	1.0	U	1.0	U	- -		1.0	U	- -		- -		- -	

Table F-1. Former Boise Cascade Mill Site 2008 Groundwater and Surface Water Data

TABLE A-2
2008 Groundwater and Surface Water Data

			Groundwater Regulatory Standards															
PARAMETERS	**Units**	**Analytical Method**	**MCL**	**MTCA A**	**MTCA B carcin.**	**non-carc.**	MW-7 02/06/08		MW-7D 02/06/08		MW-8 02/06/08		MW-8D**** 8/13/2008	MW-9A 03/25/08		TRIP BLANK 02/05/08	TRIP BLANK 03/25/08	TRIP BLANK 08/13/08
4-Chloroaniline	µg/L	SW8270D				32	5.0	U	5.0	U	5.0	U	- -	5.0	U	- -	- -	- -
Hexachlorobutadiene	µg/L	SW8270D			0.56	1.6	1.0	U	1.0	U	1.0	U	- -	1.0	U	- -	- -	- -
4-Chloro-3-methylphenol	µg/L	SW8270D					5.0	U	5.0	U	5.0	U	- -	5.0	U	- -	- -	- -
2-Methylnaphthalene	µg/L	SW8270D					1.0	U	1.0	U	1.0	U	- -	1.0	U	- -	- -	- -
Hexachlorocyclopentadiene	µg/L	SW8270D	50			48	5.0	U	5.0	U	5.0	U	- -	5.0	U	- -	- -	- -
2,4,6-Trichlorophenol	µg/L	SW8270D			4		5.0	U	5.0	U	5.0	U	- -	5.0	U	- -	- -	- -
2,4,5-Trichlorophenol	µg/L	SW8270D				800	5.0	U	5.0	U	5.0	U	- -	5.0	U	- -	- -	- -
2-Chloronaphthalene	µg/L	SW8270D					1.0	U	1.0	U	1.0	U	- -	1.0	U	- -	- -	- -
2-Nitroaniline	µg/L	SW8270D					5.0	U	5.0	U	5.0	U	- -	5.0	U	- -	- -	- -
Dimethylphthalate	µg/L	SW8270D				16000	1.0	U	1.0	U	1.0	U	- -	1.0	U	- -	- -	- -
Acenaphthylene	µg/L	SW8270D					1.0	U	1.0	U	1.0	U	- -	1.0	U	- -	- -	- -
3-Nitroaniline	µg/L	SW8270D					5.0	U	5.0	U	5.0	U	- -	5.0	U	- -	- -	- -
Acenaphthene	µg/L	SW8270D				960	1.0	U	1.0	U	1.0	U	- -	1.0	U	- -	- -	- -
2,4-Dinitrophenol	µg/L	SW8270D				32	10	U	10	U	10	U	- -	10	U	- -	- -	- -
4-Nitrophenol	µg/L	SW8270D					5.0	U	5.0	U	5.0	U	- -	5.0	U	- -	- -	- -
Dibenzofuran	µg/L	SW8270D				32	1.0	U	1.0	U	1.0	U	- -	1.0	U	- -	- -	- -
2,6-Dinitrotoluene	µg/L	SW8270D				16	5.0	U	5.0	U	5.0	U	- -	5.0	U	- -	- -	- -
2,4-Dinitrotoluene	µg/L	SW8270D				32	5.0	U	5.0	U	5.0	U	- -	5.0	U	- -	- -	- -
Diethylphthalate	µg/L	SW8270D				13000	1.0	U	1.0	U	1.0	U	- -	1.0	U	- -	- -	- -
4-Chlorophenyl-phenylether	µg/L	SW8270D					1.0	U	1.0	U	1.0	U	- -	1.0	U	- -	- -	- -
Fluorene	µg/L	SW8270D				640	1.0	U	1.0	U	1.0	U	- -	1.0	U	- -	- -	- -
4-Nitroaniline	µg/L	SW8270D					5.0	U	5.0	U	5.0	U	- -	5.0	U	- -	- -	- -
4,6-Dinitro-2-Methylphenol	µg/L	SW8270D					10	U	10	U	10	U	- -	10	U	- -	- -	- -
N-Nitrosodiphenylamine	µg/L	SW8270D			29000		**1.6**		**1.5**		1.0	U	- -	1.0	U	- -	- -	- -
4-Bromophenyl-phenylether	µg/L	SW8270D					1.0	U	1.0	U	1.0	U	- -	1.0	U	- -	- -	- -
Hexachlorobenzene	µg/L	SW8270D	1		0.055	13	1.0	U	1.0	U	1.0	U	- -	1.0	U	- -	- -	- -
Pentachlorophenol	µg/L	SW8270D	1		0.73	480	5.0	U	5.0	U	5.0	U	- -	5.0	U	- -	- -	- -
Phenanthrene	µg/L	SW8270D					1.0	U	1.0	U	1.0	U	- -	1.0	U	- -	- -	- -
Carbazole	µg/L	SW8270D			4.4		1.0	U	1.0	U	1.0	U	- -	1.0	U	- -	- -	- -
Anthracene	µg/L	SW8270D				4800	1.0	U	1.0	U	1.0	U	- -	1.0	U	- -	- -	- -
Di-n-Butylphthalate	µg/L	SW8270D					1.0	U	1.0	U	1.0	U	- -	1.0	U	- -	- -	- -
Fluoranthene	µg/L	SW8270D				640	1.0	U	1.0	U	1.0	U	- -	1.0	U	- -	- -	- -
Pyrene	µg/L	SW8270D				480	1.0	U	1.0	U	1.0	U	- -	1.0	U	- -	- -	- -
Butylbenzylphthalate	µg/L	SW8270D				3200	1.0	U	1.0	U	1.0	U	- -	1.0	U	- -	- -	- -
3,3'-Dichlorobenzidine	µg/L	SW8270D			0.19		5.0	U	5.0	U	5.0	U	- -	5.0	U	- -	- -	- -
Benzo(a)anthracene	µg/L	SW8270D			0.012		1.0	U	1.0	U	1.0	U	- -	1.0	U	- -	- -	- -
bis(2-Ethylhexyl)phthalate	µg/L	SW8270D	6		6.3	320	1.0	U	1.0	U	1.0	U	- -	**1.5**		- -	- -	- -
Chrysene	µg/L	SW8270D			0.012		1.0	U	1.0	U	1.0	U	- -	1.0	U	- -	- -	- -
Di-n-Octyl phthalate	µg/L	SW8270D				320	1.0	U	1.0	U	1.0	U	- -	1.0	U	- -	- -	- -
Benzo(b)fluoranthene	µg/L	SW8270D			0.012		1.0	U	1.0	U	1.0	U	- -	1.0	U	- -	- -	- -
Benzo(k)fluoranthene	µg/L	SW8270D			0.012		1.0	U	1.0	U	1.0	U	- -	1.0	U	- -	- -	- -
Benzo(a)pyrene	µg/L	SW8270D	0.2	0.1	0.012		1.0	U	1.0	U	1.0	U	- -	1.0	U	- -	- -	- -
Indeno(1,2,3-cd)pyrene	µg/L	SW8270D			0.012		1.0	U	1.0	U	1.0	U	- -	1.0	U	- -	- -	- -
Dibenz(a,h)anthracene	µg/L	SW8270D				32	1.0	U	1.0	U	1.0	U	- -	1.0	U	- -	- -	- -
Benzo(g,h,i)perylene	µg/L	SW8270D					1.0	U	1.0	U	1.0	U	- -	1.0	U	- -	- -	- -
1-Methylnaphthalene	µg/L	SW8270D					1.0	U	1.0	U	1.0	U	- -	1.0	U	- -	- -	- -

NOTES:		
	J =	Approximate Value
	** =	Secondary MCL
	*** =	Chromium Standards based on Chromium VI
	*TH =	Primary MCL for the sum of all trihalomethanes
	*XY =	Primary MCL for the sum of all xylenes
	Bold =	For volatiles and semivolatiles only, marks a detection
	▨ =	Exceeds one or more MTCA and/or MCL standards
	* =	Second set of vinyl chloride data sampled 8/13/08.
	**** =	Lab data and COC identify MW-8 field duplicate as MW-8A.

TABLE A-3
PREVIOUS GROUNDWATER INVESTIGATION DATA (2008-2012)
YAKIMA MILL SITE AND CLOSED CITY OF YAKIMA LANDFILL SITE
YAKIMA, WASHINGTON

Location: Date Collected:	MW-9A 3/25/2008	MW-9A 2/26/2009	MW-9A 11/4/2009	MW-9A 2/4/2010	MW-9A 5/10/2012	MW-11 2/26/2009	MW-11 11/4/2009	MW-11 2/4/2010	MW-11 5/10/2012
DISSOLVED METALS (µg/L) **EPA Methods 200.8/6010B**									
Arsenic	50 U	1 U	0.93 E	1.00	0.64	4.33	4.80	3.01	5.02
Barium	13	11.3	NA	NA	NA	51.4	NA	NA	NA
Cadmium	2 U	1 U	NA	NA	NA	1 U	NA	NA	NA
Calcium	29,400	26,600	23,800	26,800	NA	30,000	44,800	31,600	NA
Cobalt	NA	1 U	NA	NA	NA	1 U	NA	NA	NA
Copper	NA	1.14	NA	NA	NA	1 U	NA	NA	NA
Chromium	5 U	1 U	NA	NA	NA	1 U	NA	NA	NA
Iron	270	10 U	20 U	20 U	20 U	24,100	35,400	7,200	35,100
Lead	20 U	1 U	NA	NA	NA	1 U	NA	NA	NA
Magnesium	NA	8,570	8,020	8,920	NA	10,700	14,500	11,000	NA
Manganese	872	10 U	13.3	1 U	11.4	1,410	1,890	1,610	1,220
Nickel	NA	1.47	NA	NA	NA	1.62	NA	NA	NA
Potassium	4,400	3,680	NA	NA	NA	5,810	NA	NA	NA
Selenium	50 U	1 U	NA	NA	NA	1 U	NA	NA	NA
Sodium	15,700	10,900	11,100	14,400	11,500	15,300	17,300	20,100	18,000
Thallium	NA	1 U	NA	NA	NA	1 U	NA	NA	NA
Zinc	NA	1.25	NA	NA	NA	6.43	NA	NA	NA
VOLATILES (µg/L) **Method EPA 8260C**									
Vinyl Chloride	1 U	0.03 U	0.2 U	0.03 UJ	0.06 UE	0.03 U	0.2 U	0.03 UJ	0.06 UE
CONVENTIONALS									
pH (SU; EPA Method 150.1/field reading)	6.77	6.69	6.72	6.65	6.02	6.28	6.47	6.50	5.97
Alkalinity (mg CaCO3/L; EPA Method SM2320/310.1)	127	118	97.5	118	NA	216	202	196	NA
Carbonate (mg CaCO3/L; EPA Method SM2320/310.1)	NA	1 U	NA	NA	NA	1 U	NA	NA	NA
Bicarbonate (mg CaCO3/L; EPA Method SM2320/310.1)	NA	80.6	NA	NA	NA	99.1	NA	NA	NA
Bromide (mg/L; EPA Method 300.0)	NA	0.05	NA	NA	NA	0.11	NA	NA	NA
Chloride (mg/L; EPA Method 325.2/300.0)	15.6	15.2	10.9	13.1	NA	11.9	13.5	11.9	NA
Fluoride (mg/L; EPA Method 300.0)	NA	0.32	NA	NA	NA	0.31	NA	NA	NA
Nitrate (mg/L; EPA Method 300.0)	1.41	2.18	3.13	2.80	4.56	0.033	0.027	0.028	0.051
Nitrite (mg/L; EPA Method 353.2/300.0)	0.22	0.014	NA	NA	NA	0.011	NA	NA	NA
Soluble Reactive Phosphate (mg/L; EPA Method 300.0)	NA	0.12	NA	NA	NA	0.022	NA	NA	NA
Sulfate (mg/L; EPA Method 375.2/300.0)	17.9	7.9	10.7	12.7	NA	1 U	1.0 U	1.0 U	NA

TABLE 9
CUMULATIVE GROUNDWATER ANALYTICAL RESULTS (2014-2015)
CLOSED CITY OF YAKIMA LANDFILL SITE

Location:	Screening Levels (a)	Targeted ALS QLs (b)	MW-7	MW-7	MW-7	MW-7	MW-8	MW-8	MW-8	MW-8	MW-9A	MW-9A	MW-9A	MW-9A
Laboratory ID(S):			EV14090091-06 EV14090107-02	EV14120119-04 EV14120162-25	EV15030162-01	EV15060188-06	EV14090091-05 EV14090107-03	EV14120162-11	EV15030143-06	EV15060188-05	EV14090080-01 EV14090107-04	EV14120143-01 EV14120162-23	EV15030162-02	EV15060175-01
Sample Date:			9/16/2014	12/16/2014	3/26/2015	6/25/2015	9/16/2014	12/19/2014	3/25/2015	6/25/2015	9/15/2014	12/17/2014	3/26/2015	6/24/2015
TOTAL PETROLEUM HYDROCARBONS (µg/L)														
HCID														
Gas Range	--		130 U	130 U	130 U	130 U	130 U	130 U	130 U	130 U	130 U	130 U	130 U	130 U
Diesel Range	--		310 U	310 U	310 U	310 U	310 U	310 U	310 U	310 U	310 U	310 U	310 U	310 U
Oil Range	--		310 U	310 U	310 U	310 U	310 U	310 U	310 U	310 U	310 U	310 U	310 U	310 U
NWTPH-G (c)	1,000		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
NWTPH-Dx														
Diesel Range (w/SGC)	500		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Diesel Range (wo/SGC)	500		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Oil Range (w/SGC)	500		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Oil Range (wo/SGC)	500		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
DISSOLVED METALS (µg/L) Methods EPA-200.8/EPA-7470/EPA-7196														
Arsenic	0.45	0.45	**1.3**	**2.8**	**2.6**	**1.8**	**3.7**	**0.68**	**1.5**	**4.1**	**1.1**	**0.67**	0.45 U	**1.1**
Barium	1,000		**28**	**52**	**52**	**33**	**77**	**64**	**65**	**54**	**8.5**	**4.9**	**11**	**8.3**
Cadmium	5.0		1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Calcium	--		**23,000**	**37,000**	**34,000**	**29,000**	**31,000**	**38,000**	**43,000**	**33,000**	**21,000**	**14,000**	**27,000**	**23,000**
Chromium (d)	57		2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
Chromium (VI) (e)	10		10 U	NS	NS	NS	10 UJ	NS	NS	NS	10 U	NS	NS	NS
Iron	300		**6800**	**23,000**	**17,000**	**11,000**	**14,000**	**7700**	**5900**	**24,000**	50 U	50 U	50 U	50 U
Lead	0.54		1.0 U	0.28 U	0.28 U	0.28 U	1.0 U	0.28 U	0.28 U	0.28 U	1.0 U	0.28 U	0.28 U	0.28 U
Magnesium	--		**7900**	**13,000**	**12,000**	**10,000**	**13,000**	**17,000**	**19,000**	**13,000**	**6600**	**4600**	**9100**	**7600**
Manganese	50		**1600**	**1900**	**1400**	**1400**	**1900**	**2000**	**2200**	**1800**	2.0 U	2.0 U	2.0 U	2.0 U
Potassium	--		NS	NS	**8700**	**7800**	NS	NS	**20,000**	**8000**	NS	NS	**3600**	**3400**
Selenium	5.0		4.0 U	4.0 U	4.0 U	4.0 U	4.0 U	4.0 U	4.0 U	4.0 U	4.0 U	4.0 U	4.0 U	4.0 U
Silver	0.32		1.0 U	0.20 U	0.20 U	0.20 U	1.0 U	0.20 U	0.20 U	0.20 U	1.0 U	0.20 U	0.20 U	0.20 U
Sodium	20,000		**13,000**	**19,000**	**18,000**	**14,000**	**25,000**	**28,000**	**30,000**	**20,000**	**11,000**	**9400**	**14,000**	**13,000**
Mercury	0.11	0.11	0.20 U	0.11 U	0.11 U	0.11 U	0.20 U	0.11 U	0.11 U	0.11 U	0.20 U	0.11 U	0.11 U	0.11 U
TOTAL METALS (µg/L) Methods EPA-200.8/EPA-7470/EPA-7196														
Arsenic	0.45	0.45	**1.7**	**2.6**	**2.0**	**1.4**	**4.8**	**1.2**	**1.6**	**3.3**	1.0 U	**0.97**	0.45 U	0.86 U
Barium	1,000		**30**	**49**	**52**	**34**	**98**	**65**	**63**	**54**	**8.5**	**5.1**	**10**	**8.1**
Cadmium	5.0		1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Calcium	--		**23,000**	**37,000**	**33,000**	**29,000**	**32,000**	**39,000**	**42,000**	**33,000**	**20,000**	**14,000**	**26,000**	**22,000**
Chromium (d)	57		2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
Chromium (VI) (e)	10		10 U	NS	NS	NS	10 UJ	NS	NS	NS	10 U	NS	NS	NS
Iron	300		**7100**	**22,000**	**17,000**	**11,000**	**17,000**	**6300**	**5200**	**23,000**	50 U	50 U	50 U	50 U
Lead	0.54		1.0 U	0.28 U	0.28 U	0.28 U	**2.1**	0.28 U	0.28 U	0.28 U	1.0 U	0.28 U	0.28 U	0.32 U
Magnesium	--		**8000**	**13,000**	**12,000**	**10,000**	**14,000**	**18,000**	**19,000**	**13,000**	**6600**	**4400**	**8800**	**6700**
Manganese	50		**1700**	**2000**	**1400**	**1300**	**2000**	**2000**	**2200**	**1800**	2.0 U	2.0 U	2.0 U	2.0 U
Potassium	--		NS	NS	**8500**	**7900**	NS	NS	**20,000**	**7700**	NS	NS	**3400**	**3100**
Selenium	5.0		4.0 U	4.0 U	4.0 U	4.0 U	4.0 U	4.0 U	4.0 U	4.0 U	4.0 U	4.0 U	4.0 U	4.0 U
Silver	0.32		1.0 U	0.20 U	0.20 U	0.20 U	1.0 U	0.20 U	0.20 U	0.20 U	1.0 U	0.20 U	0.20 U	0.20 U
Sodium	20,000		**13,000**	**19,000**	**18,000**	**15,000**	**26,000**	**28,000**	**30,000**	**20,000**	**11,000**	**9000**	**13,000**	**11,000**
Mercury	0.11	0.11	0.20 U	0.11 U	0.11 U	0.11 U	0.20 U	0.11 U	0.11 U	0.11 U	0.20 U	0.11 U	0.11 U	0.11 U
CONVENTIONALS (mg/L)														
Total Dissolved Solids (SM2540C)	--		**130**	**240**	**210**	**170**	**230**	**300**	**290**	**240**	**170** J	**100**	**180**	**140**
Chloride (EPA-300.0)	230		**12**	**19**	**17**	**14**	**18**	**21**	**24**	**16**	**8.8**	**6.0**	**12**	**12**
Fluoride (EPA-300.0)	0.64		**0.25**	**0.39**	0.16 U	0.16 U	**0.23**	**0.26**	**0.19**	0.16 U	**0.41**	**0.32**	0.16 U	0.16 U
Nitrate as N (EPA-300.0)	10		**0.39**	**0.35**	**4.1**	**0.061**	0.034 U	**0.44**	**27**	**0.047**	**3.3**	**0.53**	**2.0**	**4.0**
Nitrite as N (EPA-300.0)	1.0		0.043 U	0.043 U	0.043 U	0.043 U	0.043 U	0.043	0.043 U	0.043 U	0.043 U	0.043 U	0.043 U	0.043 U
Sulfate (EPA-300.0)	--		**1.8**	0.26 U	**0.67**	**1.1**	**0.41**	**0.82**	**1.2**	0.26 U	**10**	**6.4**	**11**	**12**
Ammonia (EPA-350.1)	--		**2.8**	**5.0**	**4.1** J	**2.9**	**8.4**	**8.9**	**11**	**4.4**	**0.060**	0.050 U	0.050 U	0.050 U
Alkalinity as CaCO3, Total (SM2320B)	--		**140**	**220**	**170**	**170**	**250**	**260**	**260**	**200**	**88**	**67**	**110**	**85**
Bicarbonate as CaCO3 (SM2320B)	--		**140**	**220**	**170**	**170**	**250**	**260**	**260**	**200**	**88**	**67**	**110**	**85**
Total Organic Carbon (TOC) (SM5310C)	--		**3.2**	**4.2**	**4.1**	**3.8**	**8.0**	**4.5**	**3.8**	**4.3**	**1.6**	**1.0**	**0.83**	**1.3**

TABLE 9
CUMULATIVE GROUNDWATER ANALYTICAL RESULTS (2014-2015)
CLOSED CITY OF YAKIMA LANDFILL SITE

Location:			MW-7	MW-7	MW-7	MW-7	MW-8	MW-8	MW-8	MW-8	MW-9A	MW-9A	MW-9A	MW-9A
Laboratory ID(S):		Targeted ALS	EV14090091-06 EV14090107-02	EV14120119-04 EV14120162-25	EV15030162-01	EV15060188-06	EV14090091-05 EV14090107-03	EV14120162-11	EV15030143-06	EV15060188-05	EV14090080-01 EV14090107-04	EV14120143-01 EV14120162-23	EV15030162-02	EV15060175-01
Sample Date:	Screening Levels (a)	QLs (b)	9/16/2014	12/16/2014	3/26/2015	6/25/2015	9/16/2014	12/19/2014	3/25/2015	6/25/2015	9/15/2014	12/17/2014	3/26/2015	6/24/2015
FIELD PARAMETERS														
Temperature (°C)	--		18.02	14.20	15.41	19.17	17.93	15.88	14.45	17.3	16.96	15.26	14.97	16.53
Specific Conductivity (uS/cm)	--		224	366	520	554	495	698	734	449	248	131	332	199
Dissolved Oxygen (mg/L)	--		1.40	1.78	0.54	0.49	0.50	0.34	0.10	0.14	6.20	4.60	3.15	8.85
pH (S.U.)	6.5 to 8.5		5.84	6.39	6.20	6.14	5.95	7 (f)	6.46	6.51	9.76	9.10	6.40	6.46
Oxidation Reduction Potential (mV)	--		29.2	-44.1	-34.2	5.2	-64.6	-13.0	-76.9	-109.8	-259.3	39.7	-8.9	74.9
Turbidity (NTU)	--		13.3	4.07	3.05	1.03	45.6	2.46	1.69	4.77	7.15	0.49	1.18	0.40
PESTICIDES (µg/L) **Method EPA-8081**														
hexachlorocyclohexane, alpha (A-BHC)	0.01	0.01	0.011 U	0.011 U	0.010 U	0.010 U	0.011 U	0.011 U	0.011 U	0.010 U	0.01 U	0.010 U	0.011 U	0.010 U
G-BHC (Lindane)	0.019	0.01	0.011 U	0.011 U	0.010 U	0.010 U	0.011 U	0.011 U	0.011 U	0.010 U	0.01 U	0.010 U	0.011 U	0.010 U
hexachlorocyclohexane; beta (B-BHC)	0.01	0.01	0.011 U	0.011 U	0.010 U	0.010 U	0.011 U	0.011 U	0.011 U	0.010 U	0.01 U	0.010 U	0.011 U	0.010 U
Heptachlor	0.01	0.01	0.011 U	0.011 U	0.010 U	0.010 U	0.011 U	0.011 U	0.011 U	0.010 U	0.01 U	0.010 U	0.011 U	0.010 U
hexachlorocyclohexane, delta (D-BHC)	0.012	0.01	0.011 U	0.011 U	0.010 U	0.010 U	0.011 U	0.011 U	0.011 U	0.010 U	0.01 U	0.010 U	0.011 U	0.010 U
Aldrin	0.01	0.01	0.011 U	0.011 U	0.010 U	0.010 U	0.011 U	0.011 U	0.011 U	0.010 U	0.01 U	0.010 U	0.011 U	0.010 U
Heptachlor Epoxide	0.01	0.01	0.011 U	0.011 U	0.010 U	0.010 U	0.011 U	0.011 U	0.011 U	0.010 U	0.01 U	0.010 U	0.011 U	0.010 U
Chlordane	0.20	0.20	0.011 U	0.011 U	0.010 U	0.010 U	0.011 U	0.011 U	0.011 U	0.010 U	0.01 U	0.010 U	0.011 U	0.010 U
Endosulfan I (g)	0.056		0.011 U	0.011 U	0.010 U	0.010 U	0.011 U	0.011 U	0.011 U	0.010 U	0.01 U	0.010 U	0.011 U	0.010 U
4,4'-DDE	0.01	0.01	0.011 U	0.011 U	0.010 U	0.010 U	0.011 U	0.011 U	0.011 U	0.010 U	0.01 U	0.010 U	0.011 U	0.010 U
Dieldrin	0.01	0.01	0.011 U	0.011 U	0.010 U	0.010 U	0.011 U	0.011 U	0.011 U	0.010 U	0.01 U	0.010 U	0.011 U	0.010 U
Endrin	0.01	0.01	0.011 U	0.011 U	0.010 U	0.010 U	0.011 U	0.011 U	0.011 U	0.010 U	0.01 U	0.010 U	0.011 U	0.010 U
4,4'-DDD	0.01	0.01	0.011 U	0.011 U	0.010 U	0.010 U	0.011 U	0.011 U	0.011 U	0.010 U	0.01 U	0.010 U	0.011 U	0.010 U
Endosulfan II (g)	0.056		0.011 U	0.011 U	0.010 U	0.010 U	0.011 U	0.011 U	0.011 U	0.010 U	0.01 U	0.010 U	**0.012**	0.010 U
4,4'-DDT	0.01	0.01	0.011 U	0.011 U	0.010 U	0.010 U	0.011 U	0.011 U	0.011 U	0.010 U	0.01 U	0.010 U	0.011 U	0.010 U
Endrin Aldehyde (h)	0.01	0.01	0.011 U	0.011 U	0.010 U	0.010 U	0.011 U	0.011 U	0.011 U	0.010 U	0.01 U	0.010 U	0.011 U	0.010 U
Endosulfan Sulfate (g)	0.056		0.011 U	0.011 U	0.010 U	0.010 U	0.011 U	0.011 U	0.011 U	0.010 U	0.01 U	0.010 U	0.011 U	0.010 U
Methoxychlor	0.030	0.01	0.011 U	0.011 U	0.010 U	0.010 U	0.011 U	0.011 U	0.011 U	0.010 U	0.01 U	0.010 U	0.011 U	0.010 U
Hexachlorobenzene (i)	0.01	0.01	2.0 U	0.011 U	0.010 U	0.010 U	2.0 U	0.011 U	0.011 U	0.010 U	2.0 U	0.010 U	0.011 U	0.010 U
Toxaphene	0.50	0.50	0.52 U	0.52 U	0.50 U	0.50 U	0.51 U	0.53 U	0.52 U	0.50 U	0.50 U	0.50 U	0.51 U	0.50 U
PCBs (µg/L) **Method EPA-8082**														
PCB-1016	0.005	0.005	0.0052 U	0.0052 U	0.0050 U	0.0050 U	0.022 U	0.0053 U	0.0052 U	0.0050 U	0.0050 U	0.0050 U	0.0051 U	0.0050 U
PCB-1221	--		0.011 U	0.011 U	0.010 U	0.010 U	0.017 U	0.011 U	0.023 U	0.010 U	0.01 U	0.010 U	0.011 U	0.014 U
PCB-1232	--		0.0052 U	0.0052 U	0.0050 U	**0.0097**	0.047 U	0.0053 U	0.026 U	0.0050 U	0.0050 U	0.0050 U	0.0051 U	0.0050 U
PCB-1242	--		0.0052 U	**0.040**	**0.026**	0.0050 U	0.028 U	**0.010**	0.011 U	0.0050 U	0.0050 U	0.0050 U	0.0051 U	0.0050 U
PCB-1248	--		0.0052 U	0.0052 U	0.0050 U	0.0050 U	0.012 U	0.0053 U	0.0064 U	**0.020**	0.0050 U	0.0050 U	0.0051 U	0.0050 U
PCB-1254	0.005	0.005	0.0052 U	0.0052 U	0.0050 U	0.0050 U	0.017 U	0.0053 U	0.0052 U	0.0050 U	0.0050 U	0.0050 U	0.0051 U	0.0050 U
PCB-1260	0.014	0.005	0.0052 U	0.0052 U	0.0050 U	0.0050 U	0.0051 U	0.0053 U	0.0052 U	0.0050 U	0.0050 U	0.0050 U	0.0051 U	0.0050 U
Total PCBs (j)	0.10		ND	**0.040**	**0.026**	**0.0097**	ND	**0.010**	ND	**0.020**	ND	ND	ND	ND
VOCs (µg/L) **Method EPA-8260**														
Dichlorodifluoromethane	1,600		2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
Chloromethane	--		2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
Bromomethane	11		2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
Chloroethane	--		2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
Trichlorofluoromethane	2,400		2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
Carbon Disulfide	800		2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
Acetone	7,200		25 U	25 U	25 U	25 U	25 U	25 U	25 U	25 U	25 U	25 U	25 U	25 U
1,1-Dichloroethene	0.057	0.014	2.0 U	0.014 U	0.014 U	0.014 U	2.0 U	0.014 U	0.014 U	0.014 U	2.0 U	0.014 U	0.014 U	0.014 U
Methylene Chloride	4.6	0.68	5.0 U	0.68 U	0.68 U	0.68 U	5.0 U	0.68 U	0.68 U	0.68 U	5.0 U	0.68 U	0.68 U	0.68 U
Acrylonitrile	0.0572	0.0572	10 U	0.057 U	0.057 U	0.057 U	10 U	0.057 U	0.057 U	0.057 U	10 U	0.057 U	0.057 U	0.057 U
Methyl T-Butyl Ether (MTBE)	20		2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
Trans-1,2-Dichloroethene	100		2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
1,1-Dichloroethane	7.7		2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
2-Butanone (MEK)	4,800		10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U

TABLE 9
CUMULATIVE GROUNDWATER ANALYTICAL RESULTS (2014-2015)
CLOSED CITY OF YAKIMA LANDFILL SITE

Location:			MW-7	MW-7	MW-7	MW-7	MW-8	MW-8	MW-8	MW-8	MW-9A	MW-9A	MW-9A	MW-9A
Laboratory ID(S):			EV14090091-06 EV14090107-02	EV14120119-04 EV14120162-25	EV15030162-01	EV15060188-06	EV14090091-05 EV14090107-03	EV14120162-11	EV15030143-06	EV15060188-05	EV14090080-01 EV14090107-04	EV14120143-01 EV14120162-23	EV15030162-02	EV15060175-01
Sample Date:	Screening Levels (a)	Targeted ALS QLs (b)	9/16/2014	12/16/2014	3/26/2015	6/25/2015	9/16/2014	12/19/2014	3/25/2015	6/25/2015	9/15/2014	12/17/2014	3/26/2015	6/24/2015
Cis-1,2-Dichloroethene	16		2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
Hexane (k)	480		NA	2.0 U	NA	2.0 U	NA	2.0 U	NA	2.0 U	NA	2.0 U	NA	2.0 U
2,2-Dichloropropane	--		2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
Bromochloromethane	--		2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
1,1,1-Trichloroethane	200		2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
1,1-Dichloropropene	--		2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
1,2-Dichloroethane	0.38	0.014	2.0 U	0.014 U	0.014 U	0.014 U	2.0 U	0.014 U	0.014 U	0.014 U	2.0 U	0.014 U	0.014 U	0.014 U
Benzene	1.2	0.028	2.0 U	0.028 U	0.028 U	0.028 U	2.0 U	0.028 U	0.028 U	0.028 U	2.0 U	0.028 U	0.028 U	0.028 U
Dibromomethane	--		2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
Bromodichloromethane	0.080	0.059	0.059 U	0.059 U	0.059 U	0.059 U	0.059 U	0.059 U	0.059 U	0.059 U	0.059 U	0.059 U	0.059 U	0.059 U
4-Methyl-2-Pentanone (MIBK)	640		10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Toluene	640		2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
Cis-1,3-Dichloropropene	--		2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
2-Hexanone	--		10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
1,3-Dichloropropane	--		2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
Tetrachloroethene (PCE)	0.69	0.023	2.0 U	0.023 U	0.023 U	0.023 U	2.0 U	0.023 U	0.023 U	0.023 U	2.0 U	0.023 U	0.023 U	0.023 U
1,2-Dibromoethane (EDB)	0.01		0.01 U	0.010 U	0.010 U	0.010 U	0.01 U	0.010 U	0.010 U	0.010 U	0.01 U	0.010 U	0.010 U	0.010 U
Chlorobenzene	100		2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
Ethylbenzene	70		2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
m,p-Xylene (l)	1,600		4.0 U	4.0 U	4.0 U	4.0 U	4.0 U	4.0 U	4.0 U	4.0 U	4.0 U	4.0 U	4.0 U	4.0 U
Styrene	100		2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
o-Xylene	1,600		2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
Bromoform	4.3		2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
Isopropylbenzene (cumene)	800		2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
1,2,3-Trichloropropane	0.023	0.023	0.023 U	0.023 U	0.023 U	0.023 U	0.023 U	0.023 U	0.023 U	0.023 U	0.023 U	0.023 U	0.023 U	0.023 U
Bromobenzene	--		2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
N-Propyl Benzene	800		2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
2-Chlorotoluene	--		2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
1,3,5-Trimethylbenzene	80		2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
4-Chlorotoluene	--		2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
T-Butyl Benzene	800		2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
1,2,4-Trimethylbenzene	--		2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
S-Butyl Benzene	800		2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
P-Isopropyltoluene	--		2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
1,3 Dichlorobenzene	320		2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
1,4-Dichlorobenzene	8.1		2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
N-Butylbenzene	--		2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
1,2-Dichlorobenzene	420		2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
1,2-Dibromo 3-Chloropropane	0.0997	0.0997	10 U	0.10 U	0.10 U	0.10 U	10 U	0.10 U	0.10 U	0.10 U	10 U	0.10 U	0.10 U	0.10 U
Hexachlorobutadiene	0.44		2.0 U	0.069 U	0.069 U	0.069 U	2.0 U	0.069 U	0.069 U	0.069 U	2.0 U	0.069 U	0.069 U	0.069 U
1,2,3-Trichlorobenzene	--		2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
VOCs (µg/L) **Method EPA-8260SIM (m)**														
Vinyl Chloride	0.031	0.031	0.20 U	0.031 U	0.031 U	0.031 U	0.20 U	0.031 U	0.031 U	0.031 U	0.20 U	0.031 U	0.031 U	0.031 U
Carbon Tetrachloride	0.23		0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U
Chloroform	1.4		0.10 U	0.14 U	0.14 U	0.14 U	0.10 U	0.14 U	0.14 U	0.14 U	**1.7**	**22**	**2.5**	0.14 U
Trichloroethene (TCE)	2.5		0.020 U	0.054 U	0.054 U	0.054 U	0.020 U	0.054 U	0.054 U	0.054 U	0.020 U	0.054 U	0.054 U	0.054 U
1,2-Dichloropropane	0.50		0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U
Trans-1,3-Dichloropropene	0.34		2.0 U	0.058 U	0.058 U	0.058 U	2.0 U	0.058 U	0.058 U	0.058 U	2.0 U	0.058 U	0.058 U	0.058 U
1,1,2-Trichloroethane	0.59		0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U
Dibromochloromethane	0.40		0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U
1,1,1,2-Tetrachloroethane	1.7		0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U
1,1,2,2-Tetrachloroethane	0.17		0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U
1,2,4-Trichlorobenzene	1.5		**0.17**	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U

TABLE 9
CUMULATIVE GROUNDWATER ANALYTICAL RESULTS (2014-2015)
CLOSED CITY OF YAKIMA LANDFILL SITE

Location:			MW-7	MW-7	MW-7	MW-7	MW-8	MW-8	MW-8	MW-8	MW-9A	MW-9A	MW-9A	MW-9A
Laboratory ID(S):			EV14090091-06 EV14090107-02	EV14120119-04 EV14120162-25	EV15030162-01	EV15060188-06	EV14090091-05 EV14090107-03	EV14120162-11	EV15030143-06	EV15060188-05	EV14090080-01 EV14090107-04	EV14120143-01 EV14120162-23	EV15030162-02	EV15060175-01
Sample Date:	Screening Levels (a)	Targeted ALS QLs (b)	9/16/2014	12/16/2014	3/26/2015	6/25/2015	9/16/2014	12/19/2014	3/25/2015	6/25/2015	9/15/2014	12/17/2014	3/26/2015	6/24/2015
SVOCs (µg/L) **Method EPA-8270**														
Pyridine	8.0		2.0 U	2.0 U	2.0 U	2.0 UJ	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
N-Nitrosodimethylamine	1.51	1.51	1.5 U	1.4 U	1.5 U	1.4 UJ	1.5 U	1.4 U	1.4 U	1.4 U	1.5 U	1.4 U	1.5 U	1.4 U
Phenol	2,400		2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
Aniline	7.7		2.0 U	2.0 U	2.0 U	2.0 UJ	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
Bis(2-Chloroethyl)Ether	0.94	0.94	0.94 U	0.87 U	0.94 U	0.88 UJ	0.94 U	0.87 U	0.87 U	0.88 U	0.94 U	0.87 U	0.94 U	0.87 U
2-Chlorophenol	40		2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
Benzyl Alcohol	800		2.0 U	2.0 U	2.0 U	2.0 UJ	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
2-Methylphenol	400		2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
Bis(2-Chloroisopropyl)Ether	1,400		2.0 U	2.0 U	2.0 U	2.0 UJ	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
3&4-Methylphenol (n)	400		2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
N-Nitroso-Di-N-Propylamine	2.0	2.0	2.0 U	1.9 U	2.0 U	1.9 UJ	2.0 U	1.9 U	1.9 U	1.9 U	2.0 U	1.9 U	2.0 U	1.9 U
Hexachloroethane	2.0	2.0	2.0 U	1.9 U	2.0 U	1.9 UJ	2.0 U	1.9 U	1.9 U	1.9 U	2.0 U	1.9 U	2.0 U	1.9 U
Nitrobenzene	16		2.0 U	2.0 U	2.0 U	2.0 UJ	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
Isophorone	8.4		2.0 U	2.0 U	2.0 U	2.0 UJ	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
2-Nitrophenol	--		2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
2,4-Dimethylphenol	160		2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
Benzoic Acid	64,000		10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Bis(2-Chloroethoxy)Methane	--		2.0 U	2.0 U	2.0 U	2.0 UJ	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
2,4-Dichlorophenol	24		2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
4-Chloroaniline (p-Chloroaniline)	1.89	1.89	2.0 U	1.8 U	1.9 U	1.8 UJ	2.0 U	1.8 U	1.8 U	1.8 U	2.0 U	1.8 U	1.9 U	1.8 U
2,6-Dichlorophenol	--		2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
4-Chloro-3-Methylphenol	--		2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
Hexachlorocyclopentadiene	40		2.0 U	2.0 U	2.0 U	2.0 UJ	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
2,4,6-Trichlorophenol	1.4	0.90	2.0 U	0.83 U	0.90 U	0.84 U	2.0 U	0.83 U	0.83 U	0.84 U	2.0 U	0.83 U	0.90 U	0.83 U
2,4,5-Trichlorophenol	800		2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
2-Chloronaphthalene	--		2.0 U	2.0 U	2.0 U	2.0 UJ	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
2-Nitroaniline	160		2.0 U	2.0 U	2.0 U	2.0 UJ	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
Dimethylphthalate	270,000		2.0 U	2.0 U	2.0 U	2.0 UJ	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
2,6-Dinitrotoluene	1.82	1.82	1.8 U	1.7 U	1.8 U	1.7 UJ	1.8 U	1.7 U	1.7 U	1.7 U	1.8 U	1.7 U	1.8 U	1.7 U
3-Nitroaniline	--		5.0 U	5.0 U	5.0 U	5.0 UJ	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
2,4-Dinitrophenol	32		10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
4-Nitrophenol	--		2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
Dibenzofuran	16		2.0 U	2.0 U	2.0 U	2.0 UJ	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
2,4-Dinitrotoluene	0.78	0.78	0.78 U	0.72 U	0.78 U	0.73 UJ	0.78 U	0.72 U	0.72 U	0.73 U	0.78 U	0.72 U	0.78 U	0.72 U
2,3,4,6-Tetrachlorophenol	480		2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
Diethylphthalate	13,000		2.0 U	2.0 U	2.0 U	2.0 UJ	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
4-Chlorophenyl-Phenylether	--		2.0 U	2.0 U	2.0 U	2.0 UJ	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
4-Nitroaniline	--		2.0 U	2.0 U	2.0 U	2.0 UJ	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
4,6-Dinitro-2-Methylphenol	--		2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
N-Nitrosodiphenylamine	3.3		2.0 U	2.0 U	2.0 U	2.0 UJ	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
Azobenzene	1.63	1.63	2.0 U	1.5 U	1.6 U	1.5 UJ	2.0 U	1.5 U	1.5 U	1.5 U	2.0 U	1.5 U	1.6 U	1.5 U
4-Bromophenyl-Phenylether	--		2.0 U	2.0 U	2.0 U	2.0 UJ	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
Carbazole	--		2.0 U	2.0 U	2.0 U	2.0 UJ	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
Di-N-Butylphthalate	1,600		2.0 U	2.0 U	2.0 U	2.0 UJ	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
Butylbenzylphthalate	8.3		2.0 U	2.0 U	2.0 U	2.0 UJ	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
3,3'-Dichlorobenzidine	2.0	2.0	2.0 U	1.9 U	2.0 U	1.9 UJ	2.0 U	1.9 U	1.9 U	1.9 U	2.0 U	1.9 U	2.0 U	1.9 U
Bis(2-Ethylhexyl)Phthalate	1.2	0.81	2.0 U	0.75 U	0.81 U	0.75 UJ	**10**	**49**	0.75 U	0.75 U	2.0 U	0.75 U	0.81 U	0.75 U
Di-N-Octylphthalate	160		2.0 U	2.0 U	2.0 U	2.0 UJ	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U

TABLE 9
CUMULATIVE GROUNDWATER ANALYTICAL RESULTS (2014-2015)
CLOSED CITY OF YAKIMA LANDFILL SITE

Location:	Screening Levels (a)	Targeted ALS QLs (b)	MW-7	MW-7	MW-7	MW-7	MW-8	MW-8	MW-8	MW-8	MW-9A	MW-9A	MW-9A	MW-9A
Laboratory ID(S):			EV14090091-06 EV14090107-02	EV14120119-04 EV14120162-25	EV15030162-01	EV15060188-06	EV14090091-05 EV14090107-03	EV14120162-11	EV15030143-06	EV15060188-05	EV14090080-01 EV14090107-04	EV14120143-01 EV14120162-23	EV15030162-02	EV15060175-01
Sample Date:			9/16/2014	12/16/2014	3/26/2015	6/25/2015	9/16/2014	12/19/2014	3/25/2015	6/25/2015	9/15/2014	12/17/2014	3/26/2015	6/24/2015
PAHs (µg/L) **Method EPA-8270 SIM**														
Naphthalene	160		0.020 U	0.013 U	0.013 U	0.013 U	0.020 U	0.013 U	0.013 U	0.013 U	0.020 U	0.013 U	0.013 U	0.013 U
2-Methylnaphthalene	32		0.020 U	0.020 U	0.02 U	0.020 U	0.020 U	0.020 U	0.02 U	0.020 U	0.020 U	0.020 U	0.02 U	0.020 U
1-Methylnaphthalene	1.5		0.020 U	0.020 U	0.02 U	0.020 U	0.020 U	0.020 U	0.02 U	0.020 U	0.020 U	0.020 U	0.02 U	0.020 U
Acenaphthylene	--		0.020 U	0.020 U	0.02 U	0.020 U	0.020 U	0.020 U	0.02 U	0.020 U	0.020 U	0.020 U	0.02 U	0.020 U
Acenaphthene	650		0.020 U	0.014 U	0.014 U	0.014 U	0.020 U	0.014 U	0.014 U	0.014 U	0.020 U	0.014 U	0.014 U	0.014 U
Fluorene	640		0.020 U	0.0090 U	0.0090 U	0.0091 U	0.020 U	0.0090 U	**0.0096**	0.0091 U	0.020 U	**0.0092**	0.0090 U	0.0090 U
Pentachlorophenol	0.23	0.23	0.13 U	0.12 U	0.12 U	0.12 U	0.13 U	0.12 U	0.12 U	0.12 U	0.13 U	0.12 U	0.12 U	0.12 U
Phenanthrene	--		0.020 U	0.013 U	**0.015**	0.013 U	0.020 U	0.013 U	0.013 U	0.013 U	0.020 U	0.013 U	0.013 U	0.013 U
Anthracene	4,800		0.020 U	0.01 U	**0.017**	0.01 U	0.020 U	0.01 U	0.01 U	0.01 U	0.020 U	0.01 U	0.01 U	0.01 U
Fluoranthene	86		0.020 U	0.0092 U	0.0092 U	0.0092 U	0.020 U	0.0092 U	0.0092 U	0.0092 U	0.020 U	0.0092 U	0.0092 U	0.0092 U
Pyrene	480		0.020 U	**0.011**	0.01 U	0.011 U	0.020 U	0.01 U	0.01 U	0.011 U	0.020 U	0.01 U	0.01 U	0.01 U
Benzo[A]Anthracene	0.00940	0.00940	0.020 U	0.017 U	0.017 U	0.017 U	0.020 U	0.017 U	0.017 U	0.017 U	0.020 U	0.017 U	0.017 U	0.017 U
Chrysene	0.00940	0.00940	0.020 U	0.018 U	0.018 U	0.018 U	0.020 U	0.018 U	0.018 U	0.018 U	0.020 U	0.018 U	0.018 U	0.018 U
Benzo[B]Fluoranthene	0.00730	0.00730	0.020 U	0.0068 U	0.0068 U	0.0068 U	0.020 U	0.0068 U	0.0068 U	0.0068 U	0.020 U	0.0068 U	0.0068 U	0.0068 U
Benzo[K]Fluoranthene	0.0237	0.0237	0.020 U	0.013 U	0.013 U	0.013 U	0.020 U	0.013 U	0.013 U	0.013 U	0.020 U	0.013 U	0.013 U	0.013 U
Benzo[A]Pyrene	0.0104	0.0104	0.029 U	0.027 U	0.027 U	0.027 U	0.029 U	0.027 U	0.027 U	0.027 U	0.029 U	0.027 U	0.027 U	0.027 U
Indeno[1,2,3-Cd]Pyrene	0.0164	0.0164	0.020 U	0.014 U	0.014 U	0.014 U	0.020 U	0.014 U	0.014 U	0.014 U	0.020 U	0.014 U	0.014 U	0.014 U
Dibenz[A,H]Anthracene	0.0127	0.0127	0.012 U	0.011 U	0.011 U	0.011 U	0.012 U	0.011 U	0.011 U	0.011 U	0.012 U	0.011 U	0.011 U	0.011 U
Benzo[G,H,I]Perylene	--		0.020 U	0.019 U	0.019 U	0.019 U	0.020 U	0.019 U	0.019 U	0.019 U	0.020 U	0.019 U	0.019 U	0.019 U
cPAH TEQ (o)	0.10		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND

TABLE 9
CUMULATIVE GROUNDWATER ANALYTICAL RESULTS (2014-2015)
CLOSED CITY OF YAKIMA LANDFILL SITE

Location:			MW-18	MW-18	MW-18	MW-18	MW-100	MW-100	MW-100	MW-100	MW-101	MW-101	MW-101	MW-101
Laboratory ID(S):			EV14090080-02 EV14090107-11	EV14120162-02	EV15030154-03	EV15060181-07	EV14090091-09 EV14090107-12	EV14120143-03 EV14120162-22	EV15030127-05	EV15060175-04	EV14090107-13	EV14120151-02 EV14120162-13	EV15030143-04	EV15060181-05
Sample Date:	Screening Levels (a)	Targeted ALS QLs (b)	9/15/2014	12/19/2014	3/26/2015	6/25/2015	9/16/2014	12/17/2014	3/23/2015	6/24/2015	9/17/2014	12/18/2014	3/25/2015	6/25/2015
TOTAL PETROLEUM HYDROCARBONS (µg/L)														
HCID														
Gas Range	--		130 U	130 U	130 U	130 U	130 U	130 U	130 U	130 U	130 U	130 U	NA	NA
Diesel Range	--		310 U	310 U	310 U	310 U	310 U	310 U	310 U	310 U	**>310**	310 U	NA	NA
Oil Range	--		310 U	310 U	310 U	310 U	310 U	310 U	310 U	310 U	**>310**	**>310** U	NA	NA
NWTPH-G (c)	1,000		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
NWTPH-Dx														
Diesel Range (w/SGC)	500		NA	NA	NA	NA	NA	NA	NA	NA	**520**	**140**	130 U	130 U
Diesel Range (wo/SGC)	500		NA	NA	NA	NA	NA	NA	NA	NA	**1800**	**450**	**350**	**450** J
Oil Range (w/SGC)	500		NA	NA	NA	NA	NA	NA	NA	NA	**360**	250 U	250 U	250 U
Oil Range (wo/SGC)	500		NA	NA	NA	NA	NA	NA	NA	NA	**1500**	**410**	250 U	**280**
DISSOLVED METALS (µg/L) Methods EPA-200.8/EPA-7470/EPA-7196														
Arsenic	0.45	0.45	**8.0**	**7.3**	**6.8**	**7.7**	1.0 U	0.45 U	**0.61**	**1.2**	**2.9**	**1.5**	**4.2**	**2.1**
Barium	1,000		**36**	**37**	**38**	**40**	**8.2**	**5.9**	**6.5**	**5.7**	**74**	**51**	**36**	**49**
Cadmium	5.0		1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Calcium	--		**47,000**	**42,000**	**44,000**	**51,000**	**22,000**	**28,000**	**32,000**	**27,000**	**65,000**	**48,000**	**38,000**	**41,000**
Chromium (d)	57		2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
Chromium (VI) (e)	10		10 U	NS	NS	NS	10 U	NS	NS	NS	10 U	NS	NS	NS
Iron	300		**41,000**	**37,000**	**38,000**	**44,000**	50 U	50 U	50 U	50 U	**19,000**	**23,000**	**21,000**	**16,000**
Lead	0.54		1.0 U	0.28 U	0.28 U	0.28 U	1.0 U	0.28 U	0.28 U	0.28 U	1.0 U	0.28 U	0.28 U	0.28 U
Magnesium	--		**19,000**	**16,000**	**17,000**	**21,000**	**9400**	**9000**	**9700**	**8300**	**20,000**	**15,000**	**13,000**	**12,000**
Manganese	50		**4400**	**3300**	**3400**	**4600**	**190**	**230**	**110**	**46**	**3000**	**2000**	**1600**	**1900**
Potassium	--		NS	NS	**3700**	**3300**	NS	NS	**3800**	**3400**	NS	NS	**5900**	**9100**
Selenium	5.0		4.0 U	4.0 U	4.0 U	4.0 U	4.0 U	4.0 U	4.0 U	4.0 U	4.0 U	4.0 U	4.0 U	4.0 U
Silver	0.32		1.0 U	0.20 U	0.20 U	0.20 U	1.0 U	0.20 U	0.20 U	0.20 U	1.0 U	0.20 U	0.20 U	0.20 U
Sodium	20,000		**14,000**	**15,000**	**15,000**	**14,000**	**20,000**	**11,000**	**12,000**	**10,000**	**29,000**	**22,000**	**20,000**	**19,000**
Mercury	0.11	0.11	0.20 U	0.11 U	0.20 U	0.11 U	0.20 U	0.11 U	0.11 U	0.11 U	0.20 U	0.11 U	0.11 U	0.11 U
TOTAL METALS (µg/L) Methods EPA-200.8/EPA-7470/EPA-7196														
Arsenic	0.45	0.45	**8.0**	**7.5**	**6.8**	**7.7**	1.0 U	**0.88**	**0.86**	0.76 U	**3.1**	**1.6**	**2.7**	2.5 U
Barium	1,000		**39**	**42**	**39**	**41**	**11**	**8.2**	**6.8**	**7.3**	**93**	**50**	**37**	**56**
Cadmium	5.0		1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Calcium	--		**50,000**	**46,000**	**45,000**	**53,000**	**22,000**	**29,000**	**33,000**	**25,000**	**71,000**	**47,000**	**39,000**	**44,000**
Chromium (d)	57		2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	**2.6**	2.0 U	2.0 U	2.0 U
Chromium (VI) (e)	10		10 U	NS	NS	NS	10 U	NS	NS	NS	10 U	NS	NS	NS
Iron	300		**44,000**	**40,000**	**39,000**	**46,000**	**400**	**260**	**110**	**100**	**23,000**	**22,000**	**21,000**	**17,000**
Lead	0.54		1.0 U	0.28 U	0.28 U	0.28 U	1.0 U	0.28 U	0.28 U	0.35 U	**1.5**	0.28 U	0.28 U	0.28 U
Magnesium	--		**20,000**	**17,000**	**17,000**	**22,000**	**9900**	**9000**	**9900**	**7400**	**22,000**	**15,000**	**14,000**	**13,000**
Manganese	50		**4700**	**3600**	**3500**	**4900**	**200**	**320**	**110**	**190**	**3200**	**2000**	**1700**	**1800**
Potassium	--		NS	NS	**3700**	**3300**	NS	NS	**3900**	**3200**	NS	NS	**6100**	**9700**
Selenium	5.0		4.0 U	4.0 U	4.0 U	4.0 U	4.0 U	4.0 U	4.0 U	4.0 U	4.0 U	4.0 U	4.0 U	4.0 U
Silver	0.32		1.0 U	0.20 U	0.20 U	0.20 U	1.0 U	0.20 U	0.20 U	0.20 U	1.0 U	0.20 U	0.20 U	0.20 U
Sodium	20,000		**15,000**	**15,000**	**15,000**	**15,000**	**21,000**	**11,000**	**12,000**	**9100**	**31,000**	**21,000**	**20,000**	**21,000**
Mercury	0.11	0.11	0.20 U	0.11 U	0.11 U	0.11 U	0.20 U	0.11 U	0.11 U	0.11 U	0.20 U	0.11 U	0.11 U	0.11 U
CONVENTIONALS (mg/L)														
Total Dissolved Solids (SM2540C)	--		**310** J	**250**	**260**	**310**	**230**	**150**	**180**	**180**	**430**	**260**	**260**	**270**
Chloride (EPA-300.0)	230		**19**	**18**	**19**	**16**	**12**	**10**	**11**	**9.7**	**20**	**12**	**11**	**10**
Fluoride (EPA-300.0)	0.64		**0.19**	0.16 U	0.16 U	0.16 U	**0.37**	**0.31**	0.16 U	0.16 U	**0.71**	**0.19**	**0.17**	**0.18**
Nitrate as N (EPA-300.0)	10		0.034 U	**0.047**	0.034 U	0.034 U	**1.1**	**1.3**	**1.2**	**3.2**	**3.5**	0.034 U	**0.045**	0.034 U
Nitrite as N (EPA-300.0)	1.0		0.043 U	0.043 U	0.043 U	0.043 U	**0.60**	0.043 U	0.043 U	0.043 U	0.043 U	0.043 U	0.043 U	0.043 U
Sulfate (EPA-300.0)	--		**0.36**	0.26 U	0.26 U	0.26 U	**14**	**12**	**10**	**17**	0.26 U	0.26 U	0.26 U	0.26 U
Ammonia (EPA-350.1)	--		**1.2**	**0.65**	**0.53**	**0.50**	**0.21**	**0.056**	0.050 U	0.050 U	**1.8**	**1.7**	**1.0**	**0.75**
Alkalinity as CaCO3, Total (SM2320B)	--		**260**	**220**	**210**	**260**	**130**	**120**	**120**	**98**	**360**	**230**	**190**	**210**
Bicarbonate as CaCO3 (SM2320B)	--		**260**	**220**	**210**	**260**	**130**	**120**	**120**	**98**	**360**	**230**	**190**	**210**
Total Organic Carbon (TOC) (SM5310C)	--		**8.2**	**5.7**	**6.0**	**8.6**	**1.6**	**1.0**	**0.88**	**1.3**	**33**	**8.6**	**6.4**	**10**

TABLE 9
CUMULATIVE GROUNDWATER ANALYTICAL RESULTS (2014-2015)
CLOSED CITY OF YAKIMA LANDFILL SITE

Location:			MW-18	MW-18	MW-18	MW-18	MW-100	MW-100	MW-100	MW-100	MW-101	MW-101	MW-101	MW-101
Laboratory ID(S):			EV14090080-02 EV14090107-11	EV14120162-02	EV15030154-03	EV15060181-07	EV14090091-09 EV14090107-12	EV14120143-03 EV14120162-22	EV15030127-05	EV15060175-04	EV14090107-13	EV14120151-02 EV14120162-13	EV15030143-04	EV15060181-05
Sample Date:	Screening Levels (a)	Targeted ALS QLs (b)	9/15/2014	12/19/2014	3/26/2015	6/25/2015	9/16/2014	12/17/2014	3/23/2015	6/24/2015	9/17/2014	12/18/2014	3/25/2015	6/25/2015
FIELD PARAMETERS														
Temperature (°C)	--		17.30	15.44	16.21	17.40	18.02	15.50	14.18	15.93	17.17	13.34	15.54	17.32
Specific Conductivity (uS/cm)	--		617	680	723	1223	269	227	536	201	714	397	534	457
Dissolved Oxygen (mg/L)	--		1.43	0.19	0.06	0.45	0.38	12.35	1.24	3.61	0.36	2.81	0.09	0.30
pH (S.U.)	6.5 to 8.5		6.37	7 (f)	6.44	6.41	6.13	6.93	6.93	6.68	6.02	6.40	6.42	6.32
Oxidation Reduction Potential (mV)	--		-29.2	-99.1	-83.5	-108.2	-6.7	7.5	92.6	82.7	-2.7	-26.3	-63.5	-70.8
Turbidity (NTU)	--		12.20	1.77	1.91	2.57	20.0	12.33	12.2	2.61	34	13.76	4.15	5.22
PESTICIDES (µg/L) **Method EPA-8081**														
hexachlorocyclohexane, alpha (A-BHC)	0.01	0.01	0.01 U	0.010 U	0.010 UJ	0.010 U	0.011 U	0.010 U	0.011 U	0.010 U	0.011 U	0.011 U	0.011 U	0.010 U
G-BHC (Lindane)	0.019	0.01	0.01 U	0.010 U	0.010 UJ	0.010 U	0.011 U	0.010 U	0.011 U	0.010 U	0.011 U	0.011 U	0.011 U	0.010 U
hexachlorocyclohexane; beta (B-BHC)	0.01	0.01	0.01 U	0.010 U	0.010 UJ	0.010 U	0.011 U	0.010 U	0.011 U	0.010 U	0.011 U	0.011 U	0.011 U	0.010 U
Heptachlor	0.01	0.01	0.01 U	0.010 U	0.010 UJ	0.010 U	0.011 U	0.010 U	0.011 U	0.010 U	0.011 U	0.011 U	0.011 U	0.010 U
hexachlorocyclohexane, delta (D-BHC)	0.012	0.01	0.01 U	0.010 U	0.010 UJ	0.010 U	0.011 U	0.010 U	0.011 U	0.010 U	0.011 U	0.011 U	0.011 U	0.010 U
Aldrin	0.01	0.01	0.01 U	0.010 U	0.010 UJ	0.010 U	0.011 U	0.010 U	0.011 U	0.010 U	0.011 U	0.011 U	0.011 U	0.010 U
Heptachlor Epoxide	0.01	0.01	0.01 U	0.010 U	0.010 UJ	0.010 U	0.011 U	0.010 U	0.011 U	0.010 U	0.011 U	0.011 U	0.011 U	0.010 U
Chlordane	0.20	0.20	0.01 U	0.010 U	0.010 UJ	0.010 U	0.011 U	0.010 U	0.011 U	0.010 U	0.011 U	0.011 U	0.011 U	0.010 U
Endosulfan I (g)	0.056		0.01 U	0.010 U	0.010 UJ	0.010 U	0.011 U	0.010 U	0.011 U	0.010 U	0.011 U	0.011 U	0.011 U	0.010 U
4,4'-DDE	0.01	0.01	0.01 U	0.010 U	0.010 UJ	0.010 U	0.011 U	0.010 U	0.011 U	0.010 U	0.011 U	0.011 U	0.011 U	0.010 U
Dieldrin	0.01	0.01	0.01 U	0.010 U	0.010 UJ	0.010 U	0.011 U	0.010 U	0.011 U	0.010 U	0.011 U	0.011 U	0.011 U	0.010 U
Endrin	0.01	0.01	0.01 U	0.010 U	0.010 UJ	0.010 U	0.011 U	0.010 U	0.011 U	0.010 U	0.011 U	0.011 U	0.011 U	0.010 U
4,4'-DDD	0.01	0.01	0.01 U	0.010 U	0.010 UJ	0.010 U	0.011 U	0.010 U	0.011 U	0.010 U	0.011 U	0.011 U	0.011 U	0.010 U
Endosulfan II (g)	0.056		0.022 U	0.019 U	**0.016** J	**0.036**	0.012 U	**0.014**	**0.017**	0.010 U	0.040 U	0.011 U	0.011 U	0.010 U
4,4'-DDT	0.01	0.01	0.01 U	0.010 U	0.010 UJ	0.010 U	0.011 U	0.010 U	0.011 U	0.010 U	0.011 U	0.011 U	0.011 U	0.010 U
Endrin Aldehyde (h)	0.01	0.01	0.01 U	0.010 U	0.010 UJ	0.010 U	0.011 U	0.010 U	0.011 U	0.010 U	0.011 U	0.011 U	0.011 U	0.010 U
Endosulfan Sulfate (g)	0.056		0.01 U	0.010 U	0.010 UJ	0.010 U	0.011 U	0.010 U	0.011 U	0.010 U	0.011 U	0.011 U	0.011 U	0.010 U
Methoxychlor	0.030	0.01	0.01 U	0.010 U	0.010 UJ	0.010 U	0.011 U	0.010 U	0.011 U	0.010 U	0.011 U	0.011 U	0.011 U	0.010 U
Hexachlorobenzene (i)	0.01	0.01	2.0 U	0.010 U	0.010 UJ	0.010 U	2.0 U	0.010 U	0.011 U	0.010 U	2.0 U	0.011 U	0.011 U	0.010 U
Toxaphene	0.50	0.50	0.50 U	0.50 U	0.50 UJ	0.50 U	0.51 U	0.50 U	0.51 U	0.50 U	0.51 U	0.52 U	0.51 U	0.50 U
PCBs (µg/L) **Method EPA-8082**														
PCB-1016	0.005	0.005	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0051 U	0.0050 U	0.0051 U	0.0050 U	0.0051 U	0.0052 U	0.0051 U	0.0050
PCB-1221	--		0.01 U	0.010 U	0.010 U	0.010 U	0.011 U	0.010 U	0.011 U	0.010 U	0.011 U	0.011 U	0.014 U	0.010
PCB-1232	--		0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0051 U	0.0050 U	0.0051 U	0.0050 U	0.0051 U	0.0052 U	0.0056 U	0.0050
PCB-1242	--		0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0051 U	0.0050 U	0.0051 U	0.0050 U	0.0051 U	0.0052 U	0.0051 U	0.0050
PCB-1248	--		0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0051 U	0.0050 U	0.0051 U	0.0050 U	0.0051 U	0.0052 U	0.0051 U	0.0050
PCB-1254	0.005	0.005	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0051 U	0.0050 U	0.0051 U	0.0050 U	0.0051 U	0.0052 U	0.0051 U	0.0050
PCB-1260	0.014	0.005	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0051 U	0.0050 U	0.0051 U	0.0050 U	0.0051 U	0.0052 U	0.0051 U	0.0050
Total PCBs (j)	0.10		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
VOCs (µg/L) **Method EPA-8260**														
Dichlorodifluoromethane	1,600		2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
Chloromethane	--		2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
Bromomethane	11		2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
Chloroethane	--		2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
Trichlorofluoromethane	2,400		2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
Carbon Disulfide	800		2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
Acetone	7,200		25 U	25 U	25 U	25 U	25 U	25 U	25 U	25 U	25 U	25 U	25 U	25 U
1,1-Dichloroethene	0.057	0.014	2.0 U	0.014 U	0.014 U	0.014 U	2.0 U	0.014 U	0.014 U	0.014 U	2.0 U	0.014 U	0.014 U	0.014 U
Methylene Chloride	4.6	0.68	5.0 U	0.68 U	0.68 U	0.68 U	5.0 U	0.68 U	0.68 U	0.68 U	5.0 U	0.68 U	0.68 U	0.68 U
Acrylonitrile	0.0572	0.0572	10 U	0.057 U	0.057 U	0.057 U	10 U	0.057 U	0.057 U	0.057 U	10 U	0.057 U	0.057 U	0.057 U
Methyl T-Butyl Ether (MTBE)	20		2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
Trans-1,2-Dichloroethene	100		2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
1,1-Dichloroethane	7.7		2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
2-Butanone (MEK)	4,800		10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U

TABLE 9
CUMULATIVE GROUNDWATER ANALYTICAL RESULTS (2014-2015)
CLOSED CITY OF YAKIMA LANDFILL SITE

Location:	Screening Levels (a)	Targeted ALS QLs (b)	MW-18	MW-18	MW-18	MW-18	MW-100	MW-100	MW-100	MW-100	MW-101	MW-101	MW-101	MW-101
Laboratory ID(S):			EV14090080-02 EV14090107-11	EV14120162-02	EV15030154-03	EV15060181-07	EV14090091-09 EV14090107-12	EV14120143-03 EV14120162-22	EV15030127-05	EV15060175-04	EV14090107-13	EV14120151-02 EV14120162-13	EV15030143-04	EV15060181-05
Sample Date:			9/15/2014	12/19/2014	3/26/2015	6/25/2015	9/16/2014	12/17/2014	3/23/2015	6/24/2015	9/17/2014	12/18/2014	3/25/2015	6/25/2015
Cis-1,2-Dichloroethene	16		2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
Hexane (k)	480		NA	2.0 U	NA	2.0 U	NA	2.0 U	NA	2.0 U	NA	2.0 U	NA	2.0 U
2,2-Dichloropropane	--		2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
Bromochloromethane	--		2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
1,1,1-Trichloroethane	200		2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
1,1-Dichloropropene	--		2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
1,2-Dichloroethane	0.38	0.014	2.0 U	0.014 U	0.014 U	0.014 U	2.0 U	0.014 U	0.014 U	0.014 U	2.0 U	0.014 U	0.014 U	0.014 U
Benzene	1.2	0.028	2.0 U	0.028 U	0.028 U	0.028 U	2.0 U	0.028 U	0.028 U	0.028 U	2.0 U	0.028 U	0.028 U	0.028 U
Dibromomethane	--		2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
Bromodichloromethane	0.080	0.059	0.059 U	0.059 U	0.059 U	0.059 U	0.059 U	0.059 U	0.059 U	0.059 U	0.059 U	0.059 U	0.059 U	0.059 U
4-Methyl-2-Pentanone (MIBK)	640		10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Toluene	640		2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
Cis-1,3-Dichloropropene	--		2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
2-Hexanone	--		10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
1,3-Dichloropropane	--		2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
Tetrachloroethene (PCE)	0.69	0.023	2.0 U	0.023 U	0.023 U	0.023 U	2.0 U	0.023 U	0.023 U	0.023 U	2.0 U	0.023 U	0.023 U	0.023 U
1,2-Dibromoethane (EDB)	0.01		0.01 U	0.010 U	0.010 U	0.010 U	0.01 U	0.010 U	0.010 U	0.010 U	0.01 U	0.010 U	0.010 U	0.010 U
Chlorobenzene	100		2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
Ethylbenzene	70		2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
m,p-Xylene (l)	1,600		4.0 U	4.0 U	4.0 U	4.0 U	4.0 U	4.0 U	4.0 U	4.0 U	4.0 U	4.0 U	4.0 U	4.0 U
Styrene	100		2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
o-Xylene	1,600		2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
Bromoform	4.3		2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
Isopropylbenzene (cumene)	800		2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
1,2,3-Trichloropropane	0.023	0.023	0.023 U	0.023 U	0.023 U	0.023 U	0.023 U	0.023 U	0.023 U	0.023 U	0.023 U	0.023 U	0.023 U	0.023 U
Bromobenzene	--		2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
N-Propyl Benzene	800		2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
2-Chlorotoluene	--		2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
1,3,5-Trimethylbenzene	80		2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
4-Chlorotoluene	--		2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
T-Butyl Benzene	800		2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
1,2,4-Trimethylbenzene	--		2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
S-Butyl Benzene	800		2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
P-Isopropyltoluene	--		2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
1,3 Dichlorobenzene	320		2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
1,4-Dichlorobenzene	8.1		2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
N-Butylbenzene	--		2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
1,2-Dichlorobenzene	420		2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
1,2-Dibromo 3-Chloropropane	0.0997	0.0997	10 U	0.10 U	0.10 U	0.10 U	10 U	0.10 U	0.10 U	0.10 U	10 U	0.10 U	0.10 U	0.10 U
Hexachlorobutadiene	0.44		2.0 U	0.069 U	0.069 U	0.069 U	2.0 U	0.069 U	0.069 U	0.069 U	2.0 U	0.069 U	0.069 U	0.069 U
1,2,3-Trichlorobenzene	--		2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
VOCs (µg/L) **Method EPA-8260SIM (m)**														
Vinyl Chloride	0.031	0.031	0.20 U	0.031 U	0.031 U	0.031 U	0.20 U	0.031 U	0.031 U	0.031 U	0.20 U	0.031 U	0.031 U	0.031 U
Carbon Tetrachloride	0.23		0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U
Chloroform	1.4		0.10 U	0.14 U	0.14 U	0.14 U	**1.2**	**1.2**	**1.1**	0.14 U	0.10 U	0.14 U	0.14 U	0.14 U
Trichloroethene (TCE)	2.5		0.020 U	0.054 U	0.054 U	0.054 U	0.020 U	0.054 U	0.054 U	0.054 U	0.020 U	0.054 U	0.054 U	0.054 U
1,2-Dichloropropane	0.50		0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U
Trans-1,3-Dichloropropene	0.34		2.0 U	0.058 U	0.058 U	0.058 U	2.0 U	0.058 U	0.058 U	0.058 U	2.0 U	0.058 U	0.058 U	0.058 U
1,1,2-Trichloroethane	0.59		0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U
Dibromochloromethane	0.40		0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U
1,1,1,2-Tetrachloroethane	1.7		0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U
1,1,2,2-Tetrachloroethane	0.17		0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U
1,2,4-Trichlorobenzene	1.5		0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U

TABLE 9
CUMULATIVE GROUNDWATER ANALYTICAL RESULTS (2014-2015)
CLOSED CITY OF YAKIMA LANDFILL SITE

Location:			MW-18	MW-18	MW-18	MW-18	MW-100	MW-100	MW-100	MW-100	MW-101	MW-101	MW-101	MW-101
Laboratory ID(S):			EV14090080-02 EV14090107-11	EV14120162-02	EV15030154-03	EV15060181-07	EV14090091-09 EV14090107-12	EV14120143-03 EV14120162-22	EV15030127-05	EV15060175-04	EV14090107-13	EV14120151-02 EV14120162-13	EV15030143-04	EV15060181-05
Sample Date:	Screening Levels (a)	Targeted ALS QLs (b)	9/15/2014	12/19/2014	3/26/2015	6/25/2015	9/16/2014	12/17/2014	3/23/2015	6/24/2015	9/17/2014	12/18/2014	3/25/2015	6/25/2015
SVOCs (µg/L)														
Method EPA-8270														
Pyridine	8.0		2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
N-Nitrosodimethylamine	1.51	1.51	1.5 U	1.4 U	1.4 U	1.4 U	1.5 U	1.4 U	1.4 U	1.4 U	1.5 U	1.4 U	1.4 U	1.4 U
Phenol	2,400		2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
Aniline	7.7		2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
Bis(2-Chloroethyl)Ether	0.94	0.94	0.94 U	0.87 U	0.87 U	0.88 U	0.94 U	0.89 U	0.87 U	0.87 U	0.94 U	0.89 U	0.87 U	0.88 U
2-Chlorophenol	40		2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
Benzyl Alcohol	800		2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
2-Methylphenol	400		2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
Bis(2-Chloroisopropyl)Ether	1,400		2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
3&4-Methylphenol (n)	400		2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	**110**	2.0 U	2.0 U	2.0 U
N-Nitroso-Di-N-Propylamine	2.0	2.0	2.0 U	1.9 U	1.9 U	1.9 U	2.0 U	1.9 U	1.9 U	1.9 U	2.0 U	1.9 U	1.9 U	1.9 U
Hexachloroethane	2.0	2.0	2.0 U	1.9 U	1.9 U	1.9 U	2.0 U	1.9 U	1.9 U	1.9 U	2.0 U	1.9 U	1.9 U	1.9 U
Nitrobenzene	16		2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
Isophorone	8.4		2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
2-Nitrophenol	--		2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
2,4-Dimethylphenol	160		2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
Benzoic Acid	64,000		10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Bis(2-Chloroethoxy)Methane	--		2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
2,4-Dichlorophenol	24		2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
4-Chloroaniline (p-Chloroaniline)	1.89	1.89	2.0 U	1.8 U	1.8 U	1.8 U	2.0 U	1.8 U	1.8 U	1.8 U	2.0 U	1.8 U	1.8 U	1.8 U
2,6-Dichlorophenol	--		2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
4-Chloro-3-Methylphenol	--		2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
Hexachlorocyclopentadiene	40		2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
2,4,6-Trichlorophenol	1.4	0.90	2.0 U	0.83 U	0.83 U	0.84 U	2.0 U	0.85 U	0.83 U	0.83 U	2.0 U	0.85 U	0.83 U	0.84 U
2,4,5-Trichlorophenol	800		2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
2-Chloronaphthalene	--		2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
2-Nitroaniline	160		2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
Dimethylphthalate	270,000		2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
2,6-Dinitrotoluene	1.82	1.82	1.8 U	1.7 U	1.7 U	1.7 U	1.8 U	1.7 U	1.7 U	1.7 U	1.8 U	1.7 U	1.7 U	1.7 U
3-Nitroaniline	--		5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
2,4-Dinitrophenol	32		10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
4-Nitrophenol	--		2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
Dibenzofuran	16		2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
2,4-Dinitrotoluene	0.78	0.78	0.78 U	0.72 U	0.72 U	0.73 U	0.78 U	0.73 U	0.72 U	0.72 U	0.78 U	0.73 U	0.72 U	0.73 U
2,3,4,6-Tetrachlorophenol	480		2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
Diethylphthalate	13,000		2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
4-Chlorophenyl-Phenylether	--		2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
4-Nitroaniline	--		2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
4,6-Dinitro-2-Methylphenol	--		2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
N-Nitrosodiphenylamine	3.3		2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
Azobenzene	1.63	1.63	2.0 U	1.5 U	1.5 U	1.5 U	2.0 U	1.5 U	1.5 U	1.5 U	2.0 U	1.5 U	1.5 U	1.5 U
4-Bromophenyl-Phenylether	--		2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
Carbazole	--		2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
Di-N-Butylphthalate	1,600		2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
Butylbenzylphthalate	8.3		2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
3,3'-Dichlorobenzidine	2.0	2.0	2.0 U	1.9 U	1.9 U	1.9 U	2.0 U	1.9 U	1.9 U	1.9 U	2.0 U	1.9 U	1.9 U	1.9 U
Bis(2-Ethylhexyl)Phthalate	1.2	0.81	2.0 U	**32**	0.75 U	0.76 U	2.0 U	0.76 U	0.75 U	0.75 U	2.0 U	**30**	0.75 U	0.75 U
Di-N-Octylphthalate	160		2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U

TABLE 9
CUMULATIVE GROUNDWATER ANALYTICAL RESULTS (2014-2015)
CLOSED CITY OF YAKIMA LANDFILL SITE

Location: Laboratory ID(S): Sample Date:	Screening Levels (a)	Targeted ALS QLs (b)	MW-18 EV14090080-02 EV14090107-11 9/15/2014	MW-18 EV14120162-02 12/19/2014	MW-18 EV15030154-03 3/26/2015	MW-18 EV15060181-07 6/25/2015	MW-100 EV14090091-09 EV14090107-12 9/16/2014	MW-100 EV14120143-03 EV14120162-22 12/17/2014	MW-100 EV15030127-05 3/23/2015	MW-100 EV15060175-04 6/24/2015	MW-101 EV14090107-13 9/17/2014	MW-101 EV14120151-02 EV14120162-13 12/18/2014	MW-101 EV15030143-04 3/25/2015	MW-101 EV15060181-05 6/25/2015
PAHs (µg/L) **Method EPA-8270 SIM**														
Naphthalene	160		0.020 U	0.013 U	**0.014**	0.013 U	0.020 U	0.014 U	**0.02**	0.013 U	**0.060**	**0.014**	**0.13**	0.013 U
2-Methylnaphthalene	32		0.020 U	0.020 U	0.02 U	0.020 U	0.020 U	0.020 U	0.02 U	0.020 U	0.020 U	0.020 U	0.02 U	0.020 U
1-Methylnaphthalene	1.5		0.020 U	0.020 U	0.02 U	0.020 U	0.020 U	0.020 U	0.02 U	0.020 U	0.020 U	0.020 U	0.02 U	0.020 U
Acenaphthylene	--		0.020 U	0.020 U	0.02 U	0.020 U	0.020 U	0.020 U	0.02 U	0.020 U	0.020 U	0.020 U	0.02 U	0.020 U
Acenaphthene	650		0.020 U	0.014 U	0.014 U	**0.019**	0.020 U	0.014 U	0.014 U	0.014 U	0.020 U	0.014 U	0.014 U	0.014 U
Fluorene	640		0.020 U	**0.012**	0.0090 U	0.0091 U	0.020 U	0.0092 U	0.0090 U	0.0090 U	0.020 U	0.0092 U	0.0090 U	0.0091 U
Pentachlorophenol	0.23	0.23	0.13 U	0.12 U	0.12 U	0.12 U	0.13 U	0.12 U	0.12 U	0.12 U	0.13 U	0.12 U	0.12 U	0.12 U
Phenanthrene	--		0.020 U	**0.015**	0.013 U	0.013 U	0.020 U	0.014 U	0.013 U	0.013 U	0.020 U	0.014 U	0.013 U	0.013 U
Anthracene	4,800		0.020 U	**0.015**	0.01 U	0.01 U	0.020 U	0.01 U	0.01 U	0.01 U	0.020 U	0.01 U	0.01 U	0.01 U
Fluoranthene	86		0.020 U	0.0092 U	0.0092 U	0.0092 U	0.020 U	0.0093 U	0.0092 U	0.0092 U	0.020 U	0.0093 U	0.0092 U	0.0092 U
Pyrene	480		0.020 U	0.01 U	0.01 U	0.011 U	0.020 U	0.011 U	0.01 U	0.01 U	0.020 U	0.011 U	0.01 U	0.011 U
Benzo[A]Anthracene	0.00940	0.00940	0.020 U	0.017 U	0.017 U	0.017 U	0.020 U	0.017 U	0.017 U	0.017 U	0.020 U	0.017 U	0.017 U	0.017 U
Chrysene	0.00940	0.00940	0.020 U	0.018 U	0.018 U	0.018 U	0.020 U	0.018 U	0.018 U	0.018 U	0.020 U	0.018 U	0.018 U	0.018 U
Benzo[B]Fluoranthene	0.00730	0.00730	0.020 U	0.0068 U	0.0068 U	0.0068 U	0.020 U	0.0068 U	0.0068 U	0.0068 U	0.020 U	0.0068 U	0.0068 U	0.0068 U
Benzo[K]Fluoranthene	0.0237	0.0237	0.020 U	0.013 U	0.013 U	0.013 U	0.020 U	0.013 U	0.013 U	0.013 U	0.020 U	0.013 U	0.013 U	0.013 U
Benzo[A]Pyrene	0.0104	0.0104	0.029 U	0.027 U	0.027 U	0.027 U	0.029 U	0.027 U	0.027 U	0.027 U	0.029 U	0.027 U	0.027 U	0.027 U
Indeno[1,2,3-Cd]Pyrene	0.0164	0.0164	0.020 U	0.014 U	0.014 U	0.014 U	0.020 U	0.014 U	0.014 U	0.014 U	0.020 U	0.014 U	0.014 U	0.014 U
Dibenz[A,H]Anthracene	0.0127	0.0127	0.012 U	0.011 U	0.011 U	0.011 U	0.012 U	0.011 U	0.011 U	0.011 U	0.012 U	0.011 U	0.011 U	0.011 U
Benzo[G,H,I]Perylene	--		0.020 U	0.019 U	0.019 U	0.019 U	0.020 U	0.019 U	0.019 U	0.019 U	0.020 U	0.019 U	0.019 U	0.019 U
cPAH TEQ (o)	0.10		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND

Appendix C

MSDSs for Plywood Adhesives

(No changes from December 2017 Final RI Work Plan submittal)

ITEM	PRODUCT NAME	SYNONYM	MSDS Date	24 HR Emergency Phone No.	MANUFACTURER / VENDOR	ADDRESS
Glue Mixing	Wheat Flour		3/1/86	913 491-9400	ADM Milling Co	Shawnee Mission,Kansas 66211
Glue Mixing	Blood,Spray Dried T/2,Type I		9/23/02	209 948-0209	California Spray Co	Stockton,Ca 95215
Glue Mixing	Sulfochem Ehs	N/A	2/21/02	800 424-9300	Chemron	Paso Robles,Ca 93447
Glue Mixing	Caustic Soda- 50% Commercial Grade		9/12/03	989 636-4400	Dow Chemical Co.	Midland, MT, 48674
Glue Mixing	GP 4445 Phenolic Plywood Resin	RPPY 4445	12/9/04	800-424-9300	Georgia-Pacific Resins, Inc.	Decatur, GA 30035

Glue Mixing

338

U.S. DEPARTMENT OF LABOR
Occupational Safety and Health Administration

Form Approved
OMB No. 44-R1387

MATERIAL SAFETY DATA SHEET

Form Date: MAR. 86

Required under USDL Safety and Health Regulations for Ship Repairing, Shipbuilding, and Shipbreaking (29 CFR 1915, 1916, 1917)

SECTION I

MANUFACTURER'S NAME ADM Milling Co.	EMERGENCY TELEPHONE NO. 913-491-9400
ADDRESS *(Number, Street, City, State, and ZIP Code)* 4550 West 109th Street - Suite 100 - Shawnee Mission, Kansas 66211	
CHEMICAL NAME AND SYNONYMS Wheat Flour	TRADE NAME AND SYNONYMS Too numerous to list
CHEMICAL FAMILY N/A	FORMULA N/A

SECTION II - HAZARDOUS INGREDIENTS – Not Applicable

PAINTS, PRESERVATIVES, & SOLVENTS	%	TLV (Units)	ALLOYS AND METALLIC COATINGS	%	TLV (Units)
PIGMENTS			BASE METAL		
CATALYST			ALLOYS		
VEHICLE			METALLIC COATINGS		
SOLVENTS			FILLER METAL PLUS COATING OR CORE FLUX		
ADDITIVES			OTHERS		
OTHERS					

HAZARDOUS MIXTURES OF OTHER LIQUIDS, SOLIDS, OR GASES	%	TLV (Units)

SECTION III - PHYSICAL DATA

BOILING POINT (°F.)	N/A	SPECIFIC GRAVITY (H_2O=1) Bulk density	32 to 40 lbs/cu ft
VAPOR PRESSURE (mm Hg.)	N/A	PERCENT, VOLATILE BY VOLUME (%)	N/A
VAPOR DENSITY (AIR=1)	N/A	EVAPORATION RATE (______ =1)	N/A
SOLUBILITY IN WATER	N/A		
APPEARANCE AND ODOR	wheat source, finess 98% thru U.S. 70 sieve, 9-14% protein, 12-14% moisture, creamy white color, natural wheat odor.		

SECTION IV - FIRE AND EXPLOSION HAZARD DATA

FLASH POINT (Method used) N/A	FLAMMABLE LIMITS N/A	Lel	Uel

EXTINGUISHING MEDIA Water, dry chemical, or carbon dioxide extinguisher.

SPECIAL FIRE FIGHTING PROCEDURES Water, fine spray, or physical removal of smouldering material.

UNUSUAL FIRE AND EXPLOSION HAZARDS Dust cloud potentially explosive(minimum explosion conc. .05 oz/cu ft; ignition temp 440°C by Bureau of Mines); difficult to ignite, slow burning.

(Continued on reverse side)

Glue-Mixing

from USDA inspected Slaughter houses

Material Safety Data Sheet

[illegible]
BLOOD, SPRAY DRIED T/2, TYPE F
Identity (Trade Name As Used On Label)

Temperature 300-400°F

N/A
MSDS Number*

Jerry Ball

N/A
CAS Number*

09-23-02
Date Prepared

LORI TONKINSON
Prepared By*

CALIFORNIA SPRAY DRY CO.
Manufacturer

4221 EAST MARIPOSA ROAD
Address
STOCKTON, CA 95215

(209)948-0209
Phone Number (For Information)

(209)948-0209 (209)948-8932 (NIGHT)
Emergency Phone Number

Telex*

Note: Blank spaces are not permitted. If any item is not applicable, or no information is available, the space must be marked to indicate that.

SECTION 1 - MATERIAL IDENTIFICATION AND INFORMATION

COMPONENTS — Chemical Name & Common Names (Hazardous Components 1% or greater; Carcinogens 0.1% or greater)	%*	OSHA PEL	ACGIH TLV	OTHER LIMITS RECOMMENDED
NATURALLY OCCURRING SUBSTANCE				
Non-Hazardous Ingredients NATURALLY OCCURRING SUBSTANCE	100%			
TOTAL	100			

SECTION 2 - PHYSICAL / CHEMICAL CHARACTERISTICS

Boiling Point	N/A	Specific Gravity (H_2O = 1)	N/A
Vapor Pressure (mm Hg and Temperature)	N/A	Melting Point	N/A
Vapor Density (Air = 1)	N/A	Evaporation Rate (_____ = 1)	N/A
Solubility in Water	10 TO 90%	Water Reactive	WILL DESOLVE IN WATER

Appearance and Odor ORGANIC FERTILIZER, PROTEIN ODOR

SECTION 3 - FIRE AND EXPLOSION HAZARD DATA

Flash Point and Method Used NONE ESTABLISHED	Auto-Ignition Temperature NONE ESTAB.	Flammability Limits in Air % by Volume WILL SMOLDER		LEL	UEL

Extinguisher Media WATER IF EXPOSED TO OPEN FLAME

Special Fire Fighting Procedures NONE

Unusual Fire and Explosion Hazards NONE

*Optional

Glue Mixing

Material Safety Data Sheet

BLOOD, SPRAY DRIED T/2, TYPE F
Identity (Trade Name As Used On Label)

CALIFORNIA SPRAY DRY CO.
Manufacturer

N/A
MSDS Number*

4221 EAST MARIPOSA ROAD
Address

N/A
CAS Number*

STOCKTON, CA 95215

09-23-02
Date Prepared

(209)948-0209
Phone Number (For Information)

LORI TONKINSON
Prepared By*

(209)948-0209 (209)948-8932 (NIGHT)
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NATURALLY OCCURRING SUBSTANCE				
Non-Hazardous Ingredients NATURALLY OCCURRING SUBSTANCE	100%			
TOTAL	100			

SECTION 2 - PHYSICAL / CHEMICAL CHARACTERISTICS

Boiling Point	N/A	Specific Gravity (H_2O = 1)	N/A
Vapor Pressure (mm Hg and Temperature)	N/A	Melting Point	N/A
Vapor Density (Air = 1)	N/A	Evaporation Rate (______ = 1)	N/A
Solubility in Water	10 TO 90%	Water Reactive	WILL DESOLVE IN WATER

Appearance and Odor ORGANIC FERTILIZER, PROTEIN ODOR

SECTION 3 - FIRE AND EXPLOSION HAZARD DATA

Flash Point and Method Used	NONE ESTABLISHED	Auto-Ignition Temperature	NONE ESTAB.	Flammability Limits in Air % by Volume	WILL SMOLDER	LEL	UEL

Extinguisher Media WATER IF EXPOSED TO OPEN FLAME

Special Fire Fighting Procedures NONE

Unusual Fire and Explosion Hazards NONE

*Optional

Material Safety Data Sheet
SPECTRA-FLO™ RED

Company Information

ROTA PMC INC
PO Box 24209
Federal Way, WA 98093
Phone: 253-661-7079
Fax: 253-661-7080

Section 1 – Product Information

SPECTRA-FLO™ RED

Product ID: MS-100-R
Common Chemical Name: None
Synonyms: Direct Red Dye
Molecular Formula: Mixture
Chemical Family: Diazo Dyes
Molecular Wt: Not Available

Section 2 – Ingredients

Chemical Name:	CAS	Amount
2,2 - Dimethyl – 1,3 - Propanediol PEL/TLV Not Established	126-30-7	Degree 2.0 %
Triethanolamine Hydrochloride PEL/TLV Not Established	637-39-8	Degree 3.0 %
Water PEL/TLV Not Established	7732-18-5	> 1.0 %
Red Dye PEL/TLV Not Established	Proprietary	Degree 1.0 %

None are EHS or TRI

Section 3 – Hazards Identification

Emergency Overview

Color:	Dark Red
Form/Appearance:	Liquid
Odor:	Odorless

Warning Statement: Caution – Contact with the eyes may result in moderate irritation. Prolonged or repeated skin contact may result in irritation. Inhalation may result in respiratory irritation. Ingestion may result in gastric disturbances. Direct contact with triethanolamine may be irritation to the skin, eyes and mucous membranes at high concentrations. In chronic studies triethanolamine has been reported to cause liver and kidney damage in laboratory animals.

Glue Mixing + Chemical

Material Safety Data Sheet

Tank + Totes

Glue, vats, WESP

Cascade Columbia Distrib.
Current 12-1-04

RECEIVED

[illegible]

1. CHEMICAL PRODUCT & COMPANY IDENTIFICATION

24-Hour Emergency Phone Number: 989-636-4400

Product: CAUSTIC SODA SOLUTION 50%, COMMERCIAL GRADE

Product Code: 15216

Effective Date: 09/12/03   Date Printed: 09/13/03   MSD: 005120

The Dow Chemical Company, Midland, MI 48674

Customer Information Center: 800-258-2436

2. COMPOSITION/INFORMATION ON INGREDIENTS

Sodium hydroxide (NaOH)	CAS# 001310-73-2	49-51%
Sodium chloride (NaCl)	CAS# 007647-14-5	0-1%
Water	CAS# 007732-18-5	BAL

3. HAZARDS IDENTIFICATION

EMERGENCY OVERVIEW

Colorless liquid. Odorless. May react violently with water. Causes severe eye burns. Causes severe skin burns. Causes respiratory tract irritation. Aspiration hazard. Can enter lungs and cause damage.

POTENTIAL HEALTH EFFECTS (See Section 11 for toxicological data.)

EYE: May cause severe irritation with corneal injury which may result in permanent impairment of vision, even blindness. Chemical burns may occur. Mist may cause eye irritation.

SKIN: Classified as corrosive to the skin according to DOT. Short single exposure may cause severe skin burns. A single prolonged exposure is not likely to result in absorption of harmful amounts.

INGESTION: This is a concentrated caustic soda solution. Swallowing may result in burns of the mouth and throat. Swallowing may result in gastrointestinal irritation or ulceration. Aspiration into the lungs may occur during ingestion or vomiting, causing tissue damage or lung injury.

(Continued on page 2 , over)

Glue Mixing - Surfactant

Chemron A Lubrizol Company

Material Safety Data Sheet

MSDS NUMBER: 70-9037 (D) 70-9036 (B)

REVISION DATE: 2/21/02

EMERGENCY TELEPHONE NUMBER: (805) 239-1550 (CHEMRON)
1-800-424-9300 (CHEMTREC)

SECTION ONE—PRODUCT DESCRIPTION

PRODUCT NAME:	**SULFOCHEM EHS ™**
CHEMICAL DESCRIPTION:	Sodium 2-Ethylhexyl Sulfate
SYNONYMS:	N. A.

SECTION TWO—HAZARDOUS INGREDIENT

CHEMICAL	*CAS NUMBER*	*% PRESENT*	*TLV or PEL (current ACGIH limit)*
(1,2,3)Formaldehyde	50-00-0	Less than 0.1	STEL = 0.3 ppm

An EHS Per 40 CFR 355

1. Currently in American Conference of Governmental Industrial Hygienists "Industrial Substances Suspect of Carcinogenic Potential for Man."
2. Formaldehyde is a listed chemical on California's "Safe Water and Toxic Enforcement Act of 1986," Proposition 65.
3. SUBJECT TO REPORTING REQUIREMENTS UNDER SECTION 313 SARA TITLE III.

SECTION THREE—PHYSICAL DATA

BOILING POINT:	212°F	*SPECIFIC GRAVITY (H_2O=1):*	1.10 9.17 lbs/gal
SOLUBILITY IN WATER (% by volume):	Completely Soluble	*FREEZING POINT:*	Not Determined
EVAPORATION RATE (butyl acetate=1):	Not Determined	*VAPOR PRESSURE @ 20°C:*	Not Determined
% VOLATILES BY VOLUME:	60	*VAPOR DENSITY*	Not Determined

APPEARANCE & ODOR: Clear, thin liquid with characteristic odor

SECTION FOUR—FIRE AND EXPLOSION HAZARD

FLASH POINT [Test Method(s)]: > 212°F

FLAMMABLE LIMITS IN AIR, % BY VOLUME: Not Established

EXTINGUISHING MEDIA: Water Fog, Dry Powder or Carbon Dioxide

UNUSUAL FIRE AND EXPLOSION HAZARDS: None currently known.

SPECIAL FIRE FIGHTING PROCEDURES: Remove unprotected personnel from hazard area. Wear protective clothing. Emergency personnel should be equipped with a NIOSH approved SCBA with full face piece. Cool exposed containers with water.

Georgia-Pacific

Georgia-Pacific Resins, Inc.
A wholly owned subsidiary of
Georgia-Pacific Corporation

Glue Mixing
Active

NFPA Ratings

Flammability	0
Health	2
Reactivity	0
Specific	

Material Safety Data Sheet

GP® 4445 Phenolic Plywood Resin

Section 1. Chemical Product and Company Identification

Product / Trade Name	GP® 4445 Phenolic Plywood Resin
Synonyms	RPPY 4445
Chemical Family	Phenol-Formaldehyde Resin
Chemical Formula	$(C_6H_6O \cdot CH_2O)x \cdot Na$
Manufacturer	**Georgia-Pacific Resins, Inc.** 2883 Miller Road Decatur, GA 30035 (770) 593-6874 (Non-Emergency)
Emergency Phone (24 hours):	**CHEMTREC 1-800-424-9300**

Section 2. Composition and Information on Ingredients

Hazardous Components	CAS #	% by Weight	ACGIH TLV ™	OSHA PEL
Formaldehyde	50-00-0	< 0.1	CEIL: 0.3 ppm	TWA: 0.75 ppm STEL: 2 ppm
Free Phenol		<0.1*	Methanol <0.2%*	
Free NaOH Sodium Hydroxide		<1.0	*Per GP letter (3-11-05) To Jon Lundyrack	

TWAs are 8 hour exposures unless otherwise noted. STELs are 15 minute exposures unless otherwise noted.

Section 3. Hazards Identification

HMIS

Health Hazard	2
Fire Hazard	0
Reactivity	0
Personal Protection	

Note: Personal protective equipment (PPE) is related to conditions of use. Determination of PPE is the responsibility of the employer. Refer to *Section 8* **(Exposure Controls / Personal Protection)** of this MSDS for recommendations.

Emergency Overview

Dark red to brown viscous liquid with a slight phenolic odor.

Eye irritation or injury may result from exposure to this product.

Potential Health Effects

Eye contact Contact with liquid or mist can cause moderate to severe eye irritation or injury. Prolonged exposure to vapors released from hot or curing product may cause mild to moderate eye irritation. Symptoms may include redness, watering, itching, or a burning sensation in the eyes.

Skin Contact This product is not a primary skin irritant.

Continued on Next Page

Inhalation	Not acutely toxic by inhalation. However, prolonged inhalation of vapors released from hot or curing product may be irritating to the nose, throat, and lungs. Symptoms may include coughing or shortness of breath, nausea, headaches, or dizziness.
Ingestion	Not orally toxic. In normal industrial use, ingestion is not considered a probable route of exposure.
Chronic	This product contains formaldehyde which may cause cancer. Repeated or prolonged exposure to formaldehyde may cause skin sensitization, dermatitis, or other allergic reactions. The degree of sensitivity varies with individuals.
	This product contains ingredients which may affect the following target organs: **Respiratory system, eyes, skin, kidneys, liver**
	See *Section 11* Toxicological Information for additional information.

Section 4. First Aid Measures

Eye contact	Immediately rinse with water. Remove contact lenses. Hold eyelids apart and flush eyes with water for at least 15 minutes. Get immediate medical attention.
Skin Contact	Wash skin thoroughly with soap and water. Get medical attention if irritation persists. Launder contaminated clothing before reuse.
Inhalation	Remove to fresh air. Rest in half-upright position. Get medical attention if necessary.
Ingestion	If conscious, immediately rinse mouth and give large quantities of milk or water. Get immediate medical attention. Emergency personnel should administer activated charcoal and should avoid lavage because of sodium hydroxide, unless large amounts are ingested and threaten potential toxicity with phenol. Never give anything by mouth to an unconscious person.

Section 5. Fire and Explosion Data

Fire Hazards	Not classified as flammable or combustible. Organic solids may burn, but only after removal of water and exposure to intense heat and flame.
Flash Point	None to boiling. [Pensky-Martens Closed Cup]
Flammable Limits (% by volume)	Not applicable.
Extinguishing Media	Use water spray, dry chemical, or carbon dioxide.
Fire Fighting Instructions	Use self contained breathing apparatus and protection for skin.
Combustion Products	Irritating fumes and toxic gases.
Special Hazards	• Unvented containers can build up pressure if exposed to heat (fire) and rupture violently. • Water runoff can cause environmental damage. Dike and collect water used to fight fire.

Continued on Next Page

Section 6. Accidental Release Measures

Spill and Leak Procedures

- Stop leak if you can do so without risk.
- Use PPE appropriate to spill size and risk of exposure.
- Confine spillage and absorb on sand, sawdust, or other available solids.
- Uncontaminated spilled material may be reused.
- Retain all contaminated water for removal and treatment. DO NOT flush to sewer.

Section 7. Handling and Storage

Handling

- Avoid eye contact. Avoid repeated or prolonged skin contact. Use proper protective equipment. (see *Section 8*)
- Avoid breathing mist or vapor. Use only in a well ventilated area.
- Unvented containers may develop pressure. Open with caution.
- Wash thoroughly after handling.
- Eyewash stations and safety showers should be easily accessible to areas where product is used.

Storage

- Do not store portable containers in direct sunlight.
- Keep containers closed when not in use.
- For maximum storage life, store at temperatures below 77°F (25°C).
- Protect from freezing.
- Store away from incompatible materials. (see *Section 10*)

Section 8. Exposure Controls / Personal Protection

Personal Protective Equipment (PPE)

Eyes and Face: Face shield with safety glasses or chemical safety goggles.

Skin: Rubber or neoprene gloves.

Respiratory: None required under normal conditions of use. However, if feasible engineering controls do not prevent overexposure, a full-face respirator with cartridges approved by NIOSH/MSHA for formaldehyde and dusts/mists may be used only when exposure levels are known to be within the unit's capability.
Use a positive pressure air supplied respirator if there is any potential for an uncontrolled release, exposure levels are not known, or in any situation where air purifying respirators may not provide adequate protection.
Observe the OSHA respirator regulations cited in 29 CFR 1910.134.

Engineering Controls

Use ventilation as necessary to keep exposure to airborne contaminants below the exposure limits.

Section 9. Physical and Chemical Properties

Physical appearance	Dark red to brown viscous liquid
Odor	slight phenolic
pH (as is)	approximately 12.0
Boiling Point	approximately 212°F (100°C)
Melting Point	not applicable
Specific Gravity (25°C)	approximately 1.20 10.01 lbs/gal
Vapor Pressure (mm Hg)	not available
Vapor Density	not available

Continued on Next Page

% Volatile (w/w)	approximately 58% Mostly water
Solubility in Water	soluble

Section 10. Stability and Reactivity Data

Chemical Stability	This product is stable under the recommended storage conditions.
Conditions to Avoid	Avoid storage in unagitated bulk tanks above the recommended storage temperature. (see *Section 7*)
Incompatibility with Other Materials	Avoid contact or contamination with strong oxidizers, acids.
Hazardous Decomposition Products	None known.
Hazardous Polymerization	Hazardous polymerization will not occur.
Special Remarks	Elevated storage temperatures will shorten product storage life. Product may darken with time.

Section 11. Toxicological Information

Eye	This product is a moderate to severe eye irritant when tested as described in 29 CFR 1910.1200, Appendix A (OSHA Hazard Communication Standard).
Dermal	This product is not a primary skin irritant and is not dermally toxic when tested as described in 29 CFR 1910.1200, Appendix A (OSHA HCS).
Inhalation	This product is not toxic by inhalation when tested as described in 29 CFR 1910.1200, Appendix A (OSHA HCS).
Oral	This product is not orally toxic when tested as described in 29 CFR 1910.1200, Appendix A (OSHA HCS).
Subchronic Effects	Exposure to gaseous formaldehyde may cause temporary irritation of the nose and throat and may lead to respiratory disorders. However, in a thorough review of sensory/respiratory irritation studies of formaldehyde from the standpoint of occupational exposure, an expert panel has observed that exposure to concentrations of 0.3 ppm or lower failed to produce irritation. No irritation will usually be reported at 0.5 ppm, especially if persons are exposed only 8 hours per day. With regard to respiratory disorders, studies have concluded the threshold for long-term exposures causing chronic pulmonary effects is between 0.4 and 3 ppm and chronic obstructive pulmonary disease is 2 ppm. Additionally, persons with asthma responded no differently than healthy individuals at concentrations as high as 3 ppm. Some reports, however, suggest formaldehyde may cause asthma and that pre-existing respiratory disorders may be aggravated by exposure.
Chronic Effects	
Carcinogenicity	The International Agency for Research on Cancer (IARC) classifies formaldehyde as a carcinogen. This classification is based on the increased occurrence of a rare cancer of the nasopharyngeal cavity. IARC determined that there was insufficient evidence of other cancers including cancer of the oral cavity, oro- and hypopharynx, larynx, lung, sinonasal cavity, pancreas, brain and leukemia. The National Toxicology Program (NTP) included formaldehyde in its Annual Report on Carcinogens. OSHA regulates formaldehyde as a potential carcinogen for exposures at or exceeding 0.5 ppm.
Target Organs	See *Section 3.*

Continued on Next Page

Section 12. Ecological Information

Ecotoxicity	This product is biodegradable under aerobic and anaerobic conditions.

Section 13. Disposal Considerations

Waste Disposal	Dispose of absorbed material in accordance with all federal, state, and local regulations. Dispose of contaminated water in a contained waste treatment system.
RCRA	The requirements of the federal hazardous waste regulations do not apply unless the waste fails to pass any of EPA's four tests for determining hazardous wastes. **Note:** If this product is altered, it is the responsibility of the user to determine whether the material meets the criteria for hazardous waste at the time of disposal.

Section 14. Transportation Information

DOT	Non-regulated

Shipping Description	**Bulk Shipments**	**Non-bulk Shipments**
Proper Shipping Name	Non-regulated	Non-regulated
Hazard Class	Not applicable.	Not applicable.
Identification Number	Not applicable.	Not applicable.
Packing Group	Not applicable.	Not applicable.
Reportable Quantities	Not applicable.	Not applicable.
Placards / Labels	**Placards:** Not applicable.	**Labels:** Not applicable.
Special Provisions for Transport	Not applicable	Not applicable.

Section 15. Regulatory Information

Federal Regulations ***The following regulations may have reporting requirements for the components listed. See "Key to Abbreviations and Acronyms" under Section 16 for definitions.***

CERCLA / SARA Emergency Reporting

A spill or release of this material may trigger the emergency release reporting requirements under CERCLA (40 CFR Part 300) and/or SARA Title III (40 CFR Part 355). State or local reporting requirements may differ from federal requirements. Consult counsel for further guidance on your responsibilities under these laws.

Formaldehyde, Phenol, Sodium hydroxide

SARA Title III Section 313 Supplier Notification

This product is known to contain the following chemicals which are listed in 40 CFR 372.65 as toxic chemicals requiring notification. This information must be included in all MSDS's that are copied and distributed for this product.

Component	CAS #	% by Weight
Not applicable.	—	—

CWA Section 307

The following chemicals are listed under Section 307 as toxic pollutants not eligible for waiver from best available technology economically achievable (BAT) effluent limitations.

Phenol

Continued on Next Page

CWA Section 311	The following chemicals are listed under Section 311 as hazardous substances requiring the submission of a National Pollutant Discharge Elimination System (NPDES) permit application to EPA. **Formaldehyde, Phenol, Sodium hydroxide**
TSCA	All components of this product are listed on the Toxic Substances Control Act Inventory or are excluded from listing requirements.
Other Regulations	See the OSHA Formaldehyde Standard 29 CFR 1910.1048 for worker training, workplace monitoring, and medical surveillance requirements. California Safe Drinking Water and Toxic Enforcement Act (Proposition 65): This product contains the following substance(s) known to the State of California to cause cancer: **Formaldehyde**

Section 16. Other Information

FDA Status	Not applicable.
Other Special Considerations	**CAUTION:** Empty containers may contain product residue. Continue to observe recommended safety precautions when handling empty containers.
Supersedes Date	All Previous
Section(s) Changed Since Last Revision	11. Toxicological Information

Key to Abbreviations and Acronyms

ACGIH - American Conference of Governmental Industrial Hygienists
ANSI - American National Standards Institute
CEIL - Ceiling value
CERCLA - Comprehensive Environmental Response, Compensation, and Liability Act
CFR - Code of Federal Regulations
CWA - Clean Water Act
DOT - Department of Transportation
FDA - Food and Drug Administration
HCS - Hazard Communication Standard
HMIS - Hazardous Materials Information System
IARC - International Agency for Research on Cancer
LC_{50} - The concentration of a material expected to kill 50% of an animal test group.
LC_{LO} - Lowest lethal concentration of a substance
LD_{50} - The dose of a material expected to kill 50% of an animal test group.
LD_{LO} - Lowest lethal dose of a material
MSHA - Mine Safety and Health Administration
N.O.S. - Not Otherwise Specified
NFPA - National Fire Protection Association
NIOSH - National Institute for Occupational Safety and Health
NTP - National Toxicology Program
OSHA - Occupational Safety and Health Administration
PEL - Permissible Exposure Limit (OSHA)
RCRA - Resource Conservation and Recovery Act
RQ - Reportable Quantity
SARA - Superfund Amendments and Reauthorization Act
STEL - Short Term Exposure Limit
TLV - Threshold Limit Value (recommended by ACGIH)
TSCA - Toxic Substances Control Act
TWA - Time Weighted Average

Continued on Next Page

IMPORTANT:

This MSDS was prepared and is to be used only for this product in its present form. If this material is altered or used as a component in another material, the information on this MSDS may not be applicable. This document is generated for the purpose of distributing health, safety, and environmental data. It is not a specification sheet nor should any displayed data be construed as a specification. Some of the information presented and conclusions drawn herein are from sources other than direct test data on the product.

This information and the data herein are believed to be accurate and have been compiled from sources believed to be reliable. It is offered for your consideration, investigation, and verification. Buyer assumes all risk of use, storage, and handling of the product in compliance with applicable federal, state, and local laws and regulations.
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SECTION FIVE—HEALTH AND FIRST AID DATA

ACUTE EFFECTS OF OVEREXPOSURE:

SWALLOWING: Ingestion may cause irritation to the membranes of the mouth, throat and gastrointestinal tract. Nausea, vomiting, cramps and diarrhea may occur.

SKIN ABSORPTION: None currently known.

INHALATION: No health effects are known to occur from inhalation of this product. Inhalation of mists or sprays may result in non-specific irritation of the upper respiratory tract.

SKIN CONTACT: Contact with skin may cause mild to moderate local irritation.

EYE CONTACT: Moderate irritation may result.

CHRONIC EFFECTS OF OVEREXPOSURE: No chronic effects, either systemic or local are known.

OTHER HEALTH HAZARDS: None currently known.

EMERGENCY AND FIRST AID PROCEDURES:

SWALLOWING: Seek medical attention.

SKIN: Remove contaminated clothing and flush skin with water. Wash with soap and water until material has been removed. Obtain medical attention if irritation persists.

INHALATION: Remove to fresh air. If symptoms of respiratory discomfort persist, obtain medical attention.

EYES: Immediately flush eyes with large quantities of water for 15 minutes. Hold eyelids apart to ensure complete flushing. Do not attempt to neutralize with chemical agents. Obtain medical attention.

TLV OR PEL AND SOURCE: None currently established.

HAZARDOUS MATERIALS IDENTIFICATION SYSTEM

HEALTH:	1
FLAMMABILITY:	0
REACTIVITY:	0
PERSONAL PROTECTION EQUIPMENT:	C

Goggles, gloves, synthetic apron

HAZARD INDEX*	
4	SEVERE HAZARD
3	SERIOUS HAZARD
2	MODERATE HAZARD
1	SLIGHT HAZARD
0	MINIMAL HAZARD

*USED AND ASSIGNED BY CHEMRON CORPORATION TO IDENTIFY HAZARDS OF THE MATERIAL. SEE ATTACHED "MATERIAL SAFETY DATA SHEET TERMINOLOGY," PAGE B, FOR SPECIFIC INFORMATION ON EACH INDEX.

SECTION SIX—REACTIVITY DATA

STABILITY: Stable

CONDITIONS TO AVOID IF UNSTABLE: None currently known.

INCOMPATIBILITY WITH OTHER MATERIALS: None currently known.

HAZARDOUS DECOMPOSITION PRODUCTS: May produce hazardous fumes or hazardous decomposition products.

HAZARDOUS POLYMERIZATION: Will not occur.

CONDITIONS TO AVOID: None currently known.

SECTION SEVEN—SPILL AND DISPOSAL PROCEDURES

STEPS TO BE TAKEN IF MATERIAL IS RELEASED OR SPILLED: Eliminate all ignition sources. Wear suitable protective equipment. *Small Spills:* Absorb liquid with absorbent material. *Large Spills:* Stop spill at source. Dike area of the spill to prevent spreading. Pump liquids into waste containers. Remaining liquids can be absorbed.

WASTE DISPOSAL METHOD: Incinerate or landfill where permitted under appropriate federal, state and local regulations. Questions concerning disposal should be directed to CHEMRON CORPORATION.

SECTION EIGHT—SPECIAL PROTECTION INFORMATION

RESPIRATORY PROTECTION: Self-contained breathing apparatus in high concentrations. Normally not required.

VENTILATION: General (mechanical) room ventilation is expected to be satisfactory.

PROTECTIVE GLOVES: Butyl or neoprene rubber

EYE PROTECTION: Monogoggles

OTHER PROTECTIVE EQUIPMENT: Synthetic apron, eye wash station

SECTION NINE—SPECIAL PRECAUTIONS

PRECAUTIONS TO BE TAKEN IN HANDLING AND STORING: Do not get in eyes, on skin, or on clothing. Wash thoroughly after handling. Soiled clothing should be removed and laundered before reuse. Store below 120°F.

Material Safety Data Sheet Terminology

SECTION ONE
PRODUCT DESCRIPTION

PRODUCT NAME:
The name under which the product is sold.

CHEMICAL DESCRIPTION:
Chemical descriptive name.

SYNONYMS:
Common names for the product.

SECTION TWO
HAZARDOUS INGREDIENTS

Lists any hazardous ingredients as required by OSHA "Hazard Communication Rule" (29 CFR Part 1910).

SECTION THREE
PHYSICAL DATA

BOILING POINT:
Temperature at which a liquid changes to a vapor at 760mm Hg or some specific pressure.

SPECIFIC GRAVITY:
Ratio of the weight of a volume of the product to the weight of an equal volume of water (liquids/solids) or air (gases).

SOLUBILITY IN WATER (% by Volume):
Solubility of the product by weight in water at ambient or specified temperature.

FREEZING POINT:
Temperature at which a liquid changes to a solid at 760mm Hg or some specific pressure.

EVAPORATION RATE (Butyl Acetate = 1):
Ratio of the rate of vaporization of the product to butyl acetate.

VAPOR PRESSURE AT 20°C:
Pressure exerted by a saturated vapor above its liquid.

% VOLATILES BY VOLUME:
The percent by volume of the product (liquid or solid) that will evaporate at ambient temperature.

VAPOR DENSITY:
Ratio of the weight of a volume of the product's vapor to the weight of an equal volume of air.

APPEARANCE AND ODOR:
Description of the material at normal temperature and pressure that may be useful in identifying the presence of the product.

SECTION FOUR
FIRE AND EXPLOSION HAZARD

FLASH POINT (Test Methods):
Lowest temperature at which the chemical will give off enough vapor to ignite. (Flash point apparatus utilized.)

FLAMMABLE LIMITS IN AIR (% by Volume):
Range of vapor concentration (% by volume in air) which will burn or explode in the presence of a spark or flame. LEL is the lower explosive limit, and UEL is the upper explosive unit.

EXTINGUISHING MEDIA:
The firefighting agents which should be used.

UNUSUAL FIRE AND EXPLOSION HAZARDS:
Hazards not covered by other sections of the MSDS pertaining to chemical reactions in the presence of heat and/or fire.

SPECIAL FIRE FIGHTING PROCEDURES:
General firefighting procedures of chemical fires are not given, but special procedures are.

SECTION FIVE
HEALTH AND FIRST AID DATA

ACUTE EFFECTS OF OVEREXPOSURE:
Gives the effects of overexposure to the chemical by swallowing, skin absorption, inhalation, skin contact, and eye contact. Common symptoms which may occur from exposure.

CHRONIC EFFECTS OF OVEREXPOSURE:
Refers to effects most likely to occur after repeated or prolonged overexposure to the chemical.

OTHER HEALTH HAZARDS:
May include medical conditions that have been known to be aggravated by exposure to the chemical.

EMERGENCY AND FIRST AID PROCEDURES:
Gives emergency and first aid procedures for treating overexposure by swallowing, skin contact, inhalation and eye contact.

TLV OR PEL AND SOURCE:
The airborne concentration at which most workers can be exposed without any expected adverse effects. Source may be a Chemron guideline, ACGIH (TLV) THRESHOLD LIMIT VALUE or OSHA (PEL) PERMISSIBLE EXPOSURE LIMIT.

HAZARDOUS MATERIAL IDENTIFICATION SYSTEM:* Hazardous communication system used by Chemron to assist user in identifying the hazards that may be associated with the use or handling of the product. Product label on the drum contains Chemron ratings for HEALTH, FLAMMABILITY, REACTIVITY, and PERSONAL PROTECTION EQUIPMENT. The following charts are the hazard indices used for assigning these ratings:

HEALTH HAZARD RATING

0 **MINIMAL HAZARD**
No significant risk to health.

1 *SLIGHT HAZARD*
Irritation or minor reversible injury may occur.

2 *MODERATE HAZARD*
Temporary or minor injury may occur.

3 *SERIOUS HAZARD*
Minor injury likely unless prompt action is taken and medical treatment is given.

4 *SEVERE HAZARD*
Life-threatening major or permanent damage may result from single or repeated exposures.

FLAMMABILITY HAZARD RATING

0 **MINIMAL HAZARD**
Materials that are normally stable and will not burn unless heated.

1 *SLIGHT HAZARD*
Materials, which must be preheated before ignition, will occur. Flammable liquids in this category will have flash points at or above 200°F (NFPA Class IIIB)

2 *MODERATE HAZARD*
Materials that must be preheated before ignition will occur, including flammable liquids with flash points at or above 100°F and below 200°F (NFPA Class II and IIIA).

3 *SERIOUS HAZARD*
Materials capable of ignition under almost all normal temperature conditions, including flammable liquids with flash points below 73°F and boiling points at or above 100°F, as well as liquids with flash points at or above 73°F and below 100°F (NFPA Class IA).

4 *SEVERE HAZARD*
Very flammable gases or very volatile flammable liquids with flash points below 73°F and boiling points below 100°F (NFPA Class IA).

REACTIVITY HAZARD RATING

0 **MINIMAL HAZARD**
Materials that are normally stable, even under fire conditions, and which will not react with water.

1 *SLIGHT HAZARD*
Materials that are normally stable, but may become unstable at high temperatures and pressures. These materials may react with water, but will not release energy violently.

2 *MODERATE HAZARD*
Materials that in themselves are normally unstable and will readily undergo violent chemical change, but will not detonate. These materials may also react violently with water.

3 *SERIOUS HAZARD*
Materials that are capable of detonation or explosive reaction, but require a strong initiating source; or must be heated under confinement before initiation; materials which react explosively with water.

4 *SEVERE HAZARD*
These materials are readily capable of detonation or explosive decomposition at normal temperatures and pressures.

PERSONAL PROTECTION INDEX

A	Safety Goggles
B	Safety Goggle/Gloves
C	Safety Goggles/Gloves/Synthetic Apron
D	Face Shield/Gloves/Synthetic Apron
E	Safety Goggles/Gloves/Dust Respirator
F	Safety Goggles/Gloves/Dust Respirator/Synthetic Apron
G	Safety Goggles/Gloves/Vapor Respirator
H	Goggles/Gloves/Synthetic Apron/Vapor Respirator
I	Safety Goggles/Gloves/Combination Dust and Vapor Respirator
J	Goggles/Gloves/Synthetic Apron/Combination Dust and Vapor Respirator
K	Air Line Mask/Gloves/Full Protective Suit/Rubber Boots
X	Ask your Supervisor for specialized handling procedures

**Rating system developed by and based on National Paint and Coatings Association's "Hazardous Materials Identification System."*

SECTION SIX
REACTIVITY DATA

STABILITY:
Indicates the susceptibility to dangerous decomposition of the chemical.

CONDITIONS TO AVOID IF UNSTABLE:
Gives conditions that may cause instability.

INCOMPATIBILITY WITH OTHER MATERIALS:
Gives the materials that may cause unstable conditions if contacted.

HAZARDOUS DECOMPOSITION PRODUCTS:
Describes the hazardous materials produced from a chemical reaction.

HAZARDOUS POLYMERIZATION:
Indicates the tendency of the chemical's molecules to combine in a violent reaction.

CONDITIONS TO AVOID:
Gives the conditions to avoid that may cause hazardous polymerization.

SECTION SEVEN
SPILL AND DISPOSAL PROCEDURES

STEPS TO BE TAKEN IF MATERIAL IS RELEASED OR SPILLED:
Indicates special precautions for cleanup of spills and leaks and preparation for disposal.

WASTE DISPOSAL METHODS:
Tells the EPA classification of the chemical as well as the proper disposal method.

SECTION EIGHT
SPECIAL PROTECTION INFORMATION

RESPIRATORY PROTECTION:
Specification of the type of respirator recommended for use during routine or emergency situations.

VENTILATION:
Specification of the type (local/general) of ventilation required to capture contaminants or prevent the buildup of hazardous atmospheres.

PROTECTIVE GLOVES:
Specification of the gloves required, based on type and degree of hazard from skin contact.

EYE PROTECTION:

OTHER PROTECTIVE EQUIPMENT:

SECTION NINE
SPECIAL PRECAUTIONS

PRECAUTIONS TO BE TAKEN IN HANDLING AND STORAGE :
States or reemphasizes any special precautions in handling and storage.

INHALATION: Mists may cause severe irritation of the upper respiratory tract (nose and throat).

SYSTEMIC (OTHER TARGET ORGAN) EFFECTS: No relevant information found.

CANCER INFORMATION: No relevant information found.

TERATOLOGY (BIRTH DEFECTS): No relevant information found.

REPRODUCTIVE EFFECTS: No relevant information found.

4. FIRST AID

EYE: Wash eyes immediately and continuously with flowing water for 30 minutes while holding eyelids open and rolling eyes back and forth. Call a physician immediately. Continue washing until the physician advises to stop. Do not use soap or attempt to neutralize with chemicals. You may have 10 seconds or less to avoid serious permanent injury.

SKIN: Immediately shower with large amounts of water for 30 minutes. Call a physician immediately. Remove clothing while showering. Remove chemical goggles last to keep material from washing into eyes. Do not apply oils or lotion. Keep victim warm.

INGESTION: Immediately have victim drink plenty of water or milk. Do not induce vomiting. Call a physician immediately. Transport to a medical facility.

INHALATION: Immediately remove to fresh air. Call a physician immediately.

NOTE TO PHYSICIAN: May cause tissue destruction leading to stricture. If lavage is performed, suggest endotracheal and/or esophageal control. Material is a strong alkali. If burn is present, treat as any thermal burn, after decontamination. For For burns of skin only. Eye irrigation may be necessary for an extended period of time to remove as much caustic as possible. Duration of irrigation and treatment is at the discretion of medical personnel. Irrigate 2L/eye, until pH 7.5-8.0 (Nitrazine paper). No specific antidote. Supportive care. Treatment based on judgment of the physician in response to reactions of the patient.

5. FIRE FIGHTING MEASURES

(Continued on page 3)

FLAMMABLE PROPERTIES
FLASH POINT: None
METHOD USED: Not applicable
AUTOIGNITION TEMPERATURE: Not applicable

FLAMMABILITY LIMITS
LFL: Not applicable
UFL: Not applicable

HAZARDOUS COMBUSTION PRODUCTS: Not applicable.

OTHER FLAMMABILITY INFORMATION: Product reacts with water. Reaction may produce heat and/or gases. This reaction may be violent. Violent steam generation or eruption may occur upon application of direct water stream to hot liquids.

EXTINGUISHING MEDIA: This material does not burn. If exposed to fire from another source, use suitable fire extinguishing agent for that fire. Do not use water.

FIRE FIGHTING INSTRUCTIONS: Keep people away. Isolate fire area and deny unnecessary entry. Water is not recommended, but may be applied in large quantities as a fine spray when other extinguishing agents are not available. This material does not burn. Fight fire for other material that is burning.

PROTECTIVE EQUIPMENT FOR FIRE FIGHTERS: Wear positive-pressure self-contained breathing apparatus (SCBA) and protective fire fighting clothing (includes fire fighting helmet, coat, pants boots and gloves). Avoid contact with this material during fire fighting operations. If contact is likely, change to full chemical resistant fire fighting clothing with SCBA. If this is not available, wear full chemical resistant clothing with SCBA and fight fire from a remote location. For protective equipment in post-fire or non-fire clean up situations, refer to the relevant sections.

6. ACCIDENTAL RELEASE MEASURES (See Section 15 for Regulatory Information)

PROTECT PEOPLE: Evacuate area. Clear non-emergency personnel from area. Ventilate area of spill or leak. See MSDS, Section 10, for information on Stability and Reactivity.

PROTECT THE ENVIRONMENT: Contain material to prevent

(Continued on page 4 , over)

contamination of soil, surface water or ground water.

CLEANUP: Dike spills immediately. Carefully flush small spills of caustic soda solution with water. Attempt to neutralize final traces of caustic soda with dilute acid, preferably acetic acid.

7. HANDLING AND STORAGE

HANDLING:
SPECIAL PRECAUTIONS FOR DILUTING CAUSTIC SODA SOLUTION:

1. ALWAYS add caustic soda solution to water with constant agitation. NEVER add water to the caustic soda solution.
2. The water should be lukewarm (80-100F). NEVER start with hot or cold water.

The addition of caustic soda to liquid will cause a rise in temperature. If caustic soda becomes concentrated in one area, is added too rapidly, or is added to hot or cold liquid, a rapid temperature increase can result in DANGEROUS mists, boiling or spattering which may cause an immediate VIOLENT ERUPTION.

STORAGE: Store above 60F (16C). Keep containers closed. Store in a dry place. Protect from atmospheric moisture. Do not store in: zinc, aluminum, brass, tin. See Section 10 for more specific information.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

ENGINEERING CONTROLS: Provide general and/or local exhaust ventilation to control airborne levels below the exposure guidelines.

PERSONAL PROTECTIVE EQUIPMENT

EYE/FACE PROTECTION:
Use chemical goggles. Wear a face-shield which allows use of chemical goggles, or wear a full-face respirator to protect face and eyes when there is any likelihood of splashes. Eye wash fountain should be located in immediate work area.

SKIN PROTECTION: Use protective clothing chemically resistant to this material. Selection of specific items such as face-shield, gloves, boots, apron, or full body suit will depend on operation. Safety shower should be located in immediate work area. Remove contaminated clothing immediately, wash

(Continued on page 5)

skin area with soap and water, and launder clothing before reuse or dispose of properly. Items which cannot be decontaminated, such as shoes, belts and watchbands, should be removed and disposed of properly. Immediately wash thoroughly any size exposure with non-abrasive soap and large quantities of water for 30 minutes, while removing contaminated clothing and shoes.

RESPIRATORY PROTECTION: Atmospheric levels should be maintained below the exposure guideline. If respiratory irritation is experienced, use an approved air-purifying respirator.

EXPOSURE GUIDELINE(S): Sodium hydroxide: OSHA PEL and ACGIH TLV are 2 mg/m3 Ceiling.

PELs are in accord with those recommended by OSHA, as in the 1989 revision of PELs.

9. PHYSICAL AND CHEMICAL PROPERTIES

APPEARANCE: Colorless to slightly hazy.
ODOR: Odorless.
VAPOR PRESS: 1.5 mmHg, 0.2kPa @ 20C
VAPOR DENSITY: Not applicable
BOILING POINT: Approximately 293F, 145C
SOLUBILITY IN WATER: Water solution
SPECIFIC GRAVITY: @ 20C (Dens.) 1.52 g/ml
FREEZING POINT: Approximately 58F, 14C
PH: 14

[illegible] 12.7 lbs/gal
(1) 3600# Tote = 283.5 gals

10. STABILITY AND REACTIVITY

CHEMICAL STABILITY: Stable under recommended storage conditions. See Storage, Section 7.

CONDITIONS TO AVOID: Avoid moisture. Product absorbs carbon dioxide from the air.

INCOMPATIBILITY WITH OTHER MATERIALS: Heat is generated when mixed with water. Spattering and boiling can occur. Caustic soda solution reacts readily with various reducing sugars (i.e. fructose, galactose, maltose, dry whey solids) to produce CO. Take precautions including monitoring the tank atmosphere for CO to ensure safety of personnel before vessel entry. Avoid contact with: acids, glycols, halogenated organics,

(Continued on page 6 , over)

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organic nitro compounds. Flammable hydrogen may be generated from contact with metals such as zinc, aluminum, tin, brass.

HAZARDOUS DECOMPOSITION PRODUCTS: Does not decompose.

HAZARDOUS POLYMERIZATION: Will not occur.

11. TOXICOLOGICAL INFORMATION (See Section 3 for Potential Health Effects. For detailed toxicological data, write or call the address or non-emergency number shown in Section 1)

SKIN: The dermal LD50 has not been determined.

INGESTION: Single dose oral LD50 has not been determined.

MUTAGENICITY: No relevant information found.

12. ECOLOGICAL INFORMATION (For detailed Ecological data, write or call the address or non-emergency number shown in Section 1)

ENVIRONMENTAL FATE:

MOVEMENT & PARTITIONING: Based on information for sodium hydroxide. No bioconcentration is expected because of the relatively high water solubility. Partitioning from water to n-octanol is not applicable.

DEGRADATION & PERSISTENCE: Based on information for sodium hydroxide. Biodegradation is not applicable.

ECOTOXICITY: Based on information for sodium hydroxide. Material is slightly toxic to aquatic organisms on an acute basis (LC50/ EC50 between 10 and 100 mg/L in most sensitive species). May cause pH shifts outside the range of 5-10; this change may be toxic to aquatic organisms.

13. DISPOSAL CONSIDERATIONS (See Section 15 for Regulatory Information)

DISPOSAL: DO NOT DUMP INTO ANY SEWERS, ON THE GROUND OR INTO ANY BODY OF WATER. All disposal methods must be in compliance with all Federal, State/Provincial and local laws and regulations. Regulations may vary in different locations. Waste characterizations and compliance with applicable laws are the responsibility solely of the waste generator. THE DOW CHEMICAL COMPANY HAS NO CONTROL OVER THE MANAGEMENT PRACTICES OR MANUFACTURING PROCESSES OF PARTIES HANDLING OR USING THIS MATERIAL. THE

(Continued on page 7)

INFORMATION PRESENTED HERE PERTAINS ONLY TO THE PRODUCT AS SHIPPED IN ITS INTENDED CONDITION AS DESCRIBED IN MSDS SECTION 2 (Composition/Information On Ingredients).

FOR UNUSED & UNCONTAMINATED PRODUCT, the preferred options include sending to a licensed, permitted: recycler.

As a service to its customers, Dow can provide names of information resources to help identify waste management companies and other facilities which recycle, reprocess or manage chemicals or plastics, and that manage used drums. Telephone Dow's Customer Information Center at 800-258-2436 or 989-832-1556 for further details.

14. TRANSPORT INFORMATION

DEPARTMENT OF TRANSPORTATION (D.O.T.): For DOT regulatory information, if required, consult transportation regulations, product shipping papers, or contact your Dow representative.

CANADIAN TDG INFORMATION: For TDG regulatory information, if required, consult transportation regulations, product shipping papers or contact your Dow representative.

15. REGULATORY INFORMATION (Not meant to be all-inclusive--selected regulations represented)

NOTICE: The information herein is presented in good faith and believed to be accurate as of the effective date shown above. However, no warranty, express or implied is given. Regulatory requirements are subject to change and may differ from one location to another; it is the buyer's responsibility to ensure that its activities comply with federal, state or provincial, and local laws. The following specific information is made for the purpose of complying with numerous federal, state or provincial, and local laws and regulations. See other sections for health and safety information.

U.S. REGULATIONS

SARA 313 INFORMATION: To the best of our knowledge, this product contains no chemical subject to SARA Title III Section 313 supplier notification requirements.

SARA HAZARD CATEGORY: This product has been reviewed according to the

(Continued on page 8 , over)

REGULATORY INFORMATION (CONTINUED)

EPA "Hazard Categories" promulgated under Sections 311 and 312 of the Superfund Amendment and Reauthorization Act of 1986 (SARA Title III) and is considered, under applicable definitions, to meet the following categories:

An immediate health hazard
A reactive hazard

TOXIC SUBSTANCES CONTROL ACT (TSCA):

All ingredients are on the TSCA inventory or are not required to be listed on the TSCA inventory.

The CAS number(s) for TSCA is(are):
CAS# 001310-73-2
CAS# 000497-19-8
CAS# 007647-14-5
CAS# 007732-18-5

STATE RIGHT-TO-KNOW: The following product components are cited on certain state lists as mentioned. Non-listed components may be shown in the composition section of the MSDS.

CHEMICAL NAME	CAS NUMBER	LIST
SODIUM HYDROXIDE (SOLUTION)	001310-73-2	NJ1 NJ3 PA1 PA3

NJ1=New Jersey Special Health Hazard Substance (present at greater than or equal to 0.1%).
NJ3=New Jersey Workplace Hazardous Substance (present at greater than or equal to 1.0%).
PA1=Pennsylvania Hazardous Substance (present at greater than or equal to 1.0%).
PA3=Pennsylvania Environmental Hazardous Substance (present at greater than or equal to 1.0%).

OSHA HAZARD COMMUNICATION STANDARD:

(Continued on page 9)

REGULATORY INFORMATION (CONTINUED)

This product is a "Hazardous Chemical" as defined by the OSHA Hazard Communication Standard, 29 CFR 1910.1200.

COMPREHENSIVE ENVIRONMENTAL RESPONSE COMPENSATION AND LIABILITY ACT (CERCLA, or SUPERFUND):

This product contains the following substance(s) listed as "Hazardous Substances" under CERCLA which may require reporting of releases:
Category:

Chemical Name	CAS#	RQ	% in Product
Sodium hydroxide	001310-73-2	1000	49-51%

CANADIAN REGULATIONS

WHMIS INFORMATION: The Canadian Workplace Hazardous Materials Information System (WHMIS) Classification for this product is:

E - corrosive to metal or skin
Refer elsewhere in the MSDS for specific warnings and safe handling information. Refer to the employer's workplace education program.

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CPR STATEMENT: This product has been classified in accordance with the hazard criteria of the Canadian Controlled Products Regulations (CPR) and the MSDS contains all the information required by the CPR.

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HAZARDOUS PRODUCTS ACT INFORMATION: This product contains the following ingredients which are Controlled Products and/or on the Ingredient Disclosure List (Canadian HPA section 13 and 14):

COMPONENTS:	CAS #	AMOUNT(%w/w)
Sodium hydroxide	CAS# 001310-73-2	49-51%

CANADIAN ENVIRONMENTAL PROTECTION ACT (CEPA):

All substances in this product are listed on the Canadian Domestic Substances List (DSL) or are not required to be listed.

16. OTHER INFORMATION

(Continued on page 10) , over)

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA) RATINGS:

Health	3
Flammability	0
Reactivity	1

MSDS STATUS: Revised Sections 2, 3, 5, 7, 8, 10. (Includes Canadian 3-year review.)

Section 3 – Hazards Identification (Continued)

Potential Health Effects

Primary Routes of Exposure: Routes of entry for solids and liquids include eye and skin contact, ingestion and inhalation. Routes of entry for gases include inhalation and eye contact. Skin contact may be a route of entry for liquefied gases.

Acute Overexposure Effects: Contact with the eyes may result in irritation. Prolonged or repeated skin contact may result in irritation. Direct contact with triethanolamine may be irritating to the skin, eyes and mucous membranes at high concentrations. Inhalation may result in respiratory irritation. Ingestion may result in gastric disturbances.

Chronic Overexposure Effects: In chronic studies triethanolamine has been reported to cause liver damage and kidney damage in laboratory animals. There are no other known chronic effects associated with this material.

First Aid Procedures – Aggravated Medical Conditions: No data is available which addresses medical conditions that are generally recognized as being aggravated by exposure to this product. Please refer to the effects of overexposure section for effects observed in animals.

Section 4 – First Aid Measures

First Aid Procedures – Skin: Wash affected areas with soap and water. Remove and launder contaminated clothing before reusing. If irritation develops seek medical attention.

First Aid Procedures – Eyes: Immediately rinse eyes with running water for 15 minuets. Get immediate medical attention.

First Aid Procedures – Ingestion: If swallowed, dilute with water and immediately induce vomiting. Never give fluids or induce vomiting if the victim is unconscious or having convulsions. Get immediate medical attention.

First Aid Procedures – Inhalation: Move to fresh air. Aid in breathing, if necessary and get immediate medical attention.

First Aid Procedures – Notes to Physicians: None Known.

First Aid Procedures – Aggravated Medical Condition: No data is available which addresses medical conditions that are generally recognized as being aggravated by exposure to this product. Please refer to the effects of overexposure section for effects observed in animals.

First Aid Procedures – Special Precautions: None Known.

Other First Aid Procedures: No other first aid needed.

Section 5 – Fire Fighting Measures

	Typical	Low/High	Deg.	Method
Flash Point:	Not Available			
Autoignition:	Not Available			

Extinguishing Media: Use CO2 or dry chemical extinguishing media.
Fire Fighting Procedures: Firefighters should be equipped with self-contained breathing apparatus and turn out gear.
Unusual Hazards: There are no known unusual fire or explosion hazards.
Additional Fire and Explosion Data: None Known.

Section 6 – Accidental Release Measures

General: Spills should be contained, solidified and placed in suitable containers for disposal in a licensed facility. This material is not regulated by RCRA or CERCLA ("Superfund"). Wear appropriate respiratory protection and protective clothing and provide adequate ventilation during clean up.
Other Spill/Leak Procedures: No other spill procedures necessary.

Section 7 – Storage and Handling

General: Protect from freezing.
Other Storage and Handling Data: No other specific storage requirements.

Section 8 – Personal Protection

Clothing: Gloves, coveralls, apron, boots as necessary to prevent skin contact.
Eyes: Chemical goggles; also wear a face shield if splashing hazard exits.
Respiration: If vapors or mists are generated wear a NIOSH/MSHA approved organic vapor/mist respirator or an air-supplied respirator as appropriate.
Ventilation: Use local exhaust to control to recommended P.E.L.
Explosion Proofing: Non required.
Other Personal Protection Data: None under normal conditions.

Section 9 – Physical Properties

Color:	Dark Red
Form/Appearance:	Liquid
Odor:	Odorless

	Typical	Low/High	U.O.M.
Specific Gravity:	Not Available		
Bulk Density:	1.06		G/CC
pH:	8		NS
Boiling Pt:	212		Deg. F @ 1 Atmospheres Pressure

Section 9 – Physical Properties (Continued)

Freezing Pt:	Not Available
Decomp. Tmp:	Not Available
Solubility in Water	
Description:	Soluble

Section 10 – Stability and Reactivity

Stability Data: Stable
Incompatibility: None know.
Conditions/Hazards to Avoid: None known.
Hazardous Decomposition Products: None known.
Polymerization: Does not occur.
Corrosive Properties: Not corrosive.
Oxidizer Properties: Not an oxidizer
Other Reactivity Data: None known.

Section 11 – Toxicological Information

Toxicology Test data:
- Rat, Oral LD50 -> G/KG (Data for a similar material)
- Rabbit, Primary skin irritation – non irritating (Data for a similar material)
- Rabbit, Eye irritation – non irritating (Data for a similar material

Section 12 – Ecological Information

Environmental Toxicity Test Data:
- Golden Orfe, Static 48 hr LC50 - > 50 MG/L (Data for a similar material)
- Photometry, Elimination, static method – 10 to 25 % (Data for a similar material)

Section 13 – Disposal Consideration

Waste Disposal: Incinerate or bury as a solid in a licensed facility. Do not discharge into waterways or sewer systems without proper authority.
Container Disposal: Dispose of in a licensed facility. Recommend crushing or other means to prevent unauthorized reuse.

Section 14 – Transportation Information

DOT Proper shipping Name: N/A

DOT Technical Name: N/A

DOT Primary Hazard Class: N/A

Section 14 – Transportation Information (Continued)

DOT Secondary Hazard Class: N/A

DOT Label Required: N/A

Dot Placard Required: N/A

Dot Poison Constituent: N/A

EBI Commodity Codes: UN/NA Code: E/R Guide:
Bill of Lading Description: Not Regulated by the Department of Transportation.

Section 15 – Regulatory Information

TSCA Inventory Status
Listed on Inventory: Yes

RCRA Haz. Waste No.: None
CERCLA: No Reportable Qty: (IF Yes)

State Regulatory Information: (By Component)		**NJ/PA/MA RTK**
CAS:	126-30-7	Yes
NAME:	2,2 – Dimethyl – 1,3 - Propanediol	
CAS:	637-39-8	Yes
NAME:	Triethanolamine Hydrochloride	
CAS:	7732-18-5	Yes
NAME:	Water	
CAS:		Yes
NAME:	Red Dye	

NJ TSR# 489909-5009-P-CP
SARA Title III Section 313: Not Listed.

Section 16 – Other Information

Hazard Ratings: ROTA PMC uses the National Paint & Coating Association (NPCA) rating system. The use of an asterisk (*) in the HMIS rating indicates the potential for chronic health effects.

	Health	Fire	Reactivity	Special
HMIS	1*	0	0	N/A

This product is hazardous or contains components, which are hazardous according to the OSHA Hazard Communication Standard.

Section 16 – Other Information (Continued)

Important: While the descriptions, designs, data and information contained herein are presented in good faith and believed to be accurate, it is provided for your guidance only. Because many factors may affect processing or application/use, we recommend that you make tests to determine the suitability of a product for your particular purpose prior to use. No warranties of any kind, either expressed or implied including warranties of merchantability or fitness for a particular purpose are made regarding products described or designs, data or information set forth, or that the products, designs, data or information may be used without infringing the intellectual property rights of others. In no case shall the descriptions, information, data or designs provided be considered a part of our terms and conditions of sale. Further, you expressly understand and agree that the descriptions, designs, data and information furnished by ROTA PMC hereunder are given gratis and ROTA PMC assumes no obligation or liability for the description, designs, data and information given or results obtained, all such being given and accepted at your risk.

END OF DATA SHEET

SECTION 4 - REACTIVITY HAZARD DATA

STABILITY ☒ Stable ☐ Unstable

Conditions To Avoid: Avoid getting wet or moist until use as product will be rendered useless

Incompatability (Materials to Avoid): N/A

Hazardous Decomposition Products: N/A

HAZARDOUS POLYMERIZATION ☐ May Occur ☒ Will Not Occur

Conditions To Avoid: Avoid getting wet prior to use.

SECTION 5 - HEALTH HAZARD DATA

PRIMARY ROUTES OF ENTRY ☒ Inhalation ☒ Skin Absorption ☐ Ingestion ☐ Not Hazardous

CARCINOGEN LISTED IN N/A ☐ NTP ☐ IARC Monograph ☐ OSHA ☒ Not Listed

HEALTH HAZARDS Acute / Chronic: Prolonged exposure to dust may cause an allergic reaction of mucous build-up in eyesm nose and throat. this is a temporary,typical reaction to any foreignn proteins.

Signs and Symptoms of Exposure: As above

Medical Conditions Generally Aggravated by Exposure: As above

EMERGENCY FIRST AID PROCEDURES - Seek medical assistance for further treatment, observation and support if necessary.

Eye Contact: Eye protection for dust recommended.

Skin Contact: Use gloves if sensative to protein

Inhalation: Approved dust mask

Ingestion: N/A

SECTION 6 - CONTROL AND PROTECTIVE MEASURES

Respiratory Protection (Specify Type): Approved dust mask

Protective Gloves: If sensitive to protein

Eye Protection: REcommended

VENTILATION TO BE USED ☐ Local Exhaust Bag House ☒ Mechanical (general) ☒ Special Air scrubber ☐ Other (specify)

Other Protective Clothing and Equipment:

Hygienic Work Practices: Store in cool, dry place. Wash skin with soap & water; Flush eyes with water after working with product.

SECTION 7 - PRECAUTIONS FOR SAFE HANDLING AND USE / LEAK PROCEDURES

Steps to be Taken If Material Is Spilled Or Released: Flush areas effected with water

Waste Disposal Methods: Organic waste

Precautions to be Taken in Handling and Storage: Store in cool dry place

Other Precautions and/or Special Hazards: If accidentally spilled ; sweep dry if possible or flush with water.

NFPA Rating* Health___ Flammability___ Reactivity___ Special___ | HMIS Rating* Health___ Flammability___ Reactivity___ Personal Protection___

CALIFORNIA
SPRAY DRY CO.

P.O. Box 5035 • 4221 East Mariposa Road
Stockton, California 95205-0035
Phone (209) 948-0209 • FAX (209) 948-0629
E-MAIL CSD@PACBELL.NET
WEB PAGE PROTEIN@CALSPRAYDRY.COM

October 11, 2005

Yakima Resources, LLC
617 North 8th Street
Yakima, Washington 98901

Attn: Mr. John Lund

Re: "Type F Blood"

Dear John,

Thank you for your call yesterday regarding our Type F spray dried whole blood. This material is considered a "naturally occurring substance" by the FDA and EPA (letter enclosed). Secondly the blood is derived ONLY from USDA inspected slaughter facilities and then only from animals destined for use as human consumption as a meat source.

The process to collect the blood is as follows:

*Blood is collected from the animals in a stainless steel or brick trough.
*The liquid blood is pumped through a stainless steel screening device to a stainless steel, refrigerated holding tank.
*The refrigerated liquid blood is transferred daily using a stainless steel, insulated tank truck to the spray drying facility.
*The refrigerated liquid blood is unloaded into stainless steel, refrigerated holding tanks.
*The refrigerated liquid blood is transferred to a mechanical vapor decompression evaporator for concentrating under full vacuum at an elevated temperature.
*The concentrated liquid blood is transferred from the evaporator to the spray dryer for drying into a water soluble powder. Temperatures approach 400F and do not go below 330F during this process.
*The spray dried powder is screened and blended in lot size quantities (45,000 pounds) to insure a consistent result when making glue mixes. QA/QC testing is done on each lot for both analytical and microbiological results prior to release for selling to the industry.

I have enclosed pertinent information and documents that will address your questions. I would like to add that the same blood utilized for the Type F (F is for "foam) is utilized in our dried blood that is certified organic by both the California Certified Organic Farmers organization and the Organic Materials Review Institute.

Typical safety precautions should always be taken when working around protein powders such as dust mask and goggle use and washing ones hands after use.

I hope that this has answered your questions, if not, please feel free to contact me at any time.

Yours truly,

Jerry Ball

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

OFFICE OF TOXIC SUBSTANCES

James Allan & Son
4221 East Mariposa Road
Stockton, California 95202

Attn: Mr. Jerry Ball

Dear Sir:

We were pleased you could attend our seminar on TSCA Inventory reporting and that you found it worthwhile to ask a follow-up question on applying the reporting requirements to your individual situation. During the week after the seminar series closed we have had our "traveling experts" develop an answer for you which is presented below. We hope you will stay in touch with us on problems of understanding and compliance as further TSCA rules are made.

Answer.
(1) The stabilizer you add to blood to keep it from decomposing does not alter the blood's status as a nuturally occurring substance which is not reportable.

(2) Your blood product which you have denatured by adding a solution of Glyoxal is not a naturally occurring substance and may be reported as denatured blood.

Sincerely,

John B Ritch Jr
John B. Ritch, Jr.
Director
Industry Assistance Office

* ANSWER #1 APPLIES TO OUR TYPE 2 & TYPE F BLOODS

ANSWER #2 APPLIES TO ALL OF OUR TYPE HVLS BLOODS.

NTAL PROTECTION AGENCY
, D.C. 20460

OFFICE OF TOXIC SUBSTANCES

UNITED STATES
ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

OFFICIAL BUSINESS
PENALTY FOR PRIVATE USE, $300

POSTAGE AND FEES PAID
ENVIRONMENTAL PROTECTION AGENCY
EPA-335

U.S.MAIL

James Allan & Son
4221 East Mariposa Road
Stockton, California 95202

Attn: Mr. Jerry Ball

attend our seminar on TSCA
ou found it worthwhile to
plying the reporting require-
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on problems of understanding
rules are made.

d to blood to keep it from
blood's status as a nuturally
not reportable.

hich you have denatured by
is not a naturally occurring
as denatured blood.

incerely,

John B Ritch Jr

John B. Ritch, Jr.
Director
Industry Assistance Office

1000w
250

IES TO OUR TYPE 2 & TYPE F
DS

ANSWER #2 APPLIES TO ALL OF OUR TYPE HVLS BLOODS.

VETERINARY DIAGNOSTIC LABORATORY
Iowa State University
Ames, IA 50011
Phone (515) 294-1950

VIROLOGY EXAMINATION

California Spray Dry Company
Attn: Erin Mullen
4221 East Mariposa
Stockton, CA 95215

Case No: 93-43713
Owner: Ca. Spray Dry Co
Address: Stockton, CA
Specimen: 1 dried blood

	TEST PERFORMED:	VIRUS DETECTED:
XX	Inoculation of cell cultures	Negative
	Direct FA exam	
	Tissue section FA exam	
XX	Cell culture FA exam	Negative
	Animal inoculation	
XX	Other: Hemadsorption of cell culture	Negative

INTERPRETATION:

The protein extract sample(s) from Lot(s) # T12-076 was/were tested using the guidelines stated in the Code of Federal Regulations for Ingredients of Animal Origin 9CFR, Part 113, 1990.

1. Cytopathic observations on cell cultures - Negative
2. Fluorescent antibody staining on cell cultures - Negative for IBR, BVD, PI_3, Bovine Adenovirus, Bovine Parvovirus, Bovine Reovirus, Rabies virus.
3. Hemadsorption of cell cultures - Negative, no hemadsorbing agents detected.
4. Pathogenic bacteria results - Negative, no pathogenic bacteria detected.
5. Inclusion body staining on cell cultures - Negative, no inclusions detected.

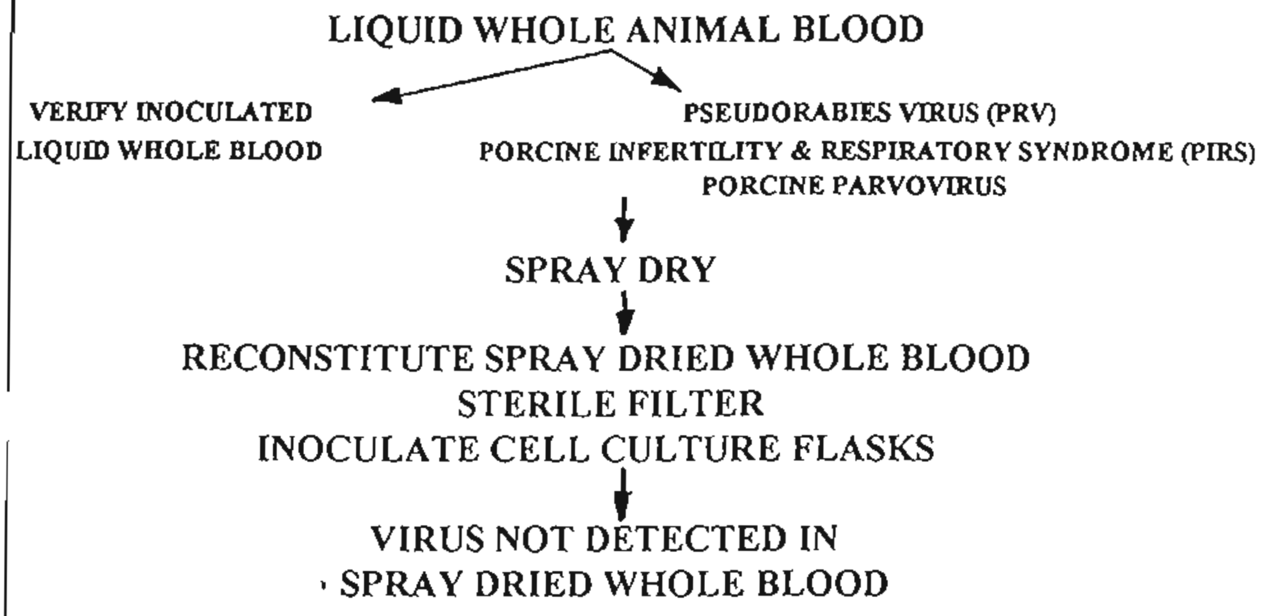
Date received: November 29, 1993
Date reported: January 17, 1994

irologist: ______________________
Howard T. Hill, D.V.M., Ph. D.

jab

CALIFORNIA
SPRAY DRY CO.
P.O. Box 5035 • 4221 East Mariposa Road
Stockton, California 95205-0035
Phone (209) 948-0209
FAX (209) 948-0629

VIRUSES ARE INACTIVATED IN SPRAY DRIED WHOLE BLOOD



* unpublished data and test conducted by Iowa State University
unpublished data and test conducted by University of Georgia

OBJECTIVES: Determine the effect of spray drying virus inoculated whole blood on viral activity.

PROCEDURES: Three studies were conducted to evaluate the effect of spray drying whole blood in viral activity. The studies were conducted at Iowa State University Veterinary Diagnostic Laboratory. Whole blood was inoculated (10,000 TCID/ml plasma) with psuedorabies virus, PIRS (Porcine Infertility and Respiratory Syndrome) and porcine parvovirus. The whole blood was spray dried and reconstituted with water to a 7% solution. The solution was then sterile filtered (.22 micron). !0 ml of the reconstituted samples were then innoculated into 175 ml flasks of MA cells and cultured for one week. Negative samples underwent two additional cell culture passages to assure complete inactivation.

RESULTS: Spray drying whole animal blood inactivates pseudorabies, PIRS, and parvovirus.

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SPRAY DRY CO.

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(209) 948-0209
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SPRAY DRIED WHOLE ANIMAL BLOOD

TYPICAL ANALYSIS

PROTEIN	80-88%	
MOISTURE	5-10%	MAX
SOLUBILITY	70%	MIN.
pH	6.0-7.6	
ASH	5.0	MAX.
FAT	1.0-3.5%	MAX.
FIBER	1.0%	MAX.
BULK DENSITY	25.0-30.0#/ft^3	

AMINO ACIDS, AS IS BASIS (W/W)

Alanine	7.02%	Hydroxyproline	0.01%
Valine	7.75%	Phenylalanine	6.42%
Glycine	3.81%	Aspartic Acid	9.41%
Isoleucine	0.92%	Glutamic Acid	7.94%
Leucine	11.07%	Tyrosine	2.94%
Proline	3.52%	Lysine	9.0%
Threonine	4.49%	Histidine	5.53%
Serine	4.64%	Arginine	4.24%
Methionine	1.41%	Cystine	1.18%
		Tryptophan	.97%

The information given in this product data sheet is, to the best of our knowledge, accurate. It is intended to be helpful but no warranty is expressed or implied regarding the accuracy of such data. It is the user's responsibility to determine the suitability for his own use of the product described herein, since conditions of use are beyond our control. California Spray Dry Co., expressly disclaims all liability with respect to use of any material supplied by us.

CALIFORNIA SPRAY DRY CO.
P.O. Box 5035 • 4221 East Mariposa Road
Stockton, California 95215-0035
Phone (209) 948-0209
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FEEDSTUFFS INGREDIENT ANALYSIS TABLE: 1995 EDITION

TYPICAL ANALYSIS ANIMAL BLOOD

DRY MATTER	89%
CRUDE PROTEIN	80%
ETHER EXTRACT	1%
CRUDE FIBER	1%
CALCIUM	.28%
TOTAL PHOSPHORUS	.22%
ASH	4.4%
RUMINANT DIGESTIBLE PROTEIN	63.1%
RUMINANT TDN	60%
POULTRY ME$_6$	
Kcal/lb.	1465
Kcal/kg.	3220
SWINE ME$_6$	
Kcal/lb.	875
Kcal/kg.	1925
SWINE TDN	61

AMINO ACIDS

METHIONINE	1.0 (91)%
CYSTINE	1.4 (76)%
LYSINE	6.9 (86)%
TRYPTOPHAN	1%
THREONINE	3.8 (87)%
ISOLEUCINE	0.8 (78)%
HISTIDINE	3.05 (84)%
VALINE	5.2 (87)%
LEUCINE	10.3 (89)%
ARGININE	2.35 (87)%
PHENYLALANINE	5.1 (88)%

VITAMINS

CAROTENE mg/kg	*
VITAMIN A IU/g	*
VITAMIN E mg/kg	*
THIAMINE mg/kg	.44
RIBOFLAVIN mg/kg	1.5
ACID mg/kg	1.1
BIOTIN ug/kg	80
FOLIC ACID ug/kg	80

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VITAMINS CONTINUED...

CHOLINE mg/kg	990
VITAMIN B 12 ug/kg	*
NIACIN mg/kg	31.0

MINERALS

SODIUM	.31%
POTASSIUM	.9%
MAGNESIUM	.22%
SULPHUR	.32%
MANGANESE ppm3	5
IRON ppm	2500
COPPER ppm	10
ZINC ppm	300
SELENIUM ppm	N/A

* INFORMATION NOT AVAILABLE

OMRI

Listed

Organic Materials Review Institute
Box 11558 • Eugene, OR 97440-3758 USA
541-343-7600 • Fax: 541-343-8971
info@omri.org • www.omri.org

OMRI has reviewed the following material based on the *OMRI Generic Materials List*, the *OMRI Operating Manual for Review of Brand Name Products*, and documentation provided by the manufacturer or distributor to support the product application.

Product Name

Spray Dried Animal Blood

OMRI Status*	**OMRI Product Nr.**
Allowed	csd-107

OMRI Generic Category*

Blood Meal

OMRI Class*

Fertilizer (F)

Supplier

California Spray Dry
Jerry Ball
P.O. Box 5035, Stockton, CA 95205
Tel: 1-209-948-0209 Fax:1-209-948-0629
jerry@calspraydry.com, www.calspraydry.com

Issue Date	**Expires**
02-Mar-98	01-Sep-05

Product Review Coordinator

Executive Director

This listing is not OMRI certification or endorsement and cannot be construed as certification or listing by any of OMRI's subscribing certifiers. Final decisions regarding the acceptability of use of the product and any restrictions on its use under any particular certifier's program are made by the certifier that still has the right to decline OMRI's recommendation. Producers and handlers still need to contact their certifiers for information as to whether or not this material may be used in organic production or handling.

* See the most current *OMRI Generic Materials List* for more information plus annotations and restrictions.

Modern QC and QA rates plasma protein as feed ingredient as negligible risk

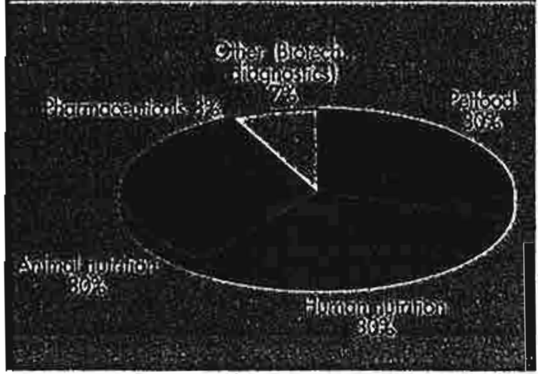
Traditionally, blood derivatives have been used extensively in the world due to their wide range of functions. Safety is the first issue that comes to mind when processing blood products. Ramon Gatnau describes the production processes and risks in modern facilities for plasma protein.

By Ramon Gatnau, Europe, Barcelona, Spain

The most important industries using blood derivatives aid the food industry, mainly in meats as gelling agents and natural colorants. The petfood industry uses them mainly in wet feed as gelling and water holding agents, and in dry feed as ingredients. The feed industry, especially the pig feeding sector, has shown the highest growth in the use of blood derivatives, especially plasma and red cells. There are 200 million pigs produced yearly worldwide consuming spray-dried plasma in their diets, of which 50% are in the American continent, 25% in Asia and 25% in Europe.

Many other industries also make use of blood-derived products: animal health (colostrum substitutes); agriculture (fertilisers); cosmetics (gelling and foaming agents); diagnostics (bovine serum albumin and immunoglobulins); the paper industry (glue) and biotechnology (reagents). Although these industries only require blood derived products in small quantities, these are nevertheless highly valued products.

Figure 1 - Blood products are used widely throughout the feed and food sectors



Plasma production

As indicated, blood has a high biological value, and their proteins have interesting functional properties. Blood is collected in abattoirs from animals that have undergone veterinary inspection, and had their health approved. Thus, they have a double inspection at the farm and the abattoir, before going on to manufacturing.

Blood is collected under hygienic conditions, and an anticoagulant is added by automatically operated devices. The anticoagulants are typically citrates and phosphates. Blood is immediately refrigerated at 4°C and goes into stainless steel tanks at the abattoir. The blood is stirred continuously whilst isothermic stainless steel trucks collect it in a manner similar to that in the milk industry, for transport to the manufacturing plant. These trucks are used only for blood transportation. They are routinely cleaned automatically by the Cleaning in Process System (CIP) before they leave the plants.

Once the blood arrives at the plant for unloading, tests for Quality Control (QC) and Quality Assurance (QA) are performed on temperature, colour, pH and clotting. If QA and QC are passed, then the blood can be unloaded.

Blood that does not pass QA and QC goes to blood meal production in other facilities with different heat and pressure treatment (133°C/20mins/3atm in a batch system or 100°C for 150 mins in continuous systems).

Closed systems

After unloading, the blood goes through closed systems to refrigerated and stirred stainless steel tanks. It is important to note that from collection in the abattoir to the final products, blood and its products are always in enclosed systems with two transfers the first from tank to truck at the abattoir, and the second from the truck to the plant. Once in the plant, plasma production takes place in a completely closed system.

Blood is centrifuged with industrial centrifuges that separate plasma and cells. Blood consists of 60% plasma and 40% cells in volume. Cells are heavier than plasma and tend to spin to the bottom of the centrifuge containers; so the plasma remains at the top. They are collected with two different tubing systems. The cell fraction goes directly to the spray drier and the plasma fraction is then submitted to a process of ultrafiltration, or reverse osmosis, to remove water (concentrating the plasma) and, in the case of ultrafiltration, to remove the ash content which has low nutritional value.

Finally, the plasma is spray-dried. Briefly, this process consists of micronisation of plasma in small droplets (10-100μm), achieved by using very high pressure (200atm), in a tower with very high temperatures over a short period of time (Filková, 1987). The inlet temperature is 240°C, while that at the outlet is 90°C. This drying system allows the proteins to remain functional, whilst making it hygienic. However, the biosafety of plasma protein is due to the security of the whole production process and not only to spray drying. Finally, plasma is dried with hot air in order to reduce the humidity, then bagged in new polylined paper bags so that it can be stored.

Standardising

In order to standardise and optimise the immunoglobulin content of the plasma *(Figure 3)*, the globulin fraction is analysed during the production process by an automated Cobas analyser, then mixed to achieve a homologous globulin content. Finally it is chelsinated, which is a process of microgranulation with pressure rather than temperature.

Other products can be obtained by fractionating the plasma proteins or the cell fraction. They normally consist of reagent addition, pH adjustment and further separation before finally being spray dried. Those specific products are the immunoglobulins, albumin, globulin and fibrin, all of which are available on the market. Further refining steps can be taken to extract transferrin, transforming growth factor, DNA, iron and other molecules.

Plasma as feed content

All these production systems render different types of plasma that are equally safe, but can be functionally different. In order to consider plasma as a feed ingredient, one needs to take into account protein and ash content (in principle, the higher these components the better). The fact that a plasma is food-grade does not guarantee an optimal function as a feed ingredient, since for both the food and petfood industries, gel strength is the required function. The species of origin has no effect on functionality (Russell, 1994; Gatnau and Zimmerman, 1994; Rantanen *et al*, 1994; Pierce *et al*, 1996). Recently, it has been reported in the scientific literature that the high molecular weight fraction (globulin) is responsible for the plasma's effect, thus a plasma has been developed to render this fraction high and homogeneous. Additionally, it is well known that the globulin fraction has several diverse activities such as virus, bacteria and toxin binding, immune system activation, and they can generate bioactive peptides.

Protein is the most important fraction in plasma and red cell products. Obviously, it also contains minerals, fats, carbohydrates and water. Commercially, it can be said that the crude protein values of plasma are somewhere between 65 - 80%. Inversely, their ash content is low, between 5 - 20%. Plasma proteins have a high lysine and

Figure 2 - Biosafety of plasma is ensured throughout the production process

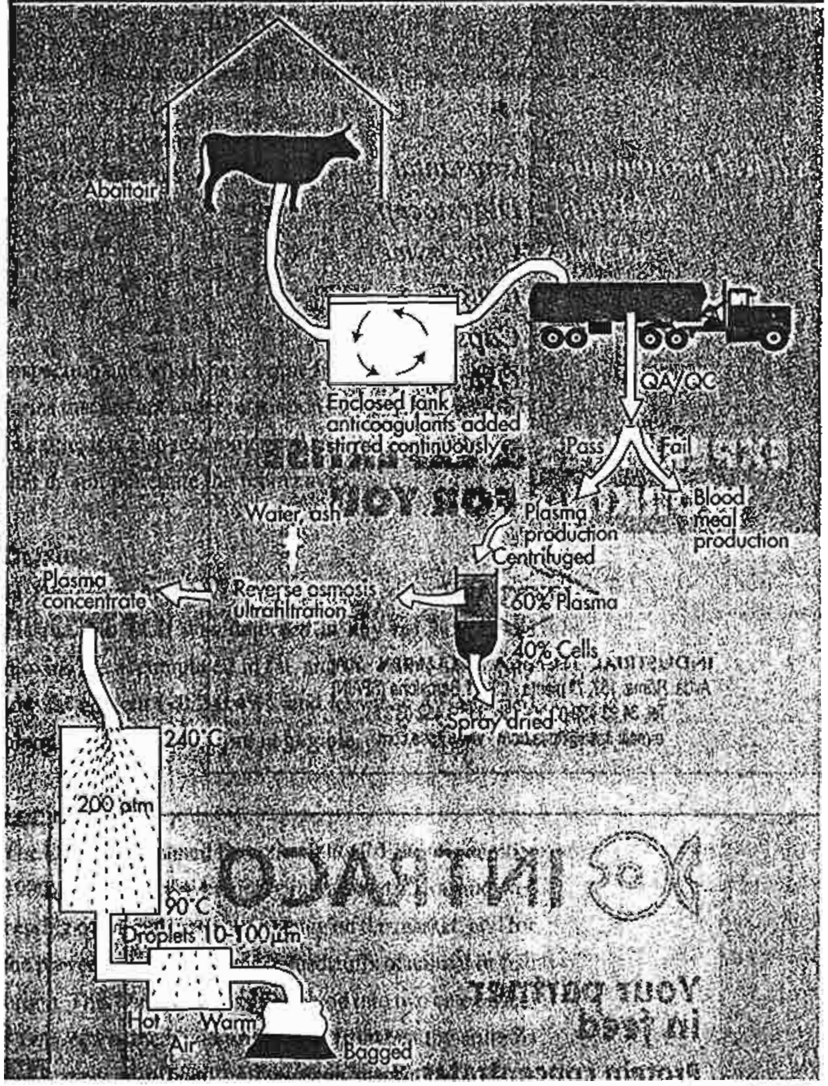
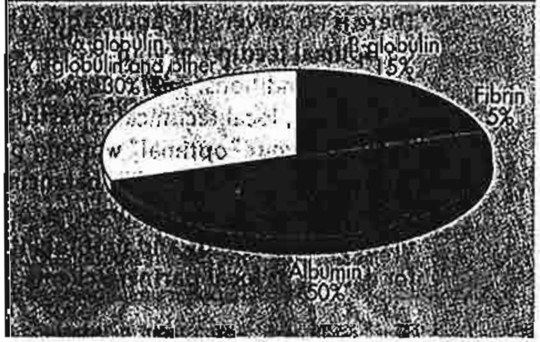


Figure 3 - Optimised immunoglobulin composition of spray dried plasma



threonine content, but are low in methionine (Delaney, 1975; Graham, 1978). The amino acid profile is very similar to the ideal protein ratio. The red cell fraction, on the other hand, has a crude protein content of 90%, with 9% lysine.

Risk assessment

APC has worked intensively on a risk assessment programme to investigate the risk of spreading known and unknown diseases by the utilisation of blood-derived proteins (APC, 2000). This assessment usually adopts standards accepted by all OIE (Office International des Epizooties) member countries, and thus has international validity. It is frequently used in the pharmaceutical industry to quantify the risk of using a product.

In the case of plasmas, risks are reduced by a number of strict measures. All these processes make the risk of spread for known and unknown diseases negligible. Animal nutrition products should have at least 6 steps towards risk reduction. Plasma production clearly has many more than this lower limit.

Biosafety

Two levels at which the risk of disease transmission can be measured for known diseases, are the bacteriological and virological levels. There is clear legislation governing the risk assessment of these.

Bacteriology can be controlled quite easily, since the blood product manufacturing industry has developed out of the food industry, and therefore the capability is already in place to study it. The total bacterial count, enterobacteriacae and salmonella in 25g are the most commonly used criteria.

Virology studies are usually carried out by external laboratories (universities or research institutes), since they are more complex and require different, more specialised facilities. There are over 15 viruses that are analysed regularly *(Table 1)*. Furthermore, techniques have been developed which demonstrate that spray drying destroys the infective ability of Pseudorabies Virus, PRRS and Parvovirus, even after a high level of infection.

Blood, as milk, is a low risk material for the transmission of Transmissible Spongiform Encephalopathies (TSE) such as BSE. Blood has never been known to be infected by a naturally occurring TSE. Many studies have been done into TSE transmission, and collectively, all these reports have enabled the authorities such as WHO, OIE and EC to conclude that blood is a no risk tissue in this sense.

Table 1 - Plasma is regularly analysed for viruses, as part of the risk assessment process

Bovine Adenovirus	PRRS
Bovine Respiratory and Vesicular Virus	Transmissible Gastroenteritis
Bovine Viral Diarrhoea	Swine Influenza
Bovine Parvovirus	Rabies Virus
Bovine Reovirus	Blue Tongue
Infectious Bovine Respiratory Virus	Porcine Parvovirus
Aujezsky	Parainfluenza 3
Classical Swine Fever	African Swine Fever

Overall, there is a very low risk of blood being infected in live, native born animals that have passed *ante mortem* inspection and which have come from regions, zones and farms that are not under restriction of movement for BSE. In cattle, it is also recommended to use stunning methods that do not penetrate the brain cavity.

Dioxins

In 1999, dioxin analysis was performed on European plasma. No PCB was detected in any batches. Since dioxins are accumulated in fat, and the blood has a very low fat content (<0.2-0.4%), and less than 4% in dried blood, the risk is therefore negligible.

Legislation

The European Council Directive 90/667/EEC (November 1990) lays down the veterinary ruling for disposal and processing of animal waste, its placing on the market, and for the prevention of pathogens in feedstuffs of animal or fish origin. This Directive classifies blood into two categories:

- *Low-risk* is the blood originating from healthy animals that pass an official *ante mortem* inspection, and no serious transmissible human or animal diseases were detected. This blood can be used in animal feeds.
- *High risk* blood comes from animals that have not passed an *ante mortem* health inspection, or from animals that suffer any serious transmissible human or animal diseases. This blood needs to be processed for incineration or at 133°C and 3 atm for 20 minutes.

Facts and figures

Annually, there are 200 million pigs world-wide receiving an average of 150g of plasma in 50 countries. Over the past 15 years there have been no disease problems reported, despite increasing use. On the contrary, in most cases, health status has been found to improve by the use of plasma as a feed additive. Plasma as an ingredient has now been introduced into the new NRC (1998) tables, and also the FEDNA (1999) tables. ●

California Certified Organic Farmers
MATERIALS DOCUMENTATION AND DECISION RECORD

This form is provided so that growers can speed the materials review process by giving the form to the suppliers of products they wish to use. CCOF cannot begin the approval process on a new material until all this information is on file, either on this form or an equivalent.

▲ Material/Brand Name: Spray dried animal blood

▲ Manufacturer (Name, Address and Phone Number):

CALIFORNIA SPRAY DRY CO.
POST OFFICE BOX 5035
STOCKTON, CALIFORNIA 95205

209 948 0209 FAX 209 948 0629

▲ Type of Material: Spray dried, water soluble, water suspendable powder.

▲ Active Ingredients: Nitrogen source, ammoniacal.

▲ Inert Ingredients: Naturally occurring ash.

▲ Source/Manufacturing Process (Use additional sheets if necessary):
Standard spray drying method, see video.

▲ Toxicity/Hazards/Classification: Naturally occurring substance. Non-toxic. Exempt from tolerance.

▲ Comments/Additional Information (Use additional sheets if necessary):

ALL OF THE ABOVE AND ENCLOSED INFORMATION IS COMPLETE AND ACCURATE TO THE BEST OF MY KNOWLEDGE.

Signed: ______

Date: 2/25/91

OFFICE USE

Date Received ______ Review Date ______ Response Date ______

Action Taken: ___ A ___ R ___ P ___ Incomplete Information

SECTION 4 - REACTIVITY HAZARD DATA

STABILITY ☐ Stable ☐ Unstable

Conditions To Avoid: AVOID GETTING WET OR MOIST UNTIL USE AS PRODUCT WILL BE RENDERED USELESS

Incompatibility (Materials to Avoid): N/A

Hazardous Decomposition Products: N/A

HAZARDOUS POLYMERIZATION ☐ May Occur ☒ Will Not Occur

Conditions To Avoid: AVOID GETTING WET PRIOR TO USE

SECTION 5 - HEALTH HAZARD DATA

PRIMARY ROUTES OF ENTRY ☒ Inhalation ☒ Skin Absorption ☐ Ingestion ☐ Not Hazardous

CARCINOGEN LISTED IN N/A ☐ NTP ☐ IARC Monograph ☐ OSHA ☒ Not Listed

HEALTH HAZARDS Acute / Chronic: PROLONGED EXPOSURE TO DUST MAY CAUSE AN ALLERGIC REACTION OR MUCOUS BUILD-UP IN EYES, NOSE AND THROAT. THIS IS A TEMPORARY, TYPICAL REACTION TO ANY FOREIGN PROTEINS.

Signs and Symptoms of Exposure: AS ABOVE

Medical Conditions Generally Aggravated by Exposure: AS ABOVE

EMERGENCY FIRST AID PROCEDURES - Seek medical assistance for further treatment, observation and support if necessary.

Eye Contact: EYE PROTECTION FOR DUST RECOMMENDED

Skin Contact: USE GLOVES IF SENSATIVE TO PROTEIN

Inhalation: APPROVED DUST MASK

Ingestion: N/A

SECTION 6 - CONTROL AND PROTECTIVE MEASURES

Respiratory Protection (Specify Type): APPROVED DUST MASK

Protective Gloves: IF SENSATIVE TO PROTEIN

Eye Protection: RECOMMENDED

VENTILATION TO BE USED ☐ Local Exhaust ☒ Mechanical (general) ☒ Special AIR SCRUBBER ☐ Other (specify)

Other Protective Clothing and Equipment:

Hygienic Work Practices: STORE IN COOL, DRY PLACE. WASH SKIN WITH SOAP & WATER; FLUSH EYES WITH WATER AFTER WORKING WITH PRODUCT

SECTION 7 - PRECAUTIONS FOR SAFE HANDLING AND USE / LEAK PROCEDURES

Steps to be Taken if Material is Spilled Or Released: FLUSH AREA AFFECTED WITH WATER

Waste Disposal Methods: ORGANIC WASTE

Precautions to be Taken in Handling and Storage: STORE IN COOL DRY PLACE

Other Precautions and/or Special Hazards

IF ACCIDENTALLY SPILLED, SWEEP DRY IF POSSIBLE OR FLUSH WITH WATER.

NFPA Rating* Health___ Flammability___ Reactivity___ Special___

HMIS Rating* Health___ Flammability___ Reactivity___ Personal Protection___

*Optional

CALIFORNIA SPRAY DRY CO.
4221 E. MARIPOSA ROAD
P.O. BOX 5035
STOCKTON, CA 95205
FAX: 209-948-0629

FACSIMILE TRANSMITTAL SHEET

TO: JOHN LUND	FROM: PARVIN SINGH PH: 209-644-8207
COMPANY:	DATE: 2/11/2005
FAX NUMBER:	TOTAL NO. OF PAGES INCLUDING COVER: 3
PHONE NUMBER:	SENDER'S REFERENCE NUMBER:
RE: MSDS T/F BLOOD	YOUR REFERENCE NUMBER:

☐ URGENT ☑ FOR REVIEW ☐ PLEASE COMMENT ☐ PLEASE REPLY ☐ PLEASE RECYCLE

NOTES/COMMENTS:

WHEAT FLOUR

SECTION V - HEALTH HAZARD DATA

THRESHOLD LIMIT VALUE	Unknown as edible food product; 10 mg/m^3 total dust or 5 mg/m^3 respirable dust as nuisance particulate.
EFFECTS OF OVEREXPOSURE	unknown as edible food product; reduced visibility, unpleasant deposits in eyes, ears, nose as nuisance particulate.
EMERGENCY AND FIRST AID PROCEDURES	None required. If extremely dusty conditions are encountered, as in any fine powder condition, wear face mask.

SECTION VI - REACTIVITY DATA

STABILITY	UNSTABLE		CONDITIONS TO AVOID 1. The formation of a nuisance particulate dust cloud. 2. The formation of an explosible dust cloud and a simultaneous ignition source.
	STABLE	X	
INCOMPATABILITY *(Materials to avoid)*	None		
HAZARDOUS DECOMPOSITION PRODUCTS	N/A		
HAZARDOUS POLYMERIZATION	MAY OCCUR		CONDITIONS TO AVOID N/A
	WILL NOT OCCUR	X	

SECTION VII - SPILL OR LEAK PROCEDURES

STEPS TO BE TAKEN IN CASE MATERIAL IS RELEASED OR SPILLED	Clean up spill, avoid moisture (Will make glue, subsequently difficult to remove).
WASTE DISPOSAL METHOD	Landfill or similar method; material is biodegradable. Follow federal, state, or local regulations.

SECTION VIII - SPECIAL PROTECTION INFORMATION

RESPIRATORY PROTECTION *(Specify type)*	If necessary, use face mask; i.e 3M #8710 or similar			
VENTILATION	LOCAL EXHAUST	N/A	SPECIAL	N/A
N/A	MECHANICAL *(General)*	N/A	OTHER	N/A
PROTECTIVE GLOVES	None	EYE PROTECTION	If necessary, goggles.	
OTHER PROTECTIVE EQUIPMENT	Avoid direct contact with the skin as much as possible.			

SECTION IX - SPECIAL PRECAUTIONS

PRECAUTIONS TO BE TAKEN IN HANDLING AND STORING	store in dry area, avoid moisture and excessive heat to maintain product quality.
OTHER PRECAUTIONS	None.

ADM
ADM MILLING COMPANY
2301 E. TRENT AVENUE
SPOKANE, WA 99202
509-534-2636
509-534-1040 FAX

Fax

To: JOHN LUND

From: DEAN HULTMAN

Fax:

Pages: 3 W/COVER

Phone: 509-574-0267.

Date: 2/18/05

Re:

CC:

☐ **Urgent** ☐ **For Review** ☐ **Please Reply**

JOHN - THIS IS MY MOST CURRENT COPY OF MSDS FOR FLOUR. I CANNOT GET A GOOD COPY ON THE SCANNER. I HOPE THE FAX WILL WORK -

- DEAN

Appendix D

QA/QC Reviews of Historical Data Sets

(No changes from December 2017 Final RI Work Plan submittal)

Appendix D1

Quality Assurance/Quality Control Review
PLSA and CES Data

resourceful. naturally.
engineering and environmental consultants
BARR

Memorandum

To: File
From: Al Gebhard and Dana Pasi – Barr Engineering
Subject: Quality Assurance /Quality Control Review – PLSA and CES data
Date: December 19, 2017
Project: Yakima Mill Site, Yakima WA

1.0 Introduction

UST removal reports were completed by PLSA Engineering (PLSA, 1990) in 1990 and by Cascade Earth Sciences, Ltd. (CES, 1993) in 1993 for work at the Yakima Mill Site (Mill Site). In addition, CES prepared a report titled Independent Assessment of Site Hazards Associated with Ethylene Glycol Release in 1994 (CES, 1994) also for the Mill Site.

Because these reports were not prepared under Ecology oversight at Barr and Barr desires to use this data in an RI being planned for the Mill Site, Barr conducted a quality assurance/quality control (QA/QC) review of the analytical data in these reports. The objective of this memorandum is to establish the usability of this data for the purposes of the RI Work Plan (RI Work Plan) that Barr and Fulcrum Environmental Consulting, Inc. (Fulcrum) are preparing for the Mill Site.

New data to be collected by Barr and Fulcrum under the RI Work Plan will be subjected to QA/QC review to confirm usability as provided in the SAP/QAPP for the project.

This memorandum summarizes Barr's QA/QC review of the analytical data from the UST removals and ethylene glycol release investigations at the Mill Site. In addition, this memorandum presents a comparison of the detection limits (referred to as Practical Quantitation Limits - PQLs) associated with these data sets to the current standard cleanup levels potentially applicable to the Mill Site (i.e., Washington State Department of Ecology (Ecology) Model Toxics Control Act (MTCA) Method A and B).

The remainder of this memorandum is organized as follows:

- Section 2 – A summary of Barr's QA/QC review of the analytical data in the three reports.
- Section 3 – A comparison of the detection limits reported for the three data sets to the current standard cleanup levels potentially applicable to the Mill Site (i.e., MTCA A and MTCA B).

- Section 4 – An evaluation of the data that can be relied upon to judge conformance with standard MTCA cleanup levels for the Mill Site, given the QA/QC review, detection limit comparison and planned investigation activities that will be conducted under the RI Work Plan.

2.0 Data Review

The data sets include soil and water samples with total petroleum hydrocarbon (TPH) and volatile organic compound (VOC) results. Barr performed a QA/QC review of the analytical data sets. Barr's QA/QC review was performed in accordance with Barr's Standard Operating Procedures (SOPs) for data evaluation. Barr's QA/QC SOPs are based on the quality assurance elements in The National Functional Guidelines for Organic and Inorganic Data Review (NFG USEPA 2008 and 2010) and are consistent with a Level 2a review. Per USEPA (2009), a Level 2a review is a verification and validation based on completeness and compliance checks of sample receipt conditions and sample-related QC results.

The areas typically covered by the Barr QA/QC evaluation process are:

- USEPA-recommended holding times and preservation
- Blank sample analyses
- Accuracy data
- Precision data
- Overall assessment of data quality

2.1 PLSA 1990 – 1989 UST Removal Report

The analyses of soil and water samples collected during the UST removal in 1989 at the Mill Site were performed by Sound Analytical Services and AmTest that were located in Tacoma, Washington and Redmond, Washington respectively.

The USEPA-recommended holding times were met for all analyses. A laboratory method blank sample was analyzed for VOCs and reported with the soil samples for VOCs. No target analytes were detected in that blank sample.

There was no review of accuracy and precision data as none was provided in the laboratory reports.

The QA/QC review indicates that the data are acceptable without qualification based on the information provided.

2.2 CES 1993 – 1993 UST Removal Report

The analyses of soil samples for TPHs collected during the 1993 UST removal at the Mill Site were performed by Pacific Environmental Laboratory that was located in Beaverton, Oregon.

The USEPA-recommended holding times were met for the TPH analyses. A laboratory method blank sample was analyzed and reported with the soil samples. No target analytes were detected in the blank sample.

The review of the accuracy and precision involved the information that was provided in the laboratory reports. Accuracy was evaluated by comparing surrogate standard recoveries to general laboratory acceptance criteria. Surrogates are similar to the analytes of interest in terms of their chemical composition, extraction, and chromatography but are not typically found in environmental samples. The surrogate recoveries were included in the laboratory reports and met general laboratory acceptance criteria.

The QA/QC review indicates that the data are acceptable without qualification.

2.3 CES 1994 – 1994 Ethylene Glycol Release Report

The analyses of soil and groundwater samples for ethylene glycol collected during the investigation of the ethylene glycol release event in 1993 at the Mill Site were performed by Oregon Analytical Laboratory that was located in Beaverton, Oregon.

The USEPA-recommended holding times were met for the ethylene glycol analyses.

The review of the accuracy and precision data involved the information that was provided in the laboratory reports. Accuracy was evaluated by comparing surrogate standard recoveries to general laboratory acceptance criteria. The surrogate recoveries included with the ethylene glycol analyses met general laboratory acceptance criteria.

The QA/QC review indicates that the data are acceptable without qualification.

3.0 PQLs Compared to MTCA A and B Cleanup Levels

The soil and groundwater sample PQLs (i.e. reported detection limits) included with the above data reports from the Mill Site were compared against the current standard MTCA cleanup levels potentially applicable for the Mill Site (i.e., Method A and Method B).

3.1 PLSA 1990 – 1989 UST Removal Report

PQLs for the soil samples and the groundwater samples are in Table 1. The following anlaytes had PQLs for some samples above the lowest current applicable MTCA Method A and MTCA Method B standard cleanup level. As noted above, under WAC 173-340-700(6)(d), this does not, in and of itself, mean that the data are not reliable or relevant to investigation and cleanup activities.

For soil:

- All PQLs were below the lowest MTCA cleanup level.

For groundwater:

- The PQL for the TPH analyses (10 mg/l) was above the lowest standard cleanup level (0.5 mg/l) for all tested samples as shown in Table 1. The assumed cleanup level is for TPH as diesel range organics as that is the most restrictive and the TPH in the laboratory report did not specify which specific TPH range was reported.

All of the data is acceptable to judge conformance with MTCA cleanup levels with the exception noted above for groundwater. The TPH groundwater data will not be relied upon to judge conformance with MTCA cleanup levels but it does inform Mill Site conditions within the constraints of the PQL that was used.

3.2 CES 1993 – 1993 UST Removal Report

PQLs for the soil samples in this report are shown in Table 2. The TPH analyses had a PQL below the lowest applicable MTCA Method A and MTCA Method B standard cleanup level.

All of the data can be relied on to judge conformance with MTCA cleanup levels.

3.3 CES 1994 – 1994 Ethylene Glycol Release Report

PQLs for the soil samples and the groundwater samples are in Table 3. Ethylene glycol was the only analyte in this data set. Ethylene glycol had a PQL above the lowest applicable MTCA Method A and MTCA Method B standard cleanup level for groundwater. As noted above, under WAC 173-340-700(6)(d), this does not, in and of itself, mean that the data are not reliable or relevant to investigation and cleanup activities.

For soil:

- The PQL was below the lowest MTCA cleanup level.

For groundwater:

- The PQL for ethylene glycol (25 mg/l) is slightly above the lowest standard cleanup level (16 mg/l) for all tested samples.

4.0 Conclusions

Barr conducted a QA/QC review of the soil and groundwater analytical data sets in the above referenced reports to evaluate the usability of the data for the purposes of the RI Work Plan for the Site being prepared by Barr and Fulcrum. In general, the QA/QC review showed that the data are considered acceptable as qualified.

4.1 PLSA 1990 – 1989 UST Removal Report

All soil data from the PLSA UST Removal Report (PLSA, 1990) can be used for judging conformance with MTCA cleanup levels during investigation and cleanup activities based on the results of the QA/QC review and the PQL comparison to cleanup levels.

For groundwater, the PQL for TPH in both water samples was above the lowest MTCA cleanup levels. This data will not be relied upon for judging conformance with MTCA cleanup levels in development of the RI Work Plan. Groundwater sampling in this area will be used in the Mill Site RI to determine if releases of TPHs have occurred to soil or groundwater in this area.

4.2 CES 1993 – 1993 UST Removal Report

All data from the CES UST Removal Report (CES, 1993) can be used for judging conformance with MTCA cleanup levels during investigation and cleanup activities based on the results of the QA/QC review and the PQL comparison to cleanup levels.

4.3 CES 1994 – 1994 Ethylene Glycol Release Report

All soils data from the CES Ethylene Glycol Release Report (CES, 1994) can be used for judging conformance with MTCA cleanup levels during investigation and cleanup activities based on the results of the QA/QC review and the PQL comparison to cleanup levels.

The PQL for ethylene glycol in the groundwater sample was slightly above the lowest MTCA cleanup levels. It is concluded that this data can still be relied upon for judging conformance with the MTCA cleanup level since the soil data showed no detectable ethylene glycol, there was no field evidence of ethylene glycol and the PQL is close to the current clean-up level.

5.0 References

CES 1993. *Underground Storage Tank Site Assessment, Boise Cascade Corporation, Yakima Washington.* Cascade Earth Sciences, Ltd. December.

CES 1994. *Independent Assessment of Site Hazards Associated with Ethylene Glycol Release, Boise Cascade Corporation, Yakima Washington.* Cascade Earth Sciences, Ltd. January.

Ecology Rev. 2013. *Model Toxics Control Act (MTCA) Regulation and Statute*. Publication No. 94-06, Revised 2013, Washington Department of Ecology,

USEPA 2009. United States Environmental Protection Agency (USEPA), 2009. *Guidance for Labeling Externally Validated Laboratory Analytical Data for Superfund Use.* EPA QA/R-5. OSWER No. 9200.1-85 EPA 540-R-08-005

NFG, USEPA 2008 and 2010. United States Environmental Protection Agency (USEPA), 2008. *USEPA Contract Laboratory Program National Functional Guidelines for Superfund Organic Methods Data Review*. EPA QA/R-5. 2008: United States Environmental Protection Agency (USEPA), 2010. *USEPA Contract Laboratory Program National Functional Guidelines for Superfund Inorganic Methods Data Review*. EPA QA/R-5. 2010

PLSA 1990. *Underground Tank Removal, Boise Cascade, Yakima WA*. PLSA Engineering & Surveying. January 3.

6.0 Attachments

Table 1 – Historical Soil and Groundwater Data Review – PLSA Data vs MTCA Cleanup Levels

Table 2 – Historical Soil Data Review – CES Soil Data vs MTCA Cleanup Levels

Table 3 – Historical Soil and Groundwater Data Review – CES Data vs MTCA Cleanup Levels

Barr Data Evaluation Standard Operating Procedures (SOPs)

Table 1
Historical Soil and Groundwater Data Review - PLSA Data vs. MTCA Cleanup Levels
Underground Tank Removal Report PLSA, January 1990
Yakima Mill Site

Soil Samples

				Location	**Tank #1 1S**		**Tank #1 1N**		**Tank #3 3SW**		**Tank #3 3E**		**Tank #3 3N**		**Tank #4 4W2**		**Tank #4 4E2**		**2E**		**2W**	
				Date	**12/21/1989**		**12/21/1989**		**12/21/1989**		**12/21/1989**		**12/21/1989**		**12/21/1989**		**12/21/1989**		**12/14/1989**		**12/14/1989**	
				Sample Type	**N**		**N**		**N**		**N**		**N**		**N**		**N**		**N**		**N**	
				Result Type	**PQL**	**Result**	**PQL**	**Result**	**PQL**	**Result**	**PQL**	**Result**	**PQL**	**Result**	**PQL**	**Result**	**PQL**	**Result**	**PQL**	**Result**	**PQL**	**Result**
				Data Status	**SSource**	**SSource**	**SSource**	**SSource**	**SSource**	**SSource**	**SSource**	**SSource**	**SSource**	**SSource**	**SSource**	**SSource**	**SSource**	**SSource**	**SSource**	**SSource**	**SSource**	**SSource**
Parameter	Units	Washington Method A Unrestricted Land Use	Washington Method B Cancer Direct Contact	Washington Method B Noncancer Direct Contact																		
Effective Date		07/01/2015	07/01/2015	07/01/2015																		
Exceedance Key		No Exceedances	No Exceedances	No Exceedances																		
Total Petroleum Hydrocarbons																						
Total Petroleum Hydrocarbons	mg/kg	30.0 (1)			10	ND	10	ND	10	ND	10	ND	10	ND	10	ND	10	ND	--	--	--	--
VOCs																						
Benzene	ug/kg	30.0	18200	320000	--	--	--	--	--	--	--	--	--	--	--	--	--	--	5	ND	5	ND
Ethyl benzene	ug/kg	6000		8000000	--	--	--	--	--	--	--	--	--	--	--	--	--	--	5	ND	5	ND
Toluene	ug/kg	7000		6400000	--	--	--	--	--	--	--	--	--	--	--	--	--	--	5	ND	5	ND
Xylene, m & p	ug/kg	9000 (2)		16000000	--	--	--	--	--	--	--	--	--	--	--	--	--	--	5	ND	5	ND
Xylene, o	ug/kg	9000 (2)		16000000	--	--	--	--	--	--	--	--	--	--	--	--	--	--	5	ND	5	ND

Groundwater Samples

				Location	**Tank #3 3S**		**Tank #4 4W3**	
				Date	**12/28/1989**		**12/28/1989**	
				Sample Type	**N**		**N**	
				Result Type	**PQL**	**Result**	**PQL**	**Result**
				Data Status	**SSource**	**SSource**	**SSource**	**SSource**
Parameter	Units	Washington GW Method A	Washington Groundwater Method B Cancer	Washington Groundwater Method B Noncancer				
Effective Date		07/01/2015	07/01/2015	07/01/2015				
Exceedance Key		**Bold**	No Criteria	No Criteria				
Total Petroleum Hydrocarbons								
Total Petroleum Hydrocarbons	mg/l	**0.5 (3)**			**10**	ND	**10**	ND

-- Not analyzed.
(1) Represents the cleanup level for TPH (gasoline range organics; benzene present) as that is the most restrictive.
(2) Represents the cleanup for Xylenes, total.
(3) Represents the cleanup for TPH (diesel range organics) as that is the most restrictive.
N: Normal Sample.
ND: Not detected.
PQL: Practical Quantitation Limit.
SSource: Laboratory and/or field data obtained from a secondary source external to Barr. Second source QA/QC evaluation procedures may or may not have been performed beyond the original data generator.

Table 2
Historical Soil Data Review - CES Soil Data vs. MTCA Cleanup Levels
Underground Storage Tank Site Assessment CES, December 1993
Yakima Mill Site

				Location	101		102		103	
				Date	11/29/1993		11/29/1993		11/29/1993	
				Sample Type	N		N		N	
				Result Type	PQL	Result	PQL	Result	PQL	Result
				Data Status	SSource	SSource	SSource	SSource	SSource	SSource
Parameter	Units	Washington Method A Unrestricted Land Use	Washington Method B Cancer Direct Contact	Washington Method B Noncancer Direct Contact						
Effective Date		07/01/2015	07/01/2015	07/01/2015						
Exceedance Key		No Exceedances	No Criteria	No Criteria						
Total Petroleum Hydrocarbons										
Total Petroleum Hydrocarbons (as diesel)	mg/kg	2000			50	ND	50	ND	50	ND
Total Petroleum Hydrocarbons (as gasoline)	mg/kg	30 (1)			20	ND	20	ND	20	ND
Total Petroleum Hydrocarbons (heavy/bunker)	mg/kg	2000			100	ND	100	ND	100	ND

(1) Represents the cleanup level for TPH (gasoline range organics; benzene present) as that is the most restrictive.

N: Normal Sample.

ND: Not detected.

PQL: Practical Quantitation Limit.

SSource: Laboratory and/or field data obtained from a secondary source external to Barr. Second source QA/QC evaluation procedures may or may not have been performed beyond the original data generator.

Table 3
Historical Soil and Groundwater Data - CES Data vs. MTCA Cleanup Levels
Ethylene Glycol Release CES 1994, December 1993
Yakima Mill Site

Soil Samples

				Location	BCC/Y/1		BCC/Y/2		BCC/Y/3		BCC/Y/4	
				Date	11/29/1993		11/29/1993		11/29/1993		11/29/1993	
				Sample Type	N		N		N		N	
				Result Type	PQL	Result	PQL	Result	PQL	Result	PQL	Result
				Data Status	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource
Parameter	Units	Washington Method A Unrestricted Land Use	Washington Method B Cancer Direct Contact	Washington Method B Noncancer Direct Contact								
Effective Date		07/01/2015	07/01/2015	07/01/2015								
Exceedance Key		No Criteria	No Criteria	No Exceedances								
VOCs												
Ethylene Glycol	mg/kg			160000	25	ND	25	ND	25	ND	25	ND

Groundwater Samples

				Location	BCC/Y/1W		BCC/Y/2W		BCC/Y/4W		BCC/Y/P1 (log pond water)	
				Date	11/29/1993		11/29/1993		11/29/1993		11/29/1993	
				Sample Type	N		N		N		N	
				Result Type	PQL	Result	PQL	Result	PQL	Result	PQL	Result
				Data Status	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource
Parameter	Units	Washington GW Method A	Washington Groundwater Method B Cancer	Washington Groundwater Method B Noncancer								
Effective Date		07/01/2015	07/01/2015	07/01/2015								
Exceedance Key		No Criteria	No Criteria	Border								
VOCs												
Ethylene Glycol	mg/l			16	25	ND	25	ND	25	ND	25	ND

N: Normal Sample.

ND: Not detected.

PQL: Practical Quantitation Limit.

SSource: Laboratory and/or field data obtained from a secondary source external to Barr. Second source QA/QC evaluation procedures may or may not have been performed beyond the original data generator.

Standard Operating Procedure

Routine Level Semivolatile Organic Compounds (SVOC), Polycyclic Aromatic Hydrocarbons (PAH), Diesel Range Organics (DRO), and Total Petroleum Hydrocarbons (TPH) Data Evaluation

Revision 6

January 19, 2016

Approved By:

Michael Dupay			01/19/16
Print	Technical Reviewer	Signature	Date
Terri Olson		Terri A. Olson	01/19/16
Print	QA Manager	Signature	Date

Review of the SOP has been performed and the SOP still reflects current practice.

Initials: ____________ Date: ____________

Initials: ____________ Date: ____________

Initials: ____________ Date: ____________

Initials: ____________ Date: ____________

Minneapolis, MN ● Hibbing, MN ● Duluth, MN ● Ann Arbor, MI ● Jefferson City, MO ● Bismarck, ND ● Calgary, AB, Canada ● Grand Rapids, MI ● Salt Lake City, UT

Routine Level Semivolatile Organic Compounds (SVOC), Polycyclic Aromatic Hydrocarbons (PAH), Diesel Range Organics (DRO), and Total Petroleum Hydrocarbons (TPH) Data Evaluation

1.0 Scope and Applicability

This SOP is intended as a guidance SOP for the routine level evaluation of semivolatile organic compounds data provided by laboratories to be used in Barr Engineering Company (Barr) projects.

This SOP is based on quality assurance elements, not the specific criteria, of *USEPA Contract Laboratory Program National Functional Guidelines (NFG) for Organic Data* and applies to routine SVOC (including PAHs and phenols), TPH at various carbon ranges (e.g., TPH as fuel oil, TPH as motor oil, TPH as jet fuel), and DRO data evaluation for analyses by the following technologies:

- Gas Chromatography/Flame Ionization Detector (GC/FID)
    - Method examples: EPA 8015, EPA 8100, WI DRO
- Gas Chromatography/Mass Spectrometry (GC/MS)
    - Method example: EPA 625, EPA 8270
- Gas Chromatography/Mass Spectrometry-Selective Ion Monitoring (GC/MS-SIM)
    - Method example: EPA 8270
- High Performance Liquid Chromatography (HPLC)
    - Method example: EPA 610, EPA 8310
- Methods above with Toxicity Characteristic Leachate Procedure (TCLP), EPA 1311
- Methods above with Synthetic Precipitation Leachate Procedure (SPLP), EPA 1312

In the case of specific technologies and/or methods not listed above, the guidelines within this document will provide the basis upon which to make adequate professional judgment in the evaluation of data submitted for review.

The recommended procedures in this SOP should be followed unless conditions make it impractical or inappropriate to do so. Modifications should be noted in the applicable documentation and communicated to appropriate personnel. Significant changes may result in a revision or newly created SOP.

2.0 Limitations

- Level IV data evaluation is not covered in this SOP and should be performed in accordance with NFG or project specific requirements.

3.0 Responsibilities

The laboratory is responsible for generating data from the samples submitted for analysis. In instances where QC criteria are not met for the analysis of samples, the laboratory is responsible for reanalysis of the samples, provided reanalysis is possible (considering matrix interference, holding times and sample volume, etc.), or documenting the impact to the data.

The Data Quality Specialist is responsible for evaluating the data in accordance with this document, in addition to using professional judgment where necessary or appropriate. Project specific requirements, such as those specified in a Quality Assurance Project Plan (QAPP) or Sampling and Analysis Plan (SAP), may differ from these recommendations and professional judgment should be applied before qualifying any data.

4.0 Procedure

The Quality Assurance/Quality Control (QA/QC) data detailed below are the most typical found in a routine level laboratory report. Other QA/QC data may be provided by the laboratory within the laboratory report case narrative, data qualifiers, or cover sheet and should be evaluated using professional judgment (e.g., initial calibration, calibration verification, internal standards).

Definitions to common QA/QC terms and terms used within this SOP along with a list of Barr 'Data Qualifiers/Footnotes' that may be applied during review can be found in Barr's "Compendium of Data Quality Assessment Documentation".

4.1 Holding Time and Preservation

The purpose of holding time and preservation evaluation is to ascertain the validity of the analytical results based on the sample condition, preservation, and time elapsed between the date of sample collection and date of analysis.

40 CFR Part 136, WI GRO method, and the *Test Methods for Evaluating Solid Waste (SW-846)* are used as guidance for the recommended holding time and preservation acceptance criteria listed in *Table 1*.

Table 1 – Recommended Holding Times and Preservation

Compound	Matrix	Temp.	Preservative	Maximum Hold Time
SVOC/PAH/TPH	Aqueous	≤6° C	Ice	7 days extraction/ addl. 40 days analysis
	Sediment/Soil	≤ 6° C	Ice	14 days extraction/ addl. 40 days analysis
DRO	Aqueous	≤ 6° C	Ice, HCl < 2 pH	7 days extraction/ 47 days collection to analysis
	Sediment/Soil	≤ 6° C	Ice	10 days solvent addition/ 47 days collection to extraction and analysis
TCLP SVOC	Various	--	NA	14 days TCLP extraction/ 7 days extraction/ addl. 40 days analysis

If samples do not meet holding time, preservation and analysis recommendations in *Table 1*, consider qualification with an "**h**". Other matrices, such as product samples (e.g. oil, waste rock, drill cores) may not be subjected to the same holding time recommendations.

If the sample was stored on ice upon collection and delivered to the laboratory the same day, the sample may exceed recommended temperature at the time of laboratory receipt. Professional judgment should be applied (considering temperature, matrix, magnitude of the exceedance, etc.) when evaluating the application of qualifiers when criteria are not met.

4.2 Blank Samples

Blank sample evaluation is conducted to determine the existence and magnitude of target analyte contamination as a result of activities in the field during collection and transport or from inter-laboratory sources.

- For each matrix, at least one method blank should be prepared and analyzed with each sample delivery group (SDG). Evaluation pertains to the batch of samples analyzed with the method blank.
- Field or equipment blank collection and analysis frequency is project specific. Evaluation pertains to the field samples associated with the field or equipment blank.
- Blank analyses may not have involved the same weights, volumes, or dilution factors as the associated samples. It may be easier to work with the raw data and/or convert the data to the same units for comparison purposes.

Table 2 – Guidelines for Blank Contamination

Sample Result	Recommended Action for Associated Data
Non-detect	No action required
< 5x blank concentration	Qualify with 'b'
≥ 5x blank concentration	Use professional judgment

b = Reported value may be a potential false positive based on blank data evaluation procedures

Note: Other multipliers of the blank contamination may be used based on professional judgment (reporting to the MDL, common lab contaminant, etc.)

Professional judgment regarding the usability of the data should be used in cases where gross detections of target analytes are found in the blank sample. A number of factors may be considered including historical data, prior knowledge of the site conditions, target analytes involved, type of blank sample, etc. In such cases, it may be appropriate to qualify the affected data with '*****' (estimated value, QA/QC criteria not met) or '******' (unusable value, QA/QC criteria not met).

4.3 Deuterated Monitoring Compounds (DMC) and Surrogates

DMCs are isotopically labeled (deuterated) analogs of native target compounds. DMCs are only used for the SVOC GC/MS analysis. *Table 3* presents the recommended DMCs with their associated target compounds.

Table 3 – DMC and Associated Target Compounds

DMC (alphabetical)	Associated Target Compounds	
2,4-Dichlorophenol-d_3	2,4-Dichlorophenol Hexachlorobutadiene 4-Chloro-3-methylphenol 2,4,6-Trichlorophenol	2,4,5-Trichlorophenol 1,2,4,5-Tetrachlorobenzene Pentachlorophenol 2,3,4,6-Tetrachlorophenol
2-Chlorophenol-d_4	2-Chlorophenol	
2-Nitrophenol-d_4	Isophorone	2-Nitrophenol
4-6-Dinitro-2-methylphenol-d_2	4,6-Ditritro-2-methylphenol	
4-Chloroaniline-d_4	4-Chloroaniline Hexachlorocyclopentadiene	3,3′-Dichlorobenzidine
4-Methylphenol-d_8	2-Methylphenol 4-Methylphenol	2,4-Dimethylphenol
4-Nitrophenol-d_4	2-Nitroaniline 3-Nitroaniline 2,4-Dinitrophenol	4-Nitrophenol 4-Nitroaniline
Acenaphthylene-d_8	Naphthalene 2-Methylnaphthalene 2-Chloronapthalene	Acenaphthylene Acenaphthene
Anthracene-d_{10}	Hexachlorobenzene Atrazine	Phenanthrene Anthracene
Benzo(a)pyrene-d_{12}	Benzo(b)fluoranthene Benzo(k)fluoranthene Benzo(a)pyrene	Indeno(1,2,3-cd)pyrene Dibenzo(a,h)anthracene Benzo(g,h,i)perylene
Bis-(2-chloroethyl) ether-d_8	Bis-(2-chloroethyl) ether 2,2′-oxybis(1-chloropropane)*	bis(2-Choloethoxy) methane
Dimethylphthalate-d_6	Caprolactum 1,1′-Biphenyl Dimethylphthalate Diethylphthalate	Di-n-butylphthalate Butylbenzylphthalate bis(2-ethylhexyl)phthalate Di-n-octylphthalate
Fluorene-d_{10}	Dibenzofuran Fluorene 4-Chlorophenyl-phenylether	4-Bromophenyl-phenylether Carbazole
Nitrobenzene-d_5	Acetophenone N-Nitroso-di-n-propylamine Hexachloroethane Nitrobenzene	2,6-Dinitrotoluene 2,4-Dinitrotoluene N-Nitrosdiphenylamine

(Table 3 continued on next page)

Table 3 – DMC and Associated Target Compounds		
DMC (alphabetical)	**Associated Target Compounds**	
Phenol-d_5	Benzaldehyde	Phenol
Pyrene-d_{10}	Fluoranthrene Pyrene	Benzo(a)anthracene Chrysene
SIM DMC and Associated Target Compounds		
Fluoranthene-d_{10}	Fluoranthene Pyrene Benzo(a)anthracene Chrysene Benzo(b)fluoranthene	Benzo(k)fluoranthene Benzo(a)pyrene Indeno(1,2,3-cd)pyrene Dibenzo(a,h)anthracene Benzo(g,h,i)perylene
2-Methylnaphthalene-d_{10}	Naphthalene 2-Methylnaphthalene Acenaphthylene Acenaphthene	Fluorene Pentachlorophenol Phenanthrene Anthracene

* = Bis(2-chloroisopropyl)ether

Surrogates are similar to analytes of interest in chemical composition, extraction, and chromatography but are not typically found in environmental samples. Other DMC or surrogates may be used by a laboratory based on their experience provided adequate chromatographic separations can be demonstrated. All samples (blanks, spiked samples, project samples, QC samples) should contain DMC or surrogates. If a sample does not contain DMC or surrogates or the method does not require surrogates (WI DRO), professional judgment should be used to determine if the reported results are useable or not. Acceptable evaluation of DMC or surrogate spikes may not be applicable if dilution of the sample was required. Percent recoveries are calculated for each DMC or surrogate and these are evaluated based on the criteria within the laboratory report or project specific requirements. If criteria are not reported, use guidance found in the NFG, if available. Percent recoveries are calculated using the equation provided under accuracy in 'Definitions' from Barr's "Compendium of Data Quality Assessment Documentation".

For the WI DRO analysis, surrogates are not required by the method. If used, the method requires that the surrogates must not elute within the WI DRO window (C_{10}-C_{28}). If the laboratory report includes a surrogate spike recovery for WI DRO, use professional judgment to assess the data.

Table 4 includes guidance to evaluate the surrogate recovery where a single surrogate is analyzed.

Table 4 – Guidelines for Single DMC or Surrogate		
Criteria	**Recommended Action for Associated Data**	
	Detect	**Non-Detect**
%R > Upper Limit	Qualify with ‘*’	No qualification
%R < Lower Limit	Qualify with ‘*’ or ‘**’, use professional judgment	
%R within Limits	No qualification	

‘*’ = reported value is estimated and QA/QA criteria were not met
‘**’ = reported value is unusable and QA/QC criteria were not met

Table 5 includes guidance where multiple surrogates are analyzed per analytical fraction.

Table 5 – Guidelines for Multiple DMC or Surrogates		
Criteria	**Recommended Action for Associated Data**	
	Detect	**Non-Detect**
One %R < Lower Limit	No qualification may be necessary, use professional judgment	
Two or more %R < Lower Limit	Qualify with ‘*’ or ‘**’, use professional judgment	
Two or more %R > Upper Limit	Qualify fraction with ‘*’	No qualification
One %R > Upper Limit	No qualification may be necessary, use professional judgment	No qualification
All %R within Limits	No qualification	

‘*’ = reported value is estimated and QA/QA criteria were not met
‘**’ = reported value is unusable and QA/QC criteria were not met

4.4 Laboratory Control Samples (LCS) and Laboratory Control Sample Duplicate Samples (LCSD)

The laboratory control sample is used to monitor the overall performance of each step during analysis, including sample preparation. The LCS should be analyzed:

- Once every preparation batch (20 or less samples of the same matrix - WI DRO requires an additional LCSD analyzed at the end of 20 samples).
- Once for each matrix.

Laboratory control samples may contain all target compounds or a subset (see *Table 6* for guidance) and the percent recoveries are evaluated based on the criteria within the laboratory report or project specific requirements. If criteria are not available, use guidance found in the NFG. Percent recoveries are calculated for accuracy and the relative percent difference (RPD) is calculated for precision (when an LCSD was analyzed). Accuracy and precision equations can be found in ‘Definitions’ from Barr’s “Compendium of Data Quality Assessment Documentation”.

Table 6 – Number of Suggested Target Compounds - LCS/LCSD and MS/MSD

Number of Target Parameters	Number of Spiked Compounds
1-10 analytes	Spike all compounds
11-20 analytes	At least 10 compounds or 80% of all analytes, whichever is greater
More than 20 analytes	Spike at least 16 compounds

Table 7 – Guidelines for Laboratory Control Samples

Criteria	Recommended Action for Associated Data	
	Detect	Non-Detect
%R and RPD > Upper Limit	Qualify with '*'	No qualification
%R < Lower Limit	Qualify with '*' or '**', use professional judgment	
%R and RPD within Limits	No qualification	

* = Reported value is estimated and QA/QC criteria were not met
** = Reported value is unusable and QA/QC criteria were not met

4.5 Laboratory Duplicate Samples

Laboratory duplicate samples are separate aliquots of field samples analyzed to demonstrate acceptable method precision by the laboratory at the time of analysis. Field blanks and proficiency testing (PT) samples should not be used for duplicate analysis. The RPDs are calculated using the equation as provided in 'Definitions' from Barr's "Compendium of Data Quality Assessment Documentation" and are not calculated where data are already qualified with b, U, <, or **. RPD results are dependent on the homogeneity of the samples.

Duplicates should be analyzed (whichever is more frequent):

- One from each matrix (soil or water)
- One from each SDG

The MS/MSD duplicate pairs may be substituted for laboratory duplicates.

Laboratory acceptance criteria or project specific requirement are used to evaluate RPDs. If criteria are not available, use guidance found in NFG or use professional judgment when considering qualification of associated results.

Higher RPDs are expected when results are at or near the reporting limits and are not always indicative of poor precision. RPDs are typically only evaluated for samples where both the native and duplicate sample concentrations are greater than five times (>5x) the RL. In cases where either of the samples (native or duplicate) is non-detect for a parameter and the other corresponding sample has detectable

concentrations much greater than five times (>5x) the RL, professional judgment should be used to determine if qualification is appropriate.

Table 8 – Guidelines for Laboratory Duplicates	
% RPD	**Recommended Action for Associated Data**
RPD < Upper Limit	No action is required
RPD > Upper Limit	Both results are ≤ 5x RL, no action is required
RPD > Upper Limit	Both results are > 5x RL, consider qualifying with '*****'

* = Reported value is estimated and QA/QC criteria were not met

4.6 Field Duplicate Samples

Field duplicate samples (also known as "masked" or "blind" duplicate samples) are used to demonstrate acceptable precision and reproducibility of the field and laboratory procedures. Frequency of collection is project specific. The RPDs are calculated using the equation as provided under precision in 'Definitions' from Barr's "Compendium of Data Quality Assessment Documentation" and are not calculated where data is already qualified with b, U, <, or **. RPD results are dependent on the homogeneity of the samples.

Acceptance criteria for field duplicate samples are subject to the professional judgment of the Data Quality Specialist but typically RPDs ≤ 30% for aqueous samples and ≤ 40% for soil and sediment samples are considered acceptable unless other project specific requirements are defined.

Higher RPDs are expected when results are at or near the reporting limits and are not always indicative of poor precision. RPDs are typically only evaluated for samples where both the native and duplicate sample concentrations are greater than five times (>5x) the RL. In cases where either of the samples (native or field duplicate) is non-detect for a parameter and the other corresponding sample has detectable concentrations much greater than five times (>5x) the RL, professional judgment should be used to determine if qualification is appropriate.

4.7 Matrix Spikes (MS) and Matrix Spike Duplicate (MSD) Samples

Matrix spike samples may contain all target compounds or a subset (see *Table 6*) and provide information about the effect of each samples' matrix on the sample preparation procedures and analytical results. Matrix spikes are typically analyzed at the following frequencies:

- 1 (MS/MSD pair) in every 20 samples (does not apply to DRO in the WI method)
- 1 per preparation batch per matrix
- 1 per SDG

However, the frequency may be project specific and the documents outlining the needs of the project (SAP, QAPP, etc.) should be reviewed. In some cases, MS/MSD analysis is not required.

The percent recoveries are evaluated based on the criteria within the laboratory report or project specific requirements. If a matrix spike recovery does not meet acceptance criteria and is not associated with a project sample, no further action is required unless other systematic evidence warrants qualification.

If the native concentration of a spiked sample is significantly greater than the spike added (>4x), spike recovery cannot be accurately evaluated, therefore the criteria do not apply. Professional judgment should be used for percent recoveries nominally outside laboratory acceptance criteria prior to qualifying data.

If criteria are not available, use guidance found in the NFG. Percent recoveries of matrix spike (and matrix spike duplicate) samples should be calculated using the equation provided under accuracy in 'Definitions' from Barr's "Compendium of Data Quality Assessment Documentation".

Solid samples may have highly variable concentrations of target analytes and percent recoveries (%R) may be influenced by the sampling precision and inherent sample homogeneity. Professional judgment should be used for difficult matrices and the acceptance criteria adjusted accordingly.

Table 9 – Guidelines for Matrix Spikes

Criteria	**Recommended Action for Associated Data**	
	Detect	**Non-Detect**
%R and RPD > Upper Limit	Qualify with '*'	No qualification
%R < Lower Limit	Qualify with '*' or '**', use professional judgment	
%R and RPD within Limits	No qualification	

* = Reported value is estimated and QA/QC criteria were not met
** = Reported value is unusable and QA/QC criteria were not met

While matrix spike duplicates are not required by all methods, if results for MSD analyses are reported, evaluate the RPD for MS and MSD pairs using the equation as provided under precision in 'Definitions' from Barr's "Compendium of Data Quality Assessment Documentation".

4.8 Overall Assessment

The chain-of-custody should be reviewed to determine if the laboratory report matches the requested analyses and that project specific parameters were analyzed as requested. The narrative and other supporting documentation should be evaluated to ensure that sample condition was appropriately documented by the laboratory upon receipt. If available, historical data should be used to assist with data evaluation. Any additional anomalies should be documented and evaluated, if necessary.

5.0 Quality Control and Quality Assurance (QA/QC)

Depending on the project objectives, the data review may include the completion of a Routine Level Quality Control Report (see Barr's "Compendium of Data Quality Assessment Documentation") as part of the evaluation process. Within each QC data section, the reviewer should include references to whether the QC data met or exceeded the acceptance criteria. The qualifiers, added, removed, or retained, should be documented also. Where multiple qualifiers may be applicable to a sample/analyte result, professional judgment should be used to determine if all qualifiers are necessary or if one qualifier would be sufficient to represent the deviations. A statement as to whether the data are acceptable as reported or acceptable with qualification(s) should also be included. If revised reports are required and the revision affects the

sample results, notification should be given to the appropriate data management personnel and/or project team members.

The Data Quality Specialist will verify that the qualifiers associated with data tables match the Routine Level Quality Control Report.

6.0 Records

The Routine Level Quality Control Report should be saved to the appropriate internal Barr file and the link uploaded to the tracking system. Periodically, Data Quality staff should check for missing Routine Level Quality Control Reports in the tracking system to help maintain the most current information.

Documentation specific to this SOP are listed below and are available in Barr's "Compendium of Data Quality Assessment Documentation".

- Definitions
- Barr Qualifiers/Footnotes
- Routine Level Quality Control Report

Additional records information can be found in Barr's "Records Management System Manual".

7.0 References

Environmental Protection Agency. *Title 40 of the Code of Federal Regulations, Part 136.3.*

Environmental Protection Agency, *National Functional Guidelines for Superfund Organic Methods Data Review.*

Analytical methods listed under the 'Scope and Applicability' section of this SOP.

Attachment 1

Revision History

Revision Number	Date of Revision	Section	Revision Made
3.1	02/2009	Document Wide	Edits to references, formatting; minor language additions and corrections
		IX	Added Table 10
		Attachments	Added Attachment 3
3.2	04/2011	Document Wide	Added analytical methods to applicability section.
		Attachments	Updated Attachment 1 and 2 to include current forms.
4.0	04/06/12	Document Wide	Major revision
5.0	0601//17/13	Cover page	Added Calgary office
		I	Added waste rock and drill cores to examples of product sample
		III, IV, V, VI, VII	Added 'project specific requirements' as possible criteria source
		VI	Added 'field and laboratory procedures' to clarify that it's not only a laboratory item
		VI	Clarified field duplicate criteria as < one value and not a range
		IX	Added statement regarding multiple qualifiers
6.0	01/19/16	Document Wide	SOP restructuring, new format

Standard Operating Procedure

Routine Level Volatile Organic Compounds (VOC), Gasoline Range Organics (GRO), and Total Petroleum Hydrocarbons (TPH) Data Evaluation

Revision 6

January 15, 2016

Approved By:

Michael Dupay 01/15/16
Print Technical Reviewer Signature Date

Terri Olson Terri A. Olson 01/15/16
Print QA Manager Signature Date

Review of the SOP has been performed and the SOP still reflects current practice.

Initials: ____________ Date: ____________

Initials: ____________ Date: ____________

Initials: ____________ Date: ____________

Initials: ____________ Date: ____________

Routine Level Volatile Organic Compounds (VOC), Gasoline Range Organics (GRO), and Total Petroleum Hydrocarbons (TPH) Data Evaluation

1.0 Scope and Applicability

This SOP is intended as a guidance SOP for the routine level evaluation of VOC, GRO, and TPH data provided by laboratories to be used in Barr Engineering Company (Barr) projects.

This SOP is based on quality assurance elements, not the specific criteria, of *USEPA Contract Laboratory Program National Functional Guidelines (NFG) for Organic Data* and applies to routine VOC (including BTEX), GRO, and TPH (in the approximate gasoline carbon range, C_6-C_{10}) data evaluation for analyses by the following technologies:

- Gas Chromatography/Flame Ionization Detector (GC/FID)
  - Method examples: EPA 8015, WI GRO (GRO)
- Gas Chromatography/Photoionization Detector (GC/PID)
  - Method example: EPA 8021, WI GRO (PVOC)
- Gas Chromatography/Electrolytic Conductivity Detector (GC/ELCD)
  - Method example: EPA 8021
- Gas Chromatography/Mass Spectrometry (GC/MS)
  - Method example: EPA 624, EPA 8260
- Gas Chromatography/Mass Spectrometry-Selective Ion Monitoring (GC/MS-SIM)
  - Method example: EPA 8260
- Methods above with Toxicity Characteristic Leachate Procedure (TCLP), EPA 1311
- Methods above with Synthetic Precipitation Leachate Procedure (SPLP), EPA 1312

In the case of specific technologies and/or methods not listed above, the guidelines within this document will provide the basis upon which to make adequate professional judgment in the evaluation of data submitted for review.

The recommended procedures in this SOP should be followed unless conditions make it impractical or inappropriate to do so. Modifications should be noted in the applicable documentation and communicated to appropriate personnel. Significant changes may result in a revision or newly created SOP.

2.0 Limitations

- Level IV data evaluation is not covered in this SOP and should be performed in accordance with NFG or project specific requirements.

3.0 Responsibilities

The laboratory is responsible for generating data from the samples submitted for analysis. In instances where QC criteria are not met for the analysis of samples, the laboratory is responsible for reanalysis of the samples, provided reanalysis is possible (considering matrix interference, holding times and sample volume, etc.), or documenting the impact to the data.

The Data Quality Specialist is responsible for evaluating the data in accordance with this document, in addition to using professional judgment where necessary or appropriate. Project specific requirements, such as those specified in a Quality Assurance Project Plan (QAPP) or Sampling and Analysis Plan (SAP), may differ from these recommendations and professional judgment should be applied before qualifying any data.

4.0 Procedure

The Quality Assurance/Quality Control (QA/QC) data detailed below are the most typical found in a routine level laboratory report. Other QA/QC data may be provided by the laboratory within the laboratory report case narrative, data qualifiers, or cover sheet and should be evaluated using professional judgment (e.g., initial calibration, calibration verification, internal standards).

Definitions to common QA/QC terms and terms used within this SOP along with a list of Barr 'Data Qualifiers/Footnotes' that may be applied during review can be found in Barr's "Compendium of Data Quality Assessment Documentation".

4.1 Holding Time and Preservation

The purpose of holding time and preservation evaluation is to ascertain the validity of the analytical results based on the sample condition, preservation, and time elapsed between the date of sample collection and date of analysis.

40 CFR Part 136, WI GRO method, and the *Test Methods for Evaluating Solid Waste (SW-846)* are used as guidance for the recommended holding time and preservation acceptance criteria listed in *Table 1.*

Table 1 – Recommended Holding Times and Preservation

Compound	**Matrix**	**Temp.**	**Preservative**	**Maximum Hold Time**
VOC/PVOC	Aqueous	≤ 6 °C	HCl < 2 pH	14 days
	Aqueous	≤ 6 °C	Unpreserved	7 days
	Sediment/Soil	≤ 6 °C	1:1 soil:solvent (e.g., 10 g soil:10 mL MeOH in lab pre-weighed vial)	14 days
GRO (WI Method)	Aqueous	≤ 6 °C	HCl < 2 pH	14 days
	Sediment/Soil	≤ 6 °C	1:1 soil:solvent (e.g., 10 g soil:10 mL MeOH in lab pre-weighed vial)	21 days

(Table 1 continued on next page)

Table 1 – Recommended Holding Times and Preservation				
Compound	**Matrix**	**Temp.**	**Preservative**	**Maximum Hold Time**
TPH	Aqueous	≤ 6 °C	HCl or H_2SO_4 < 2 pH	7 day extraction/ addl. 40 days analysis
	Sediment/Soil	≤ 6 °C	Zero headspace*	14 days extraction/ addl. 40 days analysis
TCLP	Various	≤ 6 °C	No preservative	14 days TCLP extraction/ addl. 14 days analysis

* = Alternatively, samples may be collected as per the VOC analysis.

If samples do not meet holding time, preservation and analysis recommendations in *Table 1*, consider qualification with an "**h**". Other matrices, such as product samples (e.g. oil, waste rock, drill cores) may not be subjected to the same holding time recommendations.

If the sample was stored on ice upon collection and delivered to the laboratory the same day, the sample may exceed recommended temperature at the time of laboratory receipt. Professional judgment should be applied (considering temperature, matrix, magnitude of the exceedance, etc.) when evaluating the application of qualifiers when criteria are not met.

4.2 Blank Samples

Blank sample evaluation is conducted to determine the existence and magnitude of target analyte contamination as a result of activities in the field during collection and transport or from inter-laboratory sources.

- For each matrix, at least one method blank should be prepared and analyzed with each sample delivery group (SDG) – laboratories should analyze a method blank at least once every 12 hours. Evaluation pertains to the batch of samples analyzed with the method blank.
- Field or equipment blank collection and analysis frequency is project specific. Evaluation pertains to the field samples associated with the field or equipment blank.
- Trip blanks should be placed in each transport cooler containing VOC sample containers prior to shipment into the field and remain with the associated VOC samples submitted to the laboratory for VOC analysis; including sample storage through analysis.
- Blank analyses may not have involved the same weights, volumes, or dilution factors as the associated samples. It may be easier to work with the raw data and/or convert the data to the same units for comparison purposes.

Table 2 – Guidelines for Blank Contamination	
Sample Result	**Recommended Action for Associated Data**
Non-detect	No action required
< 5x blank concentration	Qualify with 'b'
≥ 5x blank concentration	Use professional judgment

b = Reported value may be a potential false positive based on blank data evaluation procedures

Note: Other multipliers of the blank contamination may be used based on professional judgment (reporting to the MDL, common lab contaminant, etc.)

Professional judgment regarding the usability of the data should be used in cases where gross detections of target analytes are found in the blank sample. A number of factors may be considered including historical data, prior knowledge of the site conditions, target analytes involved, type of blank sample, etc. In such cases, it may be appropriate to qualify the affected data with '*****' (estimated value, QA/QC criteria not met) or '******' (unusable value, QA/QC criteria not met).

4.3 Deuterated Monitoring Compounds (DMC) and Surrogates

DMCs are isotopically labeled (deuterated) analogs of native target compounds. DMCs are only used for the VOC GC/MS analysis. *Table 3* presents the recommended DMCs with their associated target compounds.

Table 3 –DMC and Associated Target Compounds

DMC (alphabetical)	Associated Target Compounds	
1,1,2,2-Tetrachloroethane-d_2	1,1,2,2-Tetrachloroethane	1,2-Dibromo-3-chloropropane
1,1-Dichloroethane-d_2	trans-1,2-Dichloroethene 1,1-Dichloroethene	cis-1,2-Dichloroethene
1,2-Dichlorobenzene-d_4	Chlorobenzene 1,3-Dichlorobenzene 1,4-Dichlorobenzene	1,2-Dichlorobenzene 1,2,4-Trichlorobenzene 1,2,3-Trichlorobenzene
1,2-Dichloroethane-d_4	Trichlorofluoromethane 1,1,2-Trichloro-1,2,2-trifluoroethane Methyl acetate Methylene chloride Methyl-tert-butyl ether	1,1,1-Trichloroethane Carbon tetrachloride 1,2-Dibromoethane 1,2-Dichloroethane
1,2-Dicloropropane-d_6	Cyclohexane Methylcyclohexane	1,2-Dichloropropane Bromodichloromethane
1,4-Dioxane-d_8	1,4-Dioxane	
2-Butanone-d_5	Acetone	2-Butanone
2-Hexanon-d_5	4-Methyl-2-pentanone	2-Hexanone
Benzene-d_6	Benzene	
Chloroethane-d_5	Dichlorodifluoromethane Chloromethane Bromomethane	Chloroethane Carbon disulfide
Chloroform-d	1,1-Dichloroethane Bromochloromethane Chloroform	Dibromochloromethane Bromoform
Toluene-d_8	Trichloroethene Toluene Tetrachloroethene Ethylbenzene	o-Xylene m,p-Xylene Styrene Isopropylbenzene
trans-1,3-Dichloropropene-d_4	cis-1,3-Dichloropropene trans-1,3-Dichloropropene	1,1,2-Trichloroethane
Vinyl Chloride-d_3	Vinyl chloride	

Surrogates are similar to analytes of interest in chemical composition, extraction, and chromatography but are not typically found in environmental samples. Other DMCs or surrogates may be used by a laboratory based on their experience provided adequate chromatographic separations can be demonstrated. All samples (blanks, spiked samples, project samples, QC samples) should contain DMCs or surrogates. If a sample does not contain DMC or surrogates or the method does not require surrogates (WI GRO), professional judgment should be used to determine if the reported results are useable or not. Acceptable evaluation of the DMC or surrogate spikes may not be applicable if dilution of the sample was required. Percent recoveries are calculated for each DMC or surrogate and these are evaluated based on the criteria within the laboratory report or project specific requirements. If criteria are not reported, use guidance found in the NFG, if available. Percent recoveries are calculated using the equation provided under accuracy in 'Definitions' from Barr's "Compendium of Data Quality Assessment Documentation".

For the WI GRO analysis, surrogates are not required for GRO but are required for PVOC. The method minimum surrogate recovery is 80%; there is no method maximum recovery. Use professional judgment when evaluating surrogates for WI GRO samples.

Table 4 includes guidance to evaluate the surrogate recovery where a single surrogate is analyzed.

Table 4 – Guidelines for Single DMC or Surrogate

Criteria	**Recommended Action for Associated Data**	
	Detect	**Non-Detect**
%R > Upper Limit	Qualify with '*'	No qualification
%R < Lower Limit	Qualify with '*' or '**', use professional judgment	
%R within Limits	No qualification	

'*' = reported value is estimated and QA/QA criteria were not met
'**' = reported value is unusable and QA/QC criteria were not met

Table 5 includes guidance where multiple surrogates are analyzed per analytical fraction.

Table 5 – Guidelines for Multiple DMC or Surrogates

Criteria	**Recommended Action for Associated Data**	
	Detect	**Non-Detect**
One %R < Lower Limit	No qualification may be necessary, use professional judgment	
Two or more %R < Lower Limit	Qualify with '*' or '**', use professional judgment	
Two or more %R > Upper Limit	Qualify fraction with '*'	No qualification
One %R > Upper Limit	No qualification may be necessary, use professional judgment	No qualification
All %R within Limits	No qualification	

'*' = reported value is estimated and QA/QA criteria were not met
'**' = reported value is unusable and QA/QC criteria were not met

4.4 Laboratory Control Samples (LCS) and Laboratory Control Sample Duplicate Samples (LCSD)

The laboratory control sample is used to monitor the overall performance of each step during analysis, including sample preparation. The LCS should be analyzed:

- Once every preparation batch (typically 20 or less samples of the same matrix - WI GRO requires an additional LCSD analyzed at the end of 20 samples)
- Once for each matrix.

Laboratory control samples may contain all target compounds or a subset (see *Table 6* for guidance) and the percent recoveries are evaluated based on the criteria within the laboratory report or project specific requirements. If criteria are not available, use guidance found in the NFG. Percent recoveries are calculated for accuracy and the relative percent difference (RPD) is calculated for precision (when an LCSD was analyzed). Accuracy and precision equations can be found in 'Definitions' from Barr's "Compendium of Data Quality Assessment Documentation".

Table 6 – Number of Suggested Target Compounds - LCS/LCSD and MS/MSD

Number of Target Parameters	Number of Spiked Compounds
1-10 analytes	Spike all compounds
11-20 analytes	At least 10 compounds or 80% of all analytes, whichever is greater
More than 20 analytes	Spike at least 16 compounds

Table 7 – Guidelines for Laboratory Control Samples

Criteria	Recommended Action for Associated Data	
	Detect	Non-Detect
%R and RPD > Upper Limit	Qualify with '*'	No qualification
%R < Lower Limit	Qualify with '*' or '**', use professional judgment	
%R and RPD within Limits	No qualification	

* = Reported value is estimated and QA/QC criteria were not met
** = Reported value is unusable and QA/QC criteria were not met

4.5 Laboratory Duplicate Samples

Laboratory duplicate samples are separate aliquots of field samples analyzed to demonstrate acceptable method precision by the laboratory at the time of analysis. Field blanks and proficiency testing (PT) samples should not be used for duplicate analysis. The RPDs are calculated using the equation as provided in 'Definitions' from Barr's "Compendium of Data Quality Assessment Documentation" and are

not calculated where data are already qualified with b, U, <, or **. RPD results are dependent on the homogeneity of the samples.

Duplicates should be analyzed (whichever is more frequent):

- One from each matrix (soil or water)
- One from each SDG

The MS/MSD duplicate pairs may be substituted for laboratory duplicates.

Laboratory acceptance criteria or project specific requirement are used to evaluate RPDs. If criteria are not available, use guidance found in NFG or use professional judgment when considering qualification of associated results.

Higher RPDs are expected when results are at or near the reporting limits and are not always indicative of poor precision. RPDs are typically only evaluated for samples where both the native and duplicate sample concentrations are greater than five times (>5x) the RL. In cases where either of the samples (native or duplicate) is non-detect for a parameter and the other corresponding sample has detectable concentrations much greater than five times (>5x) the RL, professional judgment should be used to determine if qualification is appropriate.

Table 8 – Guidelines for Laboratory Duplicates

% RPD	Recommended Action for Associated Data
RPD < Upper Limit	No action is required
RPD > Upper Limit	Both results are ≤ 5x RL, no action is required
RPD > Upper Limit	Both results are > 5x RL, consider qualifying with '*****'

* = Reported value is estimated and QA/QC criteria were not met

4.6 Field Duplicate Samples

Field duplicate samples (also known as "masked" or "blind" duplicate samples) are used to demonstrate acceptable precision and reproducibility of the field and laboratory procedures. Frequency of collection is project specific. The RPDs are calculated using the equation as provided under precision in 'Definitions' from Barr's "Compendium of Data Quality Assessment Documentation" and are not calculated where data is already qualified with b, U, <, or **. RPD results are dependent on the homogeneity of the samples.

Acceptance criteria for field duplicate samples are subject to the professional judgment of the Data Quality Specialist but typically RPDs ≤ 30% for aqueous samples and ≤ 40% for soil and sediment samples are considered acceptable unless other project specific requirements are defined.

Higher RPDs are expected when results are at or near the reporting limits and are not always indicative of poor precision. RPDs are typically only evaluated for samples where both the native and duplicate sample concentrations are greater than five times (>5x) the RL. In cases where either of the samples (native or field duplicate) is non-detect for a parameter and the other corresponding sample has detectable concentrations much greater than five times (>5x) the RL, professional judgment should be used to determine if qualification is appropriate.

4.7 Matrix Spikes (MS) and Matrix Spike Duplicate (MSD) Samples

Matrix spike samples may contain all target compounds or a subset (see *Table 6*) and provide information about the effect of each samples' matrix on the sample preparation procedures and analytical results. Matrix spikes are typically analyzed at the following frequencies:

- 1 (MS/MSD pair) in every 20 samples (does not apply to GRO in the WI method)
- 1 per preparation batch per matrix
- 1 per SDG

However, the frequency may be project specific and the documents outlining the needs of the project (SAP, QAPP, etc.) should be reviewed. In some cases, MS/MSD analysis is not required.

The percent recoveries are evaluated based on the criteria within the laboratory report or project specific requirements. If a matrix spike recovery does not meet acceptance criteria and is not associated with a project sample, no further action is required unless other systematic evidence warrants qualification.

If the native concentration of a spiked sample is significantly greater than the spike added (>4x), spike recovery cannot be accurately evaluated, therefore the criteria do not apply. Professional judgment should be used for percent recoveries nominally outside laboratory acceptance criteria prior to qualifying data.

If criteria are not available, use guidance found in the NFG. Percent recoveries of matrix spike (and matrix spike duplicate) samples should be calculated using the equation provided under accuracy in 'Definitions' from Barr's "Compendium of Data Quality Assessment Documentation".

Solid samples may have highly variable concentrations of target analytes and percent recoveries (%R) may be influenced by the sampling precision and inherent sample homogeneity. Professional judgment should be used for difficult matrices and the acceptance criteria adjusted accordingly.

Table 9 – Guidelines for Matrix Spikes

Criteria	**Recommended Action for Associated Data**	
	Detect	**Non-Detect**
%R and RPD > Upper Limit	Qualify with '*'	No qualification
%R < Lower Limit	Qualify with '*' or '**', use professional judgment	
%R and RPD within Limits	No qualification	

* = Reported value is estimated and QA/QC criteria were not met
** = Reported value is unusable and QA/QC criteria were not met

While matrix spike duplicates are not required by all methods, if results for MSD analyses are reported, evaluate the RPD for MS and MSD pairs using the equation as provided under precision in 'Definitions' from Barr's "Compendium of Data Quality Assessment Documentation".

4.8 Overall Assessment

The chain-of-custody should be reviewed to determine if the laboratory report matches the requested analyses and that project specific parameters were analyzed as requested. The narrative and other supporting documentation should be evaluated to ensure that sample condition was appropriately documented by the laboratory upon receipt. If available, historical data should be used to assist with data evaluation. Any additional anomalies should be documented and evaluated, if necessary.

5.0 Quality Control and Quality Assurance (QA/QC)

Depending on the project objectives, the data review may include the completion of a Routine Level Quality Control Report (see Barr's "Compendium of Data Quality Assessment Documentation") as part of the evaluation process. Within each QC data section, the reviewer should include references to whether the QC data met or exceeded the acceptance criteria. The qualifiers, added, removed, or retained, should be documented also. Where multiple qualifiers may be applicable to a sample/analyte result, professional judgment should be used to determine if all qualifiers are necessary or if one qualifier would be sufficient to represent the deviations. A statement as to whether the data are acceptable as reported or acceptable with qualification(s) should also be included. If revised reports are required and the revision affects the sample results, notification should be given to the appropriate data management personnel and/or project team members.

The Data Quality Specialist will verify that the qualifiers associated with data tables match the Routine Level Quality Control Report.

6.0 Records

The Routine Level Quality Control Report should be saved to the appropriate internal Barr file and the link uploaded to the tracking system. Periodically, Data Quality staff should check for missing Routine Level Quality Control Reports in the tracking system to help maintain the most current information.

Documentation specific to this SOP are listed below and are available in Barr's "Compendium of Data Quality Assessment Documentation".

- Definitions
- Barr Qualifiers/Footnotes
- Routine Level Quality Control Report

Additional records information can be found in Barr's "Records Management System Manual".

7.0 References

Environmental Protection Agency. *Title 40 of the Code of Federal Regulations, Part 136.3.*

Environmental Protection Agency, *National Functional Guidelines for Superfund Organic Methods Data Review.*

Analytical methods listed under the 'Scope and Applicability' section of this SOP.

Attachment 1

Revision History

Revision Number	Date of Revision	Section	Revision Made
3.1	02/2009	Document Wide	Edits to references, formatting; minor language additions and corrections
		IX	Added Table 10
		Attachments	Added Attachment 3
3.2	04/2011	Document Wide	Added analytical methods to applicability section.
		Attachments	Updated Attachment 1 and 2 to include current forms.
4.0	04/06/12	Document Wide	Major revision
5.0	06/17/13	Cover page	Added Calgary office
		I	Added waste rock and drill cores to examples of product sample
		III, IV, V, VI, VII	Added 'project specific requirements' as possible criteria source
		VI	Added 'field and laboratory procedures' to clarify that it's not only a laboratory item
		VI	Clarified field duplicate criteria as < one value and not a range
		IX	Added statement regarding multiple qualifiers
6.0	01/15/16	Document Wide	SOP restructuring, new format

Appendix D2

Quality Assurance/Quality Control Review Parametrix 2008 Phase II Investigation

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Memorandum

To: Mary Monahan – Project Coordinator, Ecology and Chris Wend, Ecology
From: Al Gebhard, Dana Pasi – Barr Engineering
Subject: Quality Assurance / Quality Control Review – 2008 Parametrix Phase II ESA
Date: November 3, 2017
Project: Yakima Mill Site

Barr qualifier (*) added to Fly Ash, SS-1, and TP-8 sample results in Table 1 after date of this memo to conform table to memo text.

1.0 Introduction

A Phase II Environmental Site Assessment (Phase II) was completed at the Yakima Mill Site (Mill Site) by Parametrix in 2008 (Parametrix, 2008). The results of the Phase II are summarized in the report titled Draft Phase II Environmental Site Assessment, Former Boise Cascade Mill Site (Parametrix, 2008). Parametrix conducted the Phase II in accordance with a Quality Assurance Project Plan (QAPP) and Sampling and Analysis Plan (SAP; Parametrix, 2007). Validation of the analytical results for the soil, groundwater, and surface water samples collected during the Phase II work was conducted by Parametrix in 2008. The report (Parametrix, 2008) includes a discussion of the data review and explains any qualifiers applied to the Phase II data by Barr Engineering Co (Barr).

At Ecology's direction, because the Phase II was not prepared under Ecology oversight, Barr conducted an additional quality assurance/quality control (QA/QC) review of the Phase II data collected in 2008 (see Attachment A). The objective of this memorandum is to establish the usability of the Phase II data for the purposes of the Remedial Investigation (RI) Work Plan (Work Plan) that Barr and Fulcrum Environmental Consulting, Inc. (Fulcrum) are preparing for the Mill Site.

New data to be collected by Barr and Fulcrum under the RI Work Plan will be subject to QA/QC review to confirm usability as provided in the SAP/QAPP for the project.

This memorandum summarizes Barr's QA/QC review of the analytical data from the Parametrix Phase II investigation at the Mill Site. In addition, this memorandum presents a comparison of the practical quantitation limits (PQLs) associated with the 2008 Phase II data set to the standard cleanup levels potentially applicable to the Mill Site. The PQL, as defined in Washington State Department of Ecology (Ecology) Model Toxics Control Act (MTCA) Regulation and Statute (Ecology, Rev. 2013) is "the lowest concentration that can be reliably measured within specified limits of precision, accuracy, representativeness, completeness, and comparability during routine laboratory operating conditions, using department approved methods" (WAC 173-340-200). When establishing cleanup levels, the MTCA regulations further provide that "In some cases, cleanup levels calculated using the methods specified in this chapter are less than natural background levels or levels that can be reliably measured. In those situations, the cleanup level shall be established at a concentration equal to the practical quantitation limit or natural background concentration, whichever is higher" (WAC 173-340-700(6)(d)).

The remainder of this memorandum is organized as follows:

- Section 2 – A summary of Barr's QA/QC review of the analytical data presented in the Parametrix Phase II report.
- Section 3 – A comparison of PQLs reported in the 2008 Phase II (Parametrix, 2008) to the standard MTCA cleanup levels potentially applicable to the Mill Site (MTCA A and MTCA B).
- Section 4 – An evaluation of the data from the 2008 Phase II that can be relied upon to judge conformance with standard cleanup levels for the Mill Site given the QA/QC review, PQL comparison and planned investigation activities that will be conducted under the RI Work Plan.

2.0 Barr Data Review

The 2008 Phase II analytical data set in the Parametrix report includes 43 soil samples with a total of about 3000 individual analyte results and 14 groundwater samples with a total of about 1900 individual analyte results. Barr performed a QA/QC review of the data set. Barr's QA/QC review was performed in accordance with Barr's Standard Operating Procedures (SOPs) for data evaluation, the most recent version of which is included in Attachment B. Barr's SOPs are based on the quality assurance elements in The National Functional Guidelines for Organic and Inorganic Data Review (NFG; USEPA, 2008 and 2010) and are consistent with a Level 2a review. Per US EPA (USEPA, 2009), a Level 2a review is a verification and validation of analytical data based on completeness and compliance checks of sample receipt conditions and sample-related QC results. Details of Barr's 2008 QA/QC review of the Phase II data are presented in Attachment A.

As discussed in Attachment A, in general the data meets an acceptable level of QA/QC. There were limitations noted, however, for specific samples. The issues that would result in qualification of the data are:

- For the fly ash sample, the results for benzene, toluene, ethyl benzene, xylenes (BTEX)/Gas (total petroleum hydrocarbons (TPH) as gasoline) as well as semi-volatile organic compounds (SVOCs) and polychlorinated biphenyls (PCBs) should be qualified as estimated due to the failure of surrogate standard recoveries.
- For the matrix spike/matrix spike duplicate (MS/MSD) sample associated with sample SS-1 (sample SS-1-2 in ML66), the compounds failing MS/MSD criteria should be qualified because matrix effects were displayed.

- The SVOC MS/MSD associated with sample TP-8 (TP-8-2 in MK75) displayed matrix effects with generally low percent recoveries (~50-65%); but in some cases percent recoveries were <10% and RPDs were >50%. Data from the sample should be qualified as estimated for these compounds.

Although there were no detections in the laboratory blank samples and thus no qualifiers were applied, it was noted that there were sporadic detections of common laboratory contaminants, specifically bis(2-ethylhexyl)phthalate. The Agency for Toxic Substances and Disease Registry (ATSDR) Toxicological Profile discusses this issue in the Analytical Methods section for this compound (ATSDR, 2002).

> Detection and quantification of very low levels of bis(2-ethylhexyl)phthalate (DEHP) are seriously limited by the presence of this compound as a contaminant in almost all laboratory equipment and reagents. Plastics, glassware, aluminum foil, cork, rubber, glass wool, Teflon sheets, and solvents have all been found to be contaminated (EPA 1988a; Giam et al. 1975; Williams 1973). While efforts have been made to reduce laboratory contamination (Giam et al. 1975; Thuren 1986), DEHP is still reported in laboratory blanks, even with thorough cleaning methods (EPA 1988a; Giam et al. 1975). Therefore, practical sample detection limits are often more than an order of magnitude higher than instrument or method detection limits. The EPA (1988a) reports that DEHP, along with other common phthalate and adipate esters, cannot generally be accurately or precisely measured at concentrations below about 2 ppb, due to blank contamination *(see ATSDR, 2002 for references in this paragraph)*.

The QA/QC review indicates that the data set is acceptable as qualified except as described above.

3.0 PQLs Compared to MTCA A and B Cleanup Levels

In addition to the QA/QC evaluation of the data, the PQLs for the soil and water sample analyses presented in the Phase II report (Parametrix 2008) were compared against the standard MTCA cleanup levels potentially applicable for the Mill Site (i.e., Method A and Method B). The comparison for soil samples is shown in Table 1 and the comparison for groundwater samples is shown in Table 2. The following parameters had PQLs for some samples above the lowest applicable MTCA standard cleanup levels. As noted above, under WAC 173-340-700(6)(d), this does not, in and of itself, mean that the data are not reliable or relevant to investigation and cleanup activities.

For soil:

- Metals (Method EPA 6010) – Soil samples were analyzed by EPA method 6010 (Inductively Coupled Plasma –Atomic Emission Spectrometry [ICP-AES]).
    - The MTCA Method B cancer cleanup level for arsenic of 0.667 mg/kg is less than the PQL of EPA method 6010, which is approximately 1.0 mg/kg. However, the naturally occurring background concentration appears to be substantially higher than both the Method B level and the PQL. The 90th percentile of arsenic in soil in Yakima county is 5.13 mg/kg as

reported in Natural Background Soil Metals Concentrations in Washington State, Toxics Cleanup Program, Department of Ecology (Ecology, 1994).

- SVOCs (Method EPA 8270) – benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, bis(2-chloroethyl)ether, 4-chloroaniline, dibenz(a,h)anthracene, 3,3`-dichlorobenzidine, 2,4-dinitrotoluene, 2,6-dinitrotoluene, hexachlorobenzene, indeno(1,2,3-cd)pyrene, n-nitrosodi-n-propylamine, and pentachlorophenol had PQLs above the standard cleanup levels for multiple samples.
    - With the exception of n-nitrosodi-n-propylamine, which had a PQL approximately 2 times the standard MTCA cleanup levels without dilution, the remaining compounds had PQLs above cleanup levels only when samples were tested at a dilution. The samples tested and reported at a dilution were: B-3 8.5 ft., SS-1 2 ft., TP-10 8 ft., TP-10 13 ft,TP-11 4 ft., TP-11 14 ft., TP-12 13 ft., TP-12D 13 ft., and TP-13 8 ft. These samples displayed petroleum impacts with detections of TPH compounds, which likely necessitated the dilutions. The lab initially completed the analysis without dilutions and both the undiluted and diluted results were reported in the lab reports with no data quality concerns shown for both analyses. Both sets of results had comparable surrogate and spiked sample recoveries and were from the same extraction therefore the laboratory QC (i.e. method blanks and laboratory spike recoveries) would be shared by the undiluted and diluted sets of results. As shown in the soil summary table (Table 1), the majority of the undiluted results had PQLs below the standard cleanup levels, with PQLs for 4-chloroaniline, benzo(a)anthracene, benzo(b)fluoranthene, bis(2-chloroethyl)ether, and indeno(1,2,3-cd)pyrene no longer exceeding cleanup levels for all samples. Also, the PQLs for 2,4-dinitrotoluene, 3,3`-dichlorobenzidine, hexachlorobenzene, and pentachlorophenol only exceeded the standard cleanup levels in one sample (TP-10 8 ft). The results from the analysis of the undiluted samples are thus useful in judging conformance with MTCA standard cleanup levels even though the samples had to be diluted and the PQLs increased for some analytes.
- Volatile organic compounds (VOCs) (Method EPA 8260) – benzene, 1,2-dibromoethane (EDB), tetrachloroethylene (PCE), trichloroethylene (TCE), and 1,2,3-trichloropropane for sample TP-10 8 ft. had PQLs above the standard cleanup levels. This sample had detections of petroleum constituents that likely necessitated dilution.
- Benzene (Method EPA 8021) – benzene had a PQL above the standard cleanup level for samples: B-4 13 ft., Boiler Drain, and TP-8 8 ft. The Boiler Drain and TP-8 8 ft. samples had petroleum impacts with detections of TPH, which likely necessitated dilution. Sample B-4 13 ft. was also analyzed with method EPA 8260 with a PQL below the standard cleanup levels.

For groundwater:

- Metals (Method EPA 6010) – Groundwater samples were analyzed by EPA method 6010 (Inductively Coupled Plasma –Atomic Emission Spectrometry [ICP-AES]).
    - Arsenic had a PQL above standard MTCA cleanup levels for all samples. No samples had an arsenic concentration above the PQL of 50 ug/L in this data set.
- SVOCs (Method EPA 8270) – benzo(b)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, bis(2-chloroethyl)ether, 4-chloroaniline, dibenzo(a,h)anthracene, 3,3`-dichlorobenzidine, 2,4-dinitrotoluene, 2,6-dinitrotoluene, hexachlorobenzene, hexachlorobutadiene, indeno(1,2,3-cd)pyrene, n-nitrosodi-n-propylamine, n-nitrosodiphenylamine, 2,2'-oxybis (1-chloropropane), 2,4,6-trichlorophenol, and pentachlorophenol had PQLs 2 to 500 times greater than the standard cleanup levels for all of the samples.
- VOCs (Method 8260) – 1,1,2,2-tetrachloroethane, 1,1,2-trichloroethane, 1,2,3-trichloropropane, DBCP, EDB, 1,2-dichloroethane, cis-1,3-dichloropropene, trans-1,3-dichloropropene, acrylonitrile, benzene, bromodichloromethane, carbon tetrachloride, chlorodibromomethane, and TCE had PQLs greater than the standard cleanup levels for all of the samples. With the exception of 1,2,3-trichloropropane, the compounds has PQLs less than 100 times greater than the lowest MTCA cleanup level.
- PCBs (Method EPA 8082) – aroclors 1254 and 1260 had PQLs (typically 1 ug/L) greater than the lowest standard cleanup level (0.0438 ug/L) for all of the samples.

All of the data is acceptable to judge conformance with MTCA cleanup levels with the exceptions noted above. This data will not be relied upon to judge conformance with MTCA cleanup levels but it does inform Mill Site conditions within the constraints of the analytical methods that were used.

4.0 Conclusions

Barr conducted a QA/QC review of the soil and groundwater analytical data presented in the 2008 Phase II report (Parametrix, 2008). In general, the QA/QC review showed that the data are acceptable as qualified.

With the following exceptions, all data from the Phase II report can be used to judge compliance with MTCA cleanup levels during investigation and cleanup activities based on the results of the QA/QC review and the comparison of PQLs to standard MTCA cleanup levels. To the extent that specific sample results are not suitable to judge conformance with MTCA cleanup levels, the data does provide useful information as specifically described below.

For soil:

- SVOCs (Method EPA 8270) –The benzo(a)pyrene data from the following samples will not be used to judge conformance with MTCA cleanup levels due to the PQL being above the standard cleanup level in the undiluted sample: B-3 8.5 ft., SS-1 2 ft., TP-10 8 ft., TP-10 13 ft., TP-12 13 ft., and TP-12D 13 ft. The 2,4-dinitrotoluene, 3,3`-dichlorobenzidine, hexachlorobenzene, and pentachlorophenol data from TP-10 8ft. will not be used to judge conformance with MTCA cleanup levels due to the PQLs being above the standard cleanup levels. The data are useful however in judging that the SVOC concentrations do not exceed the PQLs reported in the analyses. The portions of the Mill Site covered by these borings/test pits will be investigated in the Mill Site RI using the methods and PQLs described in the SAP/QAPP. In the event a sample requires dilution, the laboratory will report the data, especially non-detects, at the lowest PQL possible.

- VOCs (Method EPA 8260) – The benzene, 1,2-dibromoethane (EDB), tetrachloroethylene (PCE), trichloroethylene (TCE), and 1,2,3-trichloropropane data for sample TP-10 8 ft. will not be used to judge conformance with MTCA cleanup levels due to the PQLs being greater than the standard cleanup levels. The data are useful however in judging that the VOC concentrations do not exceed the PQLs reported in the analysis. This area of the Mill Site is planned for further investigation as part of the RI Work Plan due to potential petroleum impacts. In the event a sample requires dilution, the laboratory will report the data, especially non-detects, at the lowest PQL possible.

- Benzene (Method EPA 8021) – the Fly Ash sample will not be used to judge conformance with MTCA cleanup levels due to QA/QC concerns. The inconsistency between the PID and FID results and the inconsistency between the duplicate sample results indicates that these benzene concentrations are potential false positive values. The benzene data from the Boiler Drain and TP-8 8 ft. samples will also not be used to judge conformance with MTCA cleanup levels due to PQLs being greater than the standard cleanup levels. Further investigation, with sampling for benzene, is planned for these areas as part of the RI Work Plan using the methods and PQLs described in the SAP/QAPP.

For groundwater:

- Metals (Method EPA 6010) – the PQLs for arsenic as described in Section 3 were above the MTCA cleanup level. Site-wide groundwater sampling for arsenic using a more sensitive analytical method with a PQL below the MTCA cleanup level will be included in the RI Work Plan.

- SVOCs (Method EPA 8270) – The PQLs for the SVOCs described in Section 3 were above standard cleanup levels. This data will not be relied upon to judge conformance with MTCA cleanup levels for the Work Plan. The data are useful however in judging that the SVOC concentrations do not exceed the PQLs reported in the analysis Site-wide groundwater sampling for SVOCs using methods to achieve lower PQLs will be included in the RI Work Plan.

Also, there was a handful of detections of bis(2-ethylhexyl)phthalate, a known laboratory contaminant, that exceeded standard cleanup values. Although there were no detections in the corresponding laboratory blank samples, there is concern that these are false positive values. Additional steps, including sampling and analysis of field blank samples in addition to laboratory blank samples, will be included in the Mill Site RI Work Plan to track potential sources of laboratory contamination.

- VOCs (Method 8260) – The PQLs for the VOCs described in Section 3 were above standard cleanup levels. This data will not be relied upon to judge conformance with MTCA cleanup levels for Work Plan. The data are useful however in judging that the SVOC concentrations do not exceed the PQLs reported in the analysis. Site-wide groundwater sampling for VOCs using methods to achieve lower PQLs will be conducted as described in the RI Work Plan.

- PCBs (Method EPA 8082) – The MTCA A and MTCA B cleanup levels are significantly below the PQLs reported for the PCBs in this investigation. Soil sampling at potential PCB release areas will be used in the Mill Site RI to determine if releases of PCBs have occurred to soil or groundwater at the Site

Samples not specifically discussed above will be considered useable to judge conformance with MTCA cleanup levels.

5.0 References

Ecology, Revised 2013. *Model Toxics Control Act (MTCA) Regulation and Statute*. Publication No. 94-06

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United States Environmental Protection Agency (USEPA), 2008. *USEPA Contract Laboratory Program National Functional Guidelines for Superfund Organic Methods Data Review*. EPA QA/R-5. 2008

United States Environmental Protection Agency (USEPA), 2009. *Guidance for Labeling Externally Validated Laboratory Analytical Data for Superfund Use*. EPA QA/R-5. OSWER No. 9200.1-85 EPA 540-R-08-005

United States Environmental Protection Agency (USEPA), 2010. *USEPA Contract Laboratory Program National Functional Guidelines for Superfund Inorganic Methods Data Review*. EPA QA/R-5. 2010

6.0 Attachments

Table 1 – Historical Soil Data Review – 2008 Parametrix PQLs vs MTCA cleanup levels

Table 2 – Historical Groundwater Data Review – 2008 Parametrix PQLs vs MTCA cleanup levels

Attachment A – Data Quality Review of Laboratory Results – Parametrix September 2008 Draft Phase II ESA Report – Yakima Mill Site. Sept/Oct 2008

Attachment B – Barr Data Evaluation Standard Operating Procedures

Table 1
Historical Soil Data Review - 2008 Parametrix PQLs vs. MTCA Cleanup Levels
Yakima Mill Site

Location						B-2		B-3		B-3		B-3		B-4		B-4D		B-5		B-6		B-7		B-8	
Date						3/03/2008		3/03/2008		3/03/2008		3/03/2008		3/04/2008		3/04/2008		3/04/2008		3/04/2008		3/04/2008		3/04/2008	
Depth						13 ft		8.5 ft		8.5 ft		14 ft		13 ft		13 ft		10.5 ft		14 ft		14 ft		14 ft	
Sample Type						N		N		N		N		N		N		N		N		N		N	
Result Type						PQL	Result	PQL	Result	Diluted PQL	Diluted Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result
Data Status						SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource
Parameter	Analysis Location	Units	Washington Method A Unrestricted Land Use	Washington Method B Cancer Direct Contact	Washington Method B Noncancer Direct Contact																				
Effective Date			07/01/2015	07/01/2015	07/01/2015																				
Exceedance Key			**Bold**	Shade	Border																				
General Parameters																									
Carbon, total organic	Lab	%				--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
pH	Lab	pH units				--	--	--	--	--	--	--	--	DET	7.82	DET	7.44	--	--	--	--	--	--	--	--
Solids, total	Lab	%				--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Metals																									
Arsenic	Lab	ug/kg	20000	667	24000	--	--	--	--	--	--	--	--	10000	ND	8000	ND	6000	ND	--	--	5000	ND	--	--
Barium	Lab	ug/kg			16000000	--	--	--	--	--	--	--	--	DET	111000	DET	107000	DET	103000	--	--	DET	73200	--	--
Cadmium	Lab	ug/kg	2000		80000	--	--	--	--	--	--	--	--	500	ND	300	ND	200	ND	--	--	200	ND	--	--
Chromium	Lab	ug/kg				--	--	--	--	--	--	--	--	DET	17000	DET	15600	DET	16600	--	--	DET	16000	--	--
Lead	Lab	ug/kg	250000			--	--	--	--	--	--	--	--	DET	16000 J	DET	6000 J	DET	7000 J	5000	ND	DET	3000 J	DET	2000 J
Mercury	Lab	ug/kg	2000			--	--	--	--	--	--	--	--	DET	100	DET	70	50	ND	--	--	50	ND	--	--
Selenium	Lab	ug/kg			400000	--	--	--	--	--	--	--	--	10000	ND	8000	ND	6000	ND	--	--	5000	ND	--	--
Silver	Lab	ug/kg			400000	--	--	--	--	--	--	--	--	700	ND	500	ND	300	ND	--	--	300	ND	--	--
SVOCs																									
1,2,4-Trichlorobenzene	Lab	ug/kg		34500	800000	66	ND	180	ND	870	ND	63	ND	65	ND	65	ND	64	ND	--	--	66	ND	--	--
1,2-Dichlorobenzene	Lab	ug/kg			7200000	66	ND	180	ND	870	ND	63	ND	65	ND	65	ND	64	ND	--	--	66	ND	--	--
1,3-Dichlorobenzene	Lab	ug/kg				66	ND	180	ND	870	ND	63	ND	65	ND	65	ND	64	ND	--	--	66	ND	--	--
1,4-Dichlorobenzene	Lab	ug/kg		185000	5600000	66	ND	180	ND	870	ND	63	ND	65	ND	65	ND	64	ND	--	--	66	ND	--	--
1-Methylnaphthalene	Lab	ug/kg		34500	5600000	66	ND	180	ND	870	ND	63	ND	65	ND	65	ND	64	ND	--	--	66	ND	--	--
2,2'-oxybis (1-chloropropane)	Lab	ug/kg		14300	3200000	66	ND	180	ND	870	ND	63	ND	65	ND	65	ND	64	ND	--	--	66	ND	--	--
2,4,5-Trichlorophenol	Lab	ug/kg			8000000	330	ND	870	ND	4400	ND	320	ND	320	ND	330	ND	320	ND	--	--	330	ND	--	--
2,4,6-Trichlorophenol	Lab	ug/kg		90900	80000	330	ND	870	ND	4400	ND	320	ND	320	ND	330	ND	320	ND	--	--	330	ND	--	--
2,4-Dichlorophenol	Lab	ug/kg			240000	330	ND	870	ND	4400	ND	320	ND	320	ND	330	ND	320	ND	--	--	330	ND	--	--
2,4-Dimethylphenol	Lab	ug/kg			1600000	66	ND	180	ND	870	ND	63	ND	65	ND	65	ND	64	ND	--	--	66	ND	--	--
2,4-Dinitrophenol	Lab	ug/kg			160000	660	ND	1800	ND	8700	ND	630	ND	650	ND	650	ND	640	ND	--	--	660	ND	--	--
2,4-Dinitrotoluene	Lab	ug/kg		3230	160000	330	ND	870	ND	4400	ND	320	ND	320	ND	330	ND	320	ND	--	--	330	ND	--	--
2,6-Dinitrotoluene	Lab	ug/kg		667	24000	330	ND	870	ND	4400	ND	320	ND	320	ND	330	ND	320	ND	--	--	330	ND	--	--
2-Chloronaphthalene	Lab	ug/kg			6400000	66	ND	180	ND	870	ND	63	ND	65	ND	65	ND	64	ND	--	--	66	ND	--	--
2-Chlorophenol	Lab	ug/kg			400000	66	ND	180	ND	870	ND	63	ND	65	ND	65	ND	64	ND	--	--	66	ND	--	--
2-Methyl-4,6-dinitrophenol	Lab	ug/kg				660	ND	1800	ND	8700	ND	630	ND	650	ND	650	ND	640	ND	--	--	660	ND	--	--
2-Methylnaphthalene	Lab	ug/kg			320000	66	ND	180	ND	870	ND	63	ND	65	ND	65	ND	64	ND	--	--	66	ND	--	--
2-Methylphenol (o-cresol)	Lab	ug/kg			4000000	66	ND	180	ND	870	ND	63	ND	65	ND	65	ND	64	ND	--	--	66	ND	--	--
2-Nitroaniline	Lab	ug/kg			800000	330	ND	870	ND	4400	ND	320	ND	320	ND	330	ND	320	ND	--	--	330	ND	--	--
2-Nitrophenol	Lab	ug/kg				330	ND	870	ND	4400	ND	320	ND	320	ND	330	ND	320	ND	--	--	330	ND	--	--
3,3`-Dichlorobenzidine	Lab	ug/kg		2220		330	ND	870	ND	4400	ND	320	ND	320	ND	330	ND	320	ND	--	--	330	ND	--	--
3-Nitroaniline	Lab	ug/kg				330	ND	870	ND	4400	ND	320	ND	320	ND	330	ND	320	ND	--	--	330	ND	--	--
4-Bromophenyl phenyl ether	Lab	ug/kg				66	ND	180	ND	870	ND	63	ND	65	ND	65	ND	64	ND	--	--	66	ND	--	--
4-Chloro-3-methylphenol	Lab	ug/kg				330	ND	870	ND	4400	ND	320	ND	320	ND	330	ND	320	ND	--	--	330	ND	--	--
4-Chloroaniline	Lab	ug/kg		5000	320000	330	ND	870	ND	4400	ND	320	ND	320	ND	330	ND	320	ND	--	--	330	ND	--	--
4-Chlorophenyl phenyl ether	Lab	ug/kg				66	ND	180	ND	870	ND	63	ND	65	ND	65	ND	64	ND	--	--	66	ND	--	--
4-Methylphenol (p-cresol)	Lab	ug/kg			8000000	66	ND	180	ND	870	ND	63	ND	65	ND	65	ND	64	ND	--	--	66	ND	--	--
4-Nitroaniline	Lab	ug/kg				330	ND	870	ND	4400	ND	320	ND	320	ND	330	ND	320	ND	--	--	330	ND	--	--
4-Nitrophenol	Lab	ug/kg				330	ND	870	ND	4400	ND	320	ND	320	ND	330	ND	320	ND	--	--	330	ND	--	--
Acenaphthene	Lab	ug/kg			4800000	66	ND	180	ND	870	ND	63	ND	65	ND	65	ND	64	ND	--	--	66	ND	--	--
Acenaphthylene	Lab	ug/kg				DET	71	180	ND	870	ND	63	ND	DET	72	65	ND	64	ND	--	--	66	ND	--	--
Anthracene	Lab	ug/kg			24000000	66	ND	180	ND	870	ND	63	ND	65	ND	65	ND	64	ND	--	--	66	ND	--	--
Benz(a)anthracene	Lab	ug/kg		1370		66	ND	180	ND	870	ND	63	ND	65	ND	65	ND	64	ND	--	--	66	ND	--	--
Benzo(a)pyrene	Lab	ug/kg	**100**	137		66	ND	**180**	ND	**870**	ND	63	ND	65	ND	65	ND	64	ND	--	--	66	ND	--	--
Benzo(b)fluoranthene	Lab	ug/kg		1370		66	ND	180	ND	870	ND	63	ND	65	ND	65	ND	64	ND	--	--	66	ND	--	--
Benzo(g,h,i)perylene	Lab	ug/kg				66	ND	180	ND	870	ND	63	ND	65	ND	65	ND	64	ND	--	--	66	ND	--	--
Benzo(k)fluoranthene	Lab	ug/kg		13700		66	ND	180	ND	870	ND	63	ND	65	ND	65	ND	64	ND	--	--	66	ND	--	--
Benzoic acid	Lab	ug/kg			320000000	660	ND	1800	ND	8700	ND	630	ND	650	ND	650	ND	640	ND	--	--	660	ND	--	--
Benzyl alcohol	Lab	ug/kg			8000000	330	ND	870	ND	4400	ND	320	ND	320	ND	330	ND	320	ND	--	--	330	ND	--	--
Bis(2-chloroethoxy)methane	Lab	ug/kg				66	ND	180	ND	870	ND	63	ND	65	ND	65	ND	64	ND	--	--	66	ND	--	--
Bis(2-chloroethyl)ether	Lab	ug/kg		909		66	ND	180	ND	870	ND	63	ND	65	ND	65	ND	64	ND	--	--	66	ND	--	--
Bis(2-ethylhexyl)phthalate	Lab	ug/kg		71400	1600000	66	ND	180	ND	870	ND	63	ND	65	ND	65	ND	64	ND	--	--	66	ND	--	--
Butyl benzyl phthalate	Lab	ug/kg		526000	16000000	66	ND	180	ND	870	ND	63	ND	65	ND	65	ND	64	ND	--	--	66	ND	--	--
Carbazole	Lab	ug/kg				66	ND	180	ND	870	ND	63	ND	65	ND	65	ND	64	ND	--	--	66	ND	--	--
Chrysene	Lab	ug/kg		137000		66	ND	180	ND	870	ND	63	ND	65	ND	65	ND	64	ND	--	--	66	ND	--	--

Table 1
Historical Soil Data Review - 2008 Parametrix PQLs vs. MTCA Cleanup Levels
Yakima Mill Site

Location						B-2		B-3		B-3		B-3		B-4		B-4D		B-5		B-6		B-7		B-8	
Date						3/03/2008		3/03/2008		3/03/2008		3/03/2008		3/04/2008		3/04/2008		3/04/2008		3/04/2008		3/04/2008		3/04/2008	
Depth						13 ft		8.5 ft		8.5 ft		14 ft		13 ft		13 ft		10.5 ft		14 ft		14 ft		14 ft	
Sample Type						N		N		N		N		N		N		N		N		N		N	
Result Type						PQL	Result	PQL	Result	Diluted PQL	Diluted Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result
Data Status						SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource
Parameter	Analysis Location	Units	Washington Method A Unrestricted Land Use	Washington Method B Cancer Direct Contact	Washington Method B Noncancer Direct Contact																				
Effective Date			07/01/2015	07/01/2015	07/01/2015																				
Exceedance Key			**Bold**	Shade	Border																				
Dibenz(a,h)anthracene	Lab	ug/kg		137		66	ND	180	ND	870	ND	63	ND	65	ND	65	ND	64	ND	--	--	66	ND	--	--
Dibenzofuran	Lab	ug/kg			80000	66	ND	180	ND	870	ND	63	ND	65	ND	65	ND	64	ND	--	--	66	ND	--	--
Diethyl phthalate	Lab	ug/kg			64000000	66	ND	180	ND	870	ND	63	ND	65	ND	65	ND	64	ND	--	--	66	ND	--	--
Dimethyl phthalate	Lab	ug/kg				66	ND	180	ND	870	ND	63	ND	65	ND	65	ND	64	ND	--	--	66	ND	--	--
Di-n-butyl phthalate	Lab	ug/kg			8000000	66	ND	180	ND	870	ND	63	ND	65	ND	65	ND	64	ND	--	--	66	ND	--	--
Di-n-octyl phthalate	Lab	ug/kg			800000	66	ND	180	ND	870	ND	63	ND	65	ND	65	ND	64	ND	--	--	66	ND	--	--
Fluoranthene	Lab	ug/kg			3200000	DET	170	180	ND	870	ND	63	ND	DET	120	65	ND	64	ND	--	--	66	ND	--	--
Fluorene	Lab	ug/kg			3200000	66	ND	180	ND	870	ND	63	ND	65	ND	65	ND	64	ND	--	--	66	ND	--	--
Hexachlorobenzene	Lab	ug/kg		625	64000	66	ND	180	ND	870	ND	63	ND	65	ND	65	ND	64	ND	--	--	66	ND	--	--
Hexachlorobutadiene	Lab	ug/kg		12800	80000	66	ND	180	ND	870	ND	63	ND	65	ND	65	ND	64	ND	--	--	66	ND	--	--
Hexachlorocyclopentadiene	Lab	ug/kg			480000	330	ND	870	ND	4400	ND	320	ND	320	ND	330	ND	320	ND	--	--	330	ND	--	--
Hexachloroethane	Lab	ug/kg		25000	56000	66	ND	180	ND	870	ND	63	ND	65	ND	65	ND	64	ND	--	--	66	ND	--	--
Indeno(1,2,3-cd)pyrene	Lab	ug/kg		1370		66	ND	180	ND	870	ND	63	ND	65	ND	65	ND	64	ND	--	--	66	ND	--	--
Isophorone	Lab	ug/kg		1053000	16000000	66	ND	180	ND	870	ND	63	ND	65	ND	65	ND	64	ND	--	--	66	ND	--	--
Naphthalene	Lab	ug/kg	5000		1600000	DET	180	180	ND	870	ND	63	ND	DET	550 J	DET	140 J	64	ND	--	--	66	ND	--	--
Nitrobenzene	Lab	ug/kg			160000	66	ND	180	ND	870	ND	63	ND	65	ND	65	ND	64	ND	--	--	66	ND	--	--
n-Nitrosodi-n-propylamine	Lab	ug/kg		143		330	ND	870	ND	4400	ND	320	ND	320	ND	330	ND	320	ND	--	--	330	ND	--	--
n-Nitrosodiphenylamine	Lab	ug/kg		204000		66	ND	180	ND	870	ND	63	ND	65	ND	65	ND	64	ND	--	--	66	ND	--	--
Pentachlorophenol	Lab	ug/kg		2500	400000	330	ND	870	ND	4400	ND	320	ND	320	ND	330	ND	320	ND	--	--	330	ND	--	--
Phenanthrene	Lab	ug/kg				DET	160	180	ND	870	ND	63	ND	DET	160 J	DET	66 J	64	ND	--	--	66	ND	--	--
Phenol	Lab	ug/kg			24000000	66	ND	180	ND	870	ND	63	ND	65	ND	65	ND	64	ND	--	--	66	ND	--	--
Pyrene	Lab	ug/kg			2400000	DET	160	180	ND	870	ND	63	ND	DET	74	65	ND	64	ND	--	--	66	ND	--	--
VOCs																									
1,1,1,2-Tetrachloroethane	Lab	ug/kg		38500	2400000	--	--	--	--	--	--	--	--	2.6	ND	1.7	ND	0.90	ND	--	--	--	--	--	--
1,1,1-Trichloroethane	Lab	ug/kg	2000		160000000	--	--	--	--	--	--	--	--	2.6	ND	1.7	ND	0.90	ND	--	--	--	--	--	--
1,1,2,2-Tetrachloroethane	Lab	ug/kg		5000	1600000	--	--	--	--	--	--	--	--	2.6	ND	1.7	ND	0.90	ND	--	--	--	--	--	--
1,1,2-Trichloroethane	Lab	ug/kg		17500	320000	--	--	--	--	--	--	--	--	2.6	ND	1.7	ND	0.90	ND	--	--	--	--	--	--
1,1-Dichloroethane	Lab	ug/kg		175000	16000000	--	--	--	--	--	--	--	--	2.6	ND	1.7	ND	0.90	ND	--	--	--	--	--	--
1,1-Dichloroethylene	Lab	ug/kg			4000000	--	--	--	--	--	--	--	--	2.6	ND	1.7	ND	0.90	ND	--	--	--	--	--	--
1,2,3-Trichloropropane	Lab	ug/kg		33.3	320000	--	--	--	--	--	--	--	--	5.2	ND	3.5	ND	1.8	ND	--	--	--	--	--	--
1,2-Dibromo-3-chloropropane (DBCP)	Lab	ug/kg		1250	16000	--	--	--	--	--	--	--	--	13	ND	8.7	ND	4.4	ND	--	--	--	--	--	--
1,2-Dibromoethane (EDB)	Lab	ug/kg	**5.00**	500	720000	--	--	--	--	--	--	--	--	2.6	ND	1.7	ND	0.90	ND	--	--	--	--	--	--
1,2-Dichlorobenzene	Lab	ug/kg			7200000	--	--	--	--	--	--	--	--	2.6	ND	1.7	ND	0.90	ND	--	--	--	--	--	--
1,2-Dichloroethane	Lab	ug/kg		11000	480000	--	--	--	--	--	--	--	--	2.6	ND	1.7	ND	0.90	ND	--	--	--	--	--	--
1,2-Dichloroethylene, cis	Lab	ug/kg			160000	--	--	--	--	--	--	--	--	2.6	ND	1.7	ND	0.90	ND	--	--	--	--	--	--
1,2-Dichloroethylene, trans	Lab	ug/kg			1600000	--	--	--	--	--	--	--	--	2.6	ND	1.7	ND	0.90	ND	--	--	--	--	--	--
1,2-Dichloropropane	Lab	ug/kg		27800	7200000	--	--	--	--	--	--	--	--	2.6	ND	1.7	ND	0.90	ND	--	--	--	--	--	--
1,3-Dichloropropene, cis	Lab	ug/kg		10000	2400000	--	--	--	--	--	--	--	--	2.6	ND	1.7	ND	0.90	ND	--	--	--	--	--	--
1,3-Dichloropropene, trans	Lab	ug/kg		10000	2400000	--	--	--	--	--	--	--	--	2.6	ND	1.7	ND	0.90	ND	--	--	--	--	--	--
1,4-Dichloro-2-butene, trans	Lab	ug/kg				--	--	--	--	--	--	--	--	13	ND	8.7	ND	4.4	ND	--	--	--	--	--	--
1,4-Dichlorobenzene	Lab	ug/kg		185000	5600000	--	--	--	--	--	--	--	--	2.6	ND	1.7	ND	0.90	ND	--	--	--	--	--	--
2-Hexanone	Lab	ug/kg				--	--	--	--	--	--	--	--	13	ND	8.7	ND	4.4	ND	--	--	--	--	--	--
Acetone	Lab	ug/kg			72000000	--	--	--	--	--	--	--	--	DET	61	DET	63	DET	25	--	--	--	--	--	--
Acrylonitrile	Lab	ug/kg		1850	3200000	--	--	--	--	--	--	--	--	13	ND	8.7	ND	4.4	ND	--	--	--	--	--	--
Benzene	Lab	ug/kg	**30.0**	18200	320000	--	--	--	--	--	--	--	--	2.6	ND	1.7	ND	DET	1	--	--	--	--	--	--
Bromochloromethane	Lab	ug/kg				--	--	--	--	--	--	--	--	2.6	ND	1.7	ND	0.90	ND	--	--	--	--	--	--
Bromodichloromethane	Lab	ug/kg		16100	1600000	--	--	--	--	--	--	--	--	2.6	ND	1.7	ND	0.90	ND	--	--	--	--	--	--
Bromoform	Lab	ug/kg		127000	1600000	--	--	--	--	--	--	--	--	2.6	ND	1.7	ND	0.90	ND	--	--	--	--	--	--
Bromomethane	Lab	ug/kg			112000	--	--	--	--	--	--	--	--	2.6	ND	1.7	ND	0.90	ND	--	--	--	--	--	--
Carbon disulfide	Lab	ug/kg			8000000	--	--	--	--	--	--	--	--	2.6	ND	1.7	ND	0.90	ND	--	--	--	--	--	--
Carbon tetrachloride	Lab	ug/kg		14300	320000	--	--	--	--	--	--	--	--	2.6	ND	1.7	ND	0.90	ND	--	--	--	--	--	--
Chlorobenzene	Lab	ug/kg			1600000	--	--	--	--	--	--	--	--	2.6	ND	1.7	ND	0.90	ND	--	--	--	--	--	--
Chlorodibromomethane	Lab	ug/kg		11900	1600000	--	--	--	--	--	--	--	--	2.6	ND	1.7	ND	0.90	ND	--	--	--	--	--	--
Chloroethane	Lab	ug/kg				--	--	--	--	--	--	--	--	2.6	ND	1.7	ND	0.90	ND	--	--	--	--	--	--
Chloroform	Lab	ug/kg		32300	800000	--	--	--	--	--	--	--	--	2.6	ND	1.7	ND	0.90	ND	--	--	--	--	--	--
Chloromethane	Lab	ug/kg				--	--	--	--	--	--	--	--	2.6	ND	1.7	ND	0.90	ND	--	--	--	--	--	--
Dibromomethane (methylene bromide)	Lab	ug/kg			800000	--	--	--	--	--	--	--	--	2.6	ND	1.7	ND	0.90	ND	--	--	--	--	--	--
Ethyl benzene	Lab	ug/kg	6000		8000000	--	--	--	--	--	--	--	--	2.6	ND	1.7	ND	0.90	ND	--	--	--	--	--	--
Iodomethane	Lab	ug/kg				--	--	--	--	--	--	--	--	2.6	ND	1.7	ND	0.90	ND	--	--	--	--	--	--

Table 1
Historical Soil Data Review - 2008 Parametrix PQLs vs. MTCA Cleanup Levels
Yakima Mill Site

					Location	B-2		B-3		B-3		B-3		B-4		B-4D		B-5		B-6		B-7		B-8	
					Date	3/03/2008		3/03/2008		3/03/2008		3/03/2008		3/04/2008		3/04/2008		3/04/2008		3/04/2008		3/04/2008		3/04/2008	
					Depth	13 ft		8.5 ft		8.5 ft		14 ft		13 ft		13 ft		10.5 ft		14 ft		14 ft		14 ft	
					Sample Type	N		N		N		N		N		N		N		N		N		N	
					Result Type	PQL	Result	PQL	Result	Diluted PQL	Diluted Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result
					Data Status	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource
Parameter	Analysis Location	Units	Washington Method A Unrestricted Land Use	Washington Method B Cancer Direct Contact	Washington Method B Noncancer Direct Contact																				
Effective Date			07/01/2015	07/01/2015	07/01/2015																				
Exceedance Key			**Bold**	Shade	Border																				
Methyl ethyl ketone (2-butanone)	Lab	ug/kg			48000000	--	--	--	--	--	--	--	--	13	ND	8.7	ND	4.4	ND	--	--	--	--	--	--
Methyl isobutyl ketone (MIBK)	Lab	ug/kg			6400000	--	--	--	--	--	--	--	--	13	ND	8.7	ND	4.4	ND	--	--	--	--	--	--
Methylene chloride	Lab	ug/kg	20.0	500000	480000	--	--	--	--	--	--	--	--	5.2	ND	3.5	ND	1.8	ND	--	--	--	--	--	--
Styrene	Lab	ug/kg			16000000	--	--	--	--	--	--	--	--	2.6	ND	1.7	ND	0.90	ND	--	--	--	--	--	--
Tetrachloroethylene	Lab	ug/kg	**50.0**	476000	480000	--	--	--	--	--	--	--	--	2.6	ND	1.7	ND	0.90	ND	--	--	--	--	--	--
Toluene	Lab	ug/kg	7000		6400000	--	--	--	--	--	--	--	--	2.6	ND	1.7	ND	0.90	ND	--	--	--	--	--	--
Trichloroethylene (TCE)	Lab	ug/kg	**30.0**	12000	40000	--	--	--	--	--	--	--	--	2.6	ND	1.7	ND	0.90	ND	--	--	--	--	--	--
Trichlorofluoromethane (Freon-11)	Lab	ug/kg			24000000	--	--	--	--	--	--	--	--	2.6	ND	1.7	ND	0.90	ND	--	--	--	--	--	--
Vinyl acetate	Lab	ug/kg			80000000	--	--	--	--	--	--	--	--	13	ND	8.7	ND	4.4	ND	--	--	--	--	--	--
Vinyl chloride	Lab	ug/kg			240000	--	--	--	--	--	--	--	--	2.6	ND	1.7	ND	0.90	ND	--	--	--	--	--	--
Xylene, m & p	Lab	ug/kg			16000000	--	--	--	--	--	--	--	--	2.6	ND	1.7	ND	0.90	ND	--	--	--	--	--	--
Xylene, o	Lab	ug/kg			16000000	--	--	--	--	--	--	--	--	2.6	ND	1.7	ND	0.90	ND	--	--	--	--	--	--
PCBs																									
Aroclor 1016	Lab	ug/kg		14300	5600	33	ND	32	ND	--	--	33	ND	33	ND	33	ND	--	--	--	--	--	--	--	--
Aroclor 1221	Lab	ug/kg				33	ND	32	ND	--	--	33	ND	33	ND	33	ND	--	--	--	--	--	--	--	--
Aroclor 1232	Lab	ug/kg				33	ND	32	ND	--	--	33	ND	33	ND	33	ND	--	--	--	--	--	--	--	--
Aroclor 1242	Lab	ug/kg				33	ND	32	ND	--	--	33	ND	33	ND	33	ND	--	--	--	--	--	--	--	--
Aroclor 1248	Lab	ug/kg				33	ND	32	ND	--	--	33	ND	33	ND	33	ND	--	--	--	--	--	--	--	--
Aroclor 1254	Lab	ug/kg		500	1600	33	ND	32	ND	--	--	33	ND	33	ND	33	ND	--	--	--	--	--	--	--	--
Aroclor 1260	Lab	ug/kg		500		33	ND	32	ND	--	--	33	ND	33	ND	33	ND	--	--	--	--	--	--	--	--
Total Petroleum Hydrocarbons																									
Benzene	Lab	ug/kg	**30.0**	18200	320000	13	ND	11	ND	--	--	12	ND	**45**	ND	DET	46	11	ND	13	ND	12	ND	13	ND
Ethyl benzene	Lab	ug/kg	6000		8000000	13	ND	11	ND	--	--	12	ND	45	ND	32	ND	11	ND	13	ND	12	ND	13	ND
Toluene	Lab	ug/kg	7000		6400000	DET	75	11	ND	--	--	12	ND	DET	160 J	DET	88 J	11	ND	13	ND	12	ND	13	ND
Total Petroleum Hydrocarbons (as diesel)	Lab	ug/kg	2000000			DET	32000	DET	1800000	--	--	DET	22000	DET	96000 J	DET	46000 J	DET	24000 J	5400	ND	5300	ND	5400	ND
Total Petroleum Hydrocarbons (as gasoline)	Lab	ug/kg	30000			5400	ND	4400	ND	--	--	4800	ND	18000	ND	13000	ND	4500	ND	5100	ND	4800	ND	5200	ND
Total Petroleum Hydrocarbons (as motor oil)	Lab	ug/kg	2000000			DET	130000	DET	15000000	--	--	DET	150000	DET	400000 J	DET	190000 J	DET	85000 J	11000	ND	11000	ND	11000	ND
Xylene, m & p	Lab	ug/kg				27	ND	22	ND	--	--	24	ND	91	ND	63	ND	22	ND	25	ND	24	ND	26	ND
Xylene, o	Lab	ug/kg			16000000	13	ND	11	ND	--	--	12	ND	45	ND	32	ND	11	ND	13	ND	12	ND	13	ND

DET: Result is a detection, therefore no reporting detection limit is available.
Barr qualifier - *: Estimated value, QA/QC criteria not met.
J: Estimated concentration when the value is less than the ARI's established reporting limits.
N: Normal Sample.
FD: Field Duplicate Sample.
ND: Not detected.
PQL: Practical Quantitation Limit.
SSource: Laboratory and/or field data obtained from a secondary source external to Barr. Second source QA/QC evaluation procedures may or may not have been performed beyond the original data
Diluted PQL/Result: Samples required dilution by the laboratory due to high internal standards recoveries. Both sets of data were provided in lab report.

Table was updated (items in red) after original submittal to add Barr qualifiers to be consistent with the memo.

Table 1
Historical Soil Data Review - 2008 Parametrix PQLs vs. MTCA Cleanup Levels
Yakima Mill Site

					Location	B-9		B-9		BOILER DRAIN		FLY ASH		GP-3		SS-1		SS-2		SS-3		SS-4		SS-5	
					Date	3/04/2008		3/04/2008		3/04/2008		3/03/2008		3/03/2008		3/03/2008		3/03/2008		3/05/2008		3/05/2008		3/06/2008	
					Depth	7 ft		12 ft						12 ft		2 ft		1.5 ft		2 ft		1.5 ft		2 ft	
					Sample Type	N		N		N		N		N		N		N		N		N		N	
					Result Type	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result
					Data Status	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource
Parameter	Analysis Location	Units	Washington Method A Unrestricted Land Use	Washington Method B Cancer Direct Contact	Washington Method B Noncancer Direct Contact																				
Effective Date			07/01/2015	07/01/2015	07/01/2015																				
Exceedance Key			**Bold**	Shade	Border																				
General Parameters																									
Carbon, total organic	Lab	%				--	--	--	--	--	--	--	--	DET	0.729	--	--	--	--	--	--	--	--	--	--
pH	Lab	pH units				--	--	--	--	DET	7.98	DET	8.21	--	--	--	--	DET	6.67	DET	7.6	DET	9.89	DET	7.51
Solids, total	Lab	%				--	--	--	--	--	--	--	--	DET	90.8	--	--	--	--	--	--	--	--	--	--
Metals																									
Arsenic	Lab	ug/kg	20000	667	24000	6000	ND	6000	ND	10000	ND	10000	ND	--	--	10000	ND	10000	ND	10000	ND	6000	ND	6000	ND
Barium	Lab	ug/kg			16000000	DET	99100	DET	79200	DET	811000	DET	670000	--	--	DET	76600	DET	142000	DET	163000	DET	102000	DET	87600
Cadmium	Lab	ug/kg	2000		80000	300	ND	200	ND	DET	1700	DET	2600	--	--	500	ND	600	ND	600	ND	200	ND	200	ND
Chromium	Lab	ug/kg				DET	15200	DET	25300	DET	28000	DET	17000	--	--	DET	20000	DET	19000	DET	26000	DET	29800	DET	20100
Lead	Lab	ug/kg	250000			DET	12000 J	DET	18000 J	DET	17000 J	DET	21000	--	--	5000	ND	6000	ND	DET	21000	DET	5000	DET	15000
Mercury	Lab	ug/kg	2000			DET	60	50	ND	100	ND	100	ND	--	--	50	ND	DET	70	DET	50	50	ND	DET	60
Selenium	Lab	ug/kg			400000	6000	ND	6000	ND	10000	ND	10000	ND	--	--	10000	ND	10000	ND	10000	ND	6000	ND	6000	ND
Silver	Lab	ug/kg			400000	400	ND	400	ND	700	ND	800	ND	--	--	800	ND	900	ND	900	ND	300	ND	300	ND
SVOCs																									
1,2,4-Trichlorobenzene	Lab	ug/kg		34500	800000	66	ND	63	ND	65	ND	66	ND *	65	ND	260	ND	66	ND	67	ND	64	ND	66	ND
1,2-Dichlorobenzene	Lab	ug/kg			7200000	66	ND	63	ND	65	ND	66	ND *	65	ND	260	ND	66	ND	67	ND	64	ND	66	ND
1,3-Dichlorobenzene	Lab	ug/kg				66	ND	63	ND	65	ND	66	ND *	65	ND	260	ND	66	ND	67	ND	64	ND	66	ND
1,4-Dichlorobenzene	Lab	ug/kg		185000	5600000	66	ND	63	ND	65	ND	66	ND *	65	ND	260	ND	66	ND	67	ND	64	ND	66	ND
1-Methylnaphthalene	Lab	ug/kg		34500	5600000	66	ND	63	ND	65	ND	DET	400 *	65	ND	260	ND	66	ND	67	ND	64	ND	66	ND
2,2'-oxybis (1-chloropropane)	Lab	ug/kg		14300	3200000	66	ND	63	ND	65	ND	66	ND *	65	ND	260	ND	66	ND	67	ND	64	ND	66	ND
2,4,5-Trichlorophenol	Lab	ug/kg			8000000	330	ND	320	ND	320	ND	330	ND *	320	ND	1300	ND	330	ND	330	ND	320	ND	330	ND
2,4,6-Trichlorophenol	Lab	ug/kg		90900	80000	330	ND	320	ND	320	ND	330	ND *	320	ND	1300	ND	330	ND	330	ND	320	ND	330	ND
2,4-Dichlorophenol	Lab	ug/kg			240000	330	ND	320	ND	320	ND	330	ND *	320	ND	1300	ND	330	ND	330	ND	320	ND	330	ND
2,4-Dimethylphenol	Lab	ug/kg			1600000	66	ND	63	ND	65	ND	66	ND *	65	ND	260	ND	66	ND	67	ND	64	ND	66	ND
2,4-Dinitrophenol	Lab	ug/kg			160000	660	ND	630	ND	650	ND	660	ND *	650	ND	2600	ND	660	ND	670	ND	640	ND	660	ND
2,4-Dinitrotoluene	Lab	ug/kg		3230	160000	330	ND	320	ND	320	ND	330	ND *	320	ND	1300	ND	330	ND	330	ND	320	ND	330	ND
2,6-Dinitrotoluene	Lab	ug/kg		667	24000	330	ND	320	ND	320	ND	330	ND *	320	ND	1300	ND	330	ND	330	ND	320	ND	330	ND
2-Chloronaphthalene	Lab	ug/kg			6400000	66	ND	63	ND	65	ND	66	ND *	65	ND	260	ND	66	ND	67	ND	64	ND	66	ND
2-Chlorophenol	Lab	ug/kg			400000	66	ND	63	ND	65	ND	66	ND *	65	ND	260	ND	66	ND	67	ND	64	ND	66	ND
2-Methyl-4,6-dinitrophenol	Lab	ug/kg				660	ND	630	ND	650	ND	660	ND *	650	ND	2600	ND	660	ND	670	ND	640	ND	660	ND
2-Methylnaphthalene	Lab	ug/kg			320000	66	ND	63	ND	65	ND	DET	280 *	65	ND	260	ND	66	ND	67	ND	64	ND	66	ND
2-Methylphenol (o-cresol)	Lab	ug/kg			4000000	66	ND	63	ND	65	ND	66	ND *	65	ND	260	ND	66	ND	67	ND	64	ND	66	ND
2-Nitroaniline	Lab	ug/kg			800000	330	ND	320	ND	320	ND	330	ND *	320	ND	1300	ND	330	ND	330	ND	320	ND	330	ND
2-Nitrophenol	Lab	ug/kg				330	ND	320	ND	320	ND	330	ND *	320	ND	1300	ND	330	ND	330	ND	320	ND	330	ND
3,3`-Dichlorobenzidine	Lab	ug/kg		2220		330	ND	320	ND	320	ND	330	ND *	320	ND	1300	ND	330	ND	330	ND	320	ND	330	ND
3-Nitroaniline	Lab	ug/kg				330	ND	320	ND	320	ND	330	ND *	320	ND	1300	ND	330	ND	330	ND	320	ND	330	ND
4-Bromophenyl phenyl ether	Lab	ug/kg				66	ND	63	ND	65	ND	66	ND *	65	ND	260	ND	66	ND	67	ND	64	ND	66	ND
4-Chloro-3-methylphenol	Lab	ug/kg				330	ND	320	ND	320	ND	330	ND *	320	ND	1300	ND	330	ND	330	ND	320	ND	330	ND
4-Chloroaniline	Lab	ug/kg		5000	320000	330	ND	320	ND	320	ND	330	ND *	320	ND	1300	ND	330	ND	330	ND	320	ND	330	ND
4-Chlorophenyl phenyl ether	Lab	ug/kg				66	ND	63	ND	65	ND	66	ND *	65	ND	260	ND	66	ND	67	ND	64	ND	66	ND
4-Methylphenol (p-cresol)	Lab	ug/kg			8000000	DET	3000	DET	70	65	ND	66	ND *	65	ND	260	ND	66	ND	67	ND	64	ND	66	ND
4-Nitroaniline	Lab	ug/kg				330	ND	320	ND	320	ND	330	ND *	320	ND	1300	ND	330	ND	330	ND	320	ND	330	ND
4-Nitrophenol	Lab	ug/kg				330	ND	320	ND	320	ND	330	ND *	320	ND	1300	ND	330	ND	330	ND	320	ND	330	ND
Acenaphthene	Lab	ug/kg			4800000	66	ND	63	ND	65	ND	DET	78 *	65	ND	260	ND	66	ND	67	ND	64	ND	66	ND
Acenaphthylene	Lab	ug/kg				66	ND	63	ND	DET	92	DET	2200 *	65	ND	260	ND	66	ND	DET	87	64	ND	66	ND
Anthracene	Lab	ug/kg			24000000	66	ND	63	ND	65	ND	66	ND *	65	ND	260	ND	66	ND	67	ND	64	ND	66	ND
Benz(a)anthracene	Lab	ug/kg		1370		66	ND	63	ND	65	ND	66	ND *	65	ND	260	ND	66	ND	DET	290	DET	75	66	ND
Benzo(a)pyrene	Lab	ug/kg	**100**	137		66	ND	63	ND	65	ND	66	ND *	65	ND	**260**	ND	66	ND	DET	530	DET	180	66	ND
Benzo(b)fluoranthene	Lab	ug/kg		1370		66	ND	63	ND	65	ND	66	ND *	65	ND	260	ND	66	ND	DET	350	DET	220	66	ND
Benzo(g,h,i)perylene	Lab	ug/kg				66	ND	63	ND	65	ND	66	ND *	65	ND	260	ND	66	ND	DET	280	DET	330	66	ND
Benzo(k)fluoranthene	Lab	ug/kg		13700		66	ND	63	ND	65	ND	66	ND *	65	ND	260	ND	66	ND	DET	470	DET	280	66	ND
Benzoic acid	Lab	ug/kg			320000000	660	ND	630	ND	650	ND	660	ND *	650	ND	2600	ND	660	ND	670	ND	640	ND	660	ND
Benzyl alcohol	Lab	ug/kg			8000000	330	ND	320	ND	320	ND	330	ND *	320	ND	1300	ND	330	ND	330	ND	320	ND	330	ND
Bis(2-chloroethoxy)methane	Lab	ug/kg				66	ND	63	ND	65	ND	66	ND *	65	ND	260	ND	66	ND	67	ND	64	ND	66	ND
Bis(2-chloroethyl)ether	Lab	ug/kg		909		66	ND	63	ND	65	ND	66	ND *	65	ND	260	ND	66	ND	67	ND	64	ND	66	ND
Bis(2-ethylhexyl)phthalate	Lab	ug/kg		71400	1600000	66	ND	63	ND	DET	980	66	ND *	65	ND	260	ND	66	ND	67	ND	64	ND	66	ND
Butyl benzyl phthalate	Lab	ug/kg		526000	16000000	66	ND	63	ND	65	ND	66	ND *	65	ND	260	ND	66	ND	67	ND	64	ND	66	ND
Carbazole	Lab	ug/kg				66	ND	63	ND	65	ND	66	ND *	65	ND	260	ND	66	ND	67	ND	64	ND	66	ND
Chrysene	Lab	ug/kg		137000		66	ND	63	ND	65	ND	66	ND *	65	ND	260	ND	66	ND	DET	350	DET	100	66	ND

Table 1
Historical Soil Data Review - 2008 Parametrix PQLs vs. MTCA Cleanup Levels
Yakima Mill Site

					Location	B-9		B-9		BOILER DRAIN		FLY ASH		GP-3		SS-1		SS-2		SS-3		SS-4		SS-5	
					Date	3/04/2008		3/04/2008		3/04/2008		3/03/2008		3/03/2008		3/03/2008		3/03/2008		3/05/2008		3/05/2008		3/06/2008	
					Depth	7 ft		12 ft						12 ft		2 ft		1.5 ft		2 ft		1.5 ft		2 ft	
					Sample Type	N		N		N		N		N		N		N		N		N		N	
					Result Type	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result
					Data Status	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource
Parameter	Analysis Location	Units	Washington Method A Unrestricted Land Use	Washington Method B Cancer Direct Contact	Washington Method B Noncancer Direct Contact																				
Effective Date			07/01/2015	07/01/2015	07/01/2015																				
Exceedance Key			**Bold**	Shade	Border																				
Dibenz(a,h)anthracene	Lab	ug/kg		137		66	ND	63	ND	65	ND	66	ND *	65	ND	260	ND	66	ND	DET	69	64	ND	66	ND
Dibenzofuran	Lab	ug/kg			80000	66	ND	63	ND	65	ND	DET	200 *	65	ND	260	ND	66	ND	67	ND	64	ND	66	ND
Diethyl phthalate	Lab	ug/kg			64000000	66	ND	63	ND	65	ND	66	ND *	65	ND	260	ND	66	ND	67	ND	64	ND	66	ND
Dimethyl phthalate	Lab	ug/kg				66	ND	63	ND	65	ND	66	ND *	65	ND	260	ND	66	ND	67	ND	64	ND	66	ND
Di-n-butyl phthalate	Lab	ug/kg			8000000	66	ND	63	ND	65	ND	66	ND *	65	ND	260	ND	66	ND	67	ND	64	ND	66	ND
Di-n-octyl phthalate	Lab	ug/kg			800000	66	ND	63	ND	65	ND	66	ND *	65	ND	260	ND	66	ND	67	ND	64	ND	66	ND
Fluoranthene	Lab	ug/kg			3200000	66	ND	63	ND	DET	120	DET	150 *	65	ND	260	ND	66	ND	DET	240	DET	100	66	ND
Fluorene	Lab	ug/kg			3200000	66	ND	63	ND	65	ND	66	ND *	65	ND	260	ND	66	ND	67	ND	64	ND	66	ND
Hexachlorobenzene	Lab	ug/kg		625	64000	66	ND	63	ND	65	ND	66	ND *	65	ND	260	ND	66	ND	67	ND	64	ND	66	ND
Hexachlorobutadiene	Lab	ug/kg		12800	80000	66	ND	63	ND	65	ND	66	ND *	65	ND	260	ND	66	ND	67	ND	64	ND	66	ND
Hexachlorocyclopentadiene	Lab	ug/kg			480000	330	ND	320	ND	320	ND	330	ND *	320	ND	1300	ND	330	ND	330	ND	320	ND	330	ND
Hexachloroethane	Lab	ug/kg		25000	56000	66	ND	63	ND	65	ND	66	ND *	65	ND	260	ND	66	ND	67	ND	64	ND	66	ND
Indeno(1,2,3-cd)pyrene	Lab	ug/kg		1370		66	ND	63	ND	65	ND	66	ND *	65	ND	260	ND	66	ND	DET	280	DET	260	66	ND
Isophorone	Lab	ug/kg		1053000	16000000	66	ND	63	ND	65	ND	66	ND *	65	ND	260	ND	66	ND	67	ND	64	ND	66	ND
Naphthalene	Lab	ug/kg	5000		1600000	66	ND	63	ND	DET	410 J	DET	8700 *	65	ND	260	ND	66	ND	67	ND	64	ND	66	ND
Nitrobenzene	Lab	ug/kg			160000	66	ND	63	ND	65	ND	66	ND *	65	ND	260	ND	66	ND	67	ND	64	ND	66	ND
n-Nitrosodi-n-propylamine	Lab	ug/kg		143		330	ND	320	ND	320	ND	330	ND *	320	ND	1300	ND	330	ND	330	ND	320	ND	330	ND
n-Nitrosodiphenylamine	Lab	ug/kg		204000		66	ND	63	ND	65	ND	66	ND *	65	ND	260	ND	66	ND	67	ND	64	ND	66	ND
Pentachlorophenol	Lab	ug/kg		2500	400000	330	ND	320	ND	320	ND	330	ND *	320	ND	1300	ND	330	ND	330	ND	320	ND	330	ND
Phenanthrene	Lab	ug/kg				66	ND	63	ND	DET	130 J	DET	430 *	65	ND	260	ND	66	ND	67	ND	64	ND	66	ND
Phenol	Lab	ug/kg			24000000	DET	530	63	ND	DET	110	DET	130 *	65	ND	260	ND	66	ND	67	ND	64	ND	66	ND
Pyrene	Lab	ug/kg			2400000	66	ND	63	ND	DET	92	DET	110 *	65	ND	260	ND	66	ND	DET	330	DET	120	66	ND
VOCs																									
1,1,1,2-Tetrachloroethane	Lab	ug/kg		38500	2400000	--	--	--	--	--	--	--	--	--	--	1.1	ND	--	--	--	--	--	--	0.90	ND
1,1,1-Trichloroethane	Lab	ug/kg	2000		160000000	--	--	--	--	--	--	--	--	--	--	1.1	ND	--	--	--	--	--	--	0.90	ND
1,1,2,2-Tetrachloroethane	Lab	ug/kg		5000	1600000	--	--	--	--	--	--	--	--	--	--	1.1	ND	--	--	--	--	--	--	0.90	ND
1,1,2-Trichloroethane	Lab	ug/kg		17500	320000	--	--	--	--	--	--	--	--	--	--	1.1	ND	--	--	--	--	--	--	0.90	ND
1,1-Dichloroethane	Lab	ug/kg		175000	16000000	--	--	--	--	--	--	--	--	--	--	1.1	ND	--	--	--	--	--	--	0.90	ND
1,1-Dichloroethylene	Lab	ug/kg			4000000	--	--	--	--	--	--	--	--	--	--	1.1	ND	--	--	--	--	--	--	0.90	ND
1,2,3-Trichloropropane	Lab	ug/kg		33.3	320000	--	--	--	--	--	--	--	--	--	--	2.1	ND	--	--	--	--	--	--	1.9	ND
1,2-Dibromo-3-chloropropane (DBCP)	Lab	ug/kg		1250	16000	--	--	--	--	--	--	--	--	--	--	5.3	ND	--	--	--	--	--	--	4.7	ND
1,2-Dibromoethane (EDB)	Lab	ug/kg	**5.00**	500	720000	--	--	--	--	--	--	--	--	--	--	1.0	ND	--	--	--	--	--	--	0.90	ND
1,2-Dichlorobenzene	Lab	ug/kg			7200000	--	--	--	--	--	--	--	--	--	--	1.1	ND	--	--	--	--	--	--	0.90	ND
1,2-Dichloroethane	Lab	ug/kg		11000	480000	--	--	--	--	--	--	--	--	--	--	1.1	ND	--	--	--	--	--	--	0.90	ND
1,2-Dichloroethylene, cis	Lab	ug/kg			160000	--	--	--	--	--	--	--	--	--	--	1.1	ND	--	--	--	--	--	--	0.90	ND
1,2-Dichloroethylene, trans	Lab	ug/kg			1600000	--	--	--	--	--	--	--	--	--	--	1.1	ND	--	--	--	--	--	--	0.90	ND
1,2-Dichloropropane	Lab	ug/kg		27800	7200000	--	--	--	--	--	--	--	--	--	--	1.1	ND	--	--	--	--	--	--	0.90	ND
1,3-Dichloropropene, cis	Lab	ug/kg		10000	2400000	--	--	--	--	--	--	--	--	--	--	1.1	ND	--	--	--	--	--	--	0.90	ND
1,3-Dichloropropene, trans	Lab	ug/kg		10000	2400000	--	--	--	--	--	--	--	--	--	--	1.1	ND	--	--	--	--	--	--	0.90	ND
1,4-Dichloro-2-butene, trans	Lab	ug/kg				--	--	--	--	--	--	--	--	--	--	5.3	ND	--	--	--	--	--	--	4.7	ND
1,4-Dichlorobenzene	Lab	ug/kg		185000	5600000	--	--	--	--	--	--	--	--	--	--	1.1	ND	--	--	--	--	--	--	0.90	ND
2-Hexanone	Lab	ug/kg				--	--	--	--	--	--	--	--	--	--	5.3	ND	--	--	--	--	--	--	4.7	ND
Acetone	Lab	ug/kg			72000000	--	--	--	--	--	--	--	--	--	--	DET	78	--	--	--	--	--	--	DET	130
Acrylonitrile	Lab	ug/kg		1850	3200000	--	--	--	--	--	--	--	--	--	--	5.3	ND	--	--	--	--	--	--	4.7	ND
Benzene	Lab	ug/kg	**30.0**	18200	320000	--	--	--	--	--	--	--	--	--	--	1.1	ND	--	--	--	--	--	--	0.90	ND
Bromochloromethane	Lab	ug/kg				--	--	--	--	--	--	--	--	--	--	1.0	ND	--	--	--	--	--	--	0.90	ND
Bromodichloromethane	Lab	ug/kg		16100	1600000	--	--	--	--	--	--	--	--	--	--	1.1	ND	--	--	--	--	--	--	0.90	ND
Bromoform	Lab	ug/kg		127000	1600000	--	--	--	--	--	--	--	--	--	--	1.1	ND	--	--	--	--	--	--	0.90	ND
Bromomethane	Lab	ug/kg			112000	--	--	--	--	--	--	--	--	--	--	1.1	ND	--	--	--	--	--	--	0.90	ND
Carbon disulfide	Lab	ug/kg			8000000	--	--	--	--	--	--	--	--	--	--	DET	1.6	--	--	--	--	--	--	0.90	ND
Carbon tetrachloride	Lab	ug/kg		14300	320000	--	--	--	--	--	--	--	--	--	--	1.1	ND	--	--	--	--	--	--	0.90	ND
Chlorobenzene	Lab	ug/kg			1600000	--	--	--	--	--	--	--	--	--	--	1.1	ND	--	--	--	--	--	--	0.90	ND
Chlorodibromomethane	Lab	ug/kg		11900	1600000	--	--	--	--	--	--	--	--	--	--	1.1	ND	--	--	--	--	--	--	0.90	ND
Chloroethane	Lab	ug/kg				--	--	--	--	--	--	--	--	--	--	1.1	ND	--	--	--	--	--	--	0.90	ND
Chloroform	Lab	ug/kg		32300	800000	--	--	--	--	--	--	--	--	--	--	1.1	ND	--	--	--	--	--	--	0.90	ND
Chloromethane	Lab	ug/kg				--	--	--	--	--	--	--	--	--	--	1.1	ND *	--	--	--	--	--	--	0.90	ND
Dibromomethane (methylene bromide)	Lab	ug/kg			800000	--	--	--	--	--	--	--	--	--	--	1.1	ND	--	--	--	--	--	--	0.90	ND
Ethyl benzene	Lab	ug/kg	6000		8000000	--	--	--	--	--	--	--	--	--	--	1.1	ND	--	--	--	--	--	--	0.90	ND
Iodomethane	Lab	ug/kg				--	--	--	--	--	--	--	--	--	--	1.1	ND	--	--	--	--	--	--	0.90	ND

11-29-2017

Table 1
Historical Soil Data Review - 2008 Parametrix PQLs vs. MTCA Cleanup Levels
Yakima Mill Site

Location						B-9		B-9		BOILER DRAIN		FLY ASH		GP-3		SS-1		SS-2		SS-3		SS-4		SS-5	
Date						3/04/2008		3/04/2008		3/04/2008		3/03/2008		3/03/2008		3/03/2008		3/03/2008		3/05/2008		3/05/2008		3/06/2008	
Depth						7 ft		12 ft						12 ft		2 ft		1.5 ft		2 ft		1.5 ft		2 ft	
Sample Type						N		N		N		N		N		N		N		N		N		N	
Result Type						PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result
Data Status						SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource
Parameter	Analysis Location	Units	Washington Method A Unrestricted Land Use	Washington Method B Cancer Direct Contact	Washington Method B Noncancer Direct Contact																				
Effective Date			07/01/2015	07/01/2015	07/01/2015																				
Exceedance Key			**Bold**	Shade	Border																				
Methyl ethyl ketone (2-butanone)	Lab	ug/kg			48000000	--	--	--	--	--	--	--	--	--	--	DET	6.2	--	--	--	--	--	--	4.7	ND
Methyl isobutyl ketone (MIBK)	Lab	ug/kg			6400000	--	--	--	--	--	--	--	--	--	--	5.3	ND	--	--	--	--	--	--	4.7	ND
Methylene chloride	Lab	ug/kg	20.0	500000	480000	--	--	--	--	--	--	--	--	--	--	DET	2.5	--	--	--	--	--	--	DET	5.2
Styrene	Lab	ug/kg			16000000	--	--	--	--	--	--	--	--	--	--	1.1	ND	--	--	--	--	--	--	0.90	ND
Tetrachloroethylene	Lab	ug/kg	**50.0**	476000	480000	--	--	--	--	--	--	--	--	--	--	1.1	ND	--	--	--	--	--	--	DET	9.6
Toluene	Lab	ug/kg	7000		6400000	--	--	--	--	--	--	--	--	--	--	DET	2	--	--	--	--	--	--	DET	11
Trichloroethylene (TCE)	Lab	ug/kg	**30.0**	12000	40000	--	--	--	--	--	--	--	--	--	--	1.1	ND	--	--	--	--	--	--	0.90	ND
Trichlorofluoromethane (Freon-11)	Lab	ug/kg			24000000	--	--	--	--	--	--	--	--	--	--	1.1	ND	--	--	--	--	--	--	0.90	ND
Vinyl acetate	Lab	ug/kg			80000000	--	--	--	--	--	--	--	--	--	--	5.3	ND	--	--	--	--	--	--	4.7	ND
Vinyl chloride	Lab	ug/kg			240000	--	--	--	--	--	--	--	--	--	--	1.1	ND	--	--	--	--	--	--	0.90	ND
Xylene, m & p	Lab	ug/kg			16000000	--	--	--	--	--	--	--	--	--	--	1.1	ND	--	--	--	--	--	--	0.90	ND
Xylene, o	Lab	ug/kg			16000000	--	--	--	--	--	--	--	--	--	--	1.1	ND *	--	--	--	--	--	--	0.90	ND
PCBs																									
Aroclor 1016	Lab	ug/kg		14300	5600	--	--	--	--	--	--	33	ND *	33	ND	33	ND	33	ND	--	--	--	--	32	ND
Aroclor 1221	Lab	ug/kg				--	--	--	--	--	--	33	ND *	33	ND	33	ND	33	ND	--	--	--	--	32	ND
Aroclor 1232	Lab	ug/kg				--	--	--	--	--	--	33	ND *	33	ND	33	ND	33	ND	--	--	--	--	32	ND
Aroclor 1242	Lab	ug/kg				--	--	--	--	--	--	33	ND *	33	ND	33	ND	33	ND	--	--	--	--	32	ND
Aroclor 1248	Lab	ug/kg				--	--	--	--	--	--	33	ND *	33	ND	33	ND	33	ND	--	--	--	--	32	ND
Aroclor 1254	Lab	ug/kg		500	1600	--	--	--	--	--	--	33	ND *	33	ND	33	ND	33	ND	--	--	--	--	32	ND
Aroclor 1260	Lab	ug/kg		500		--	--	--	--	--	--	33	ND *	33	ND	33	ND	33	ND	--	--	--	--	32	ND
Total Petroleum Hydrocarbons																									
Benzene	Lab	ug/kg	**30.0**	18200	320000	20	ND	17	ND	**46**	ND	DET	160 *	12	ND	14	ND	20	ND	17	ND	12	ND	13	ND
Ethyl benzene	Lab	ug/kg	6000		8000000	DET	74	17	ND	46	ND	72	ND *	12	ND	14	ND	20	ND	17	ND	12	ND	13	ND
Toluene	Lab	ug/kg	7000		6400000	DET	34 J	17	ND	46	ND	72	ND *	12	ND	14	ND	20	ND	17	ND	12	ND	DET	190
Total Petroleum Hydrocarbons (as diesel)	Lab	ug/kg	2000000			DET	370000 J	DET	180000 J	DET	92000 J	DET	120000	DET	11000	DET	2800000	5900	ND	DET	12000	DET	5800	DET	19000
Total Petroleum Hydrocarbons (as gasoline)	Lab	ug/kg	30000			DET	21000	6600	ND	18000	ND	29000	ND *	4600	ND	5600	ND	7900	ND	6600	ND	4800	ND	5200	ND
Total Petroleum Hydrocarbons (as motor oil)	Lab	ug/kg	2000000			DET	1500000 J	DET	840000 J	DET	700000 J	DET	440000	DET	83000	DET	19000000	DET	13000	DET	63000	DET	29000	DET	120000
Xylene, m & p	Lab	ug/kg				40	ND	33	ND	93	ND	140	ND *	23	ND	28	ND	39	ND	33	ND	24	ND	26	ND
Xylene, o	Lab	ug/kg			16000000	20	ND	17	ND	46	ND	72	ND *	12	ND	14	ND	20	ND	17	ND	12	ND	13	ND

DET: Result is a detection, therefore no reporting detection limit is available.
Barr qualifier - *: Estimated value, QA/QC criteria not met.
J: Estimated concentration when the value is less than the ARI's established reporting limits.
N: Normal Sample.
FD: Field Duplicate Sample.
ND: Not detected.
PQL: Practical Quantitation Limit.
SSource: Laboratory and/or field data obtained from a secondary source external to Barr. Second source QA/QC evaluation procedures may or may not have been performed beyond the original data
Diluted PQL/Result: Samples required dilution by the laboratory due to high internal standards recoveries. Both sets of data were provided in lab report.

Table was updated (items in red) after original submittal to add Barr qualifiers to be consistent with the memo.

Table 1
Historical Soil Data Review - 2008 Parametrix PQLs vs. MTCA Cleanup Levels
Yakima Mill Site

					Location	SS-6		SS-7		TP-8		TP-8		TP-9		TP-9		TP-9		TP-10		TP-10		TP-10	
					Date	3/06/2008		3/06/2008		2/27/2008		2/27/2008		2/27/2008		2/27/2008		2/27/2008		2/27/2008		2/27/2008		2/27/2008	
					Depth	1.5 ft		1.5 ft		2 ft		12.5 ft		1.5 ft		1.5 ft		13 ft		8 ft		8 ft		13 ft	
					Sample Type	N		N		N		N		N		N		N		N		N		N	
					Result Type	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	Diluted PQL	Diluted Result	PQL	Result	PQL	Result	Diluted PQL	Diluted Result	PQL	Result
					Data Status	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource
Parameter	Analysis Location	Units	Washington Method A Unrestricted Land Use	Washington Method B Cancer Direct Contact	Washington Method B Noncancer Direct Contact																				
Effective Date			07/01/2015	07/01/2015	07/01/2015																				
Exceedance Key			**Bold**	Shade	Border																				
General Parameters																									
Carbon, total organic	Lab	%				--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
pH	Lab	pH units				--	--	DET	8.12	DET	6.72	DET	6.8	--	--	--	--	--	--	DET	6.53	--	--	DET	6.35
Solids, total	Lab	%				--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Metals																									
Arsenic	Lab	ug/kg	20000	667	24000	--	--	--	--	7000	ND	20000	ND	10000	ND	--	--	10000	ND	7000	ND	--	--	10000	ND
Barium	Lab	ug/kg			16000000	--	--	--	--	DET	147000	DET	142000	DET	167000	--	--	DET	71000	DET	64300	--	--	DET	81300
Cadmium	Lab	ug/kg	2000		80000	--	--	--	--	300	ND	600	ND	600	ND	--	--	500	ND	300	ND	--	--	500	ND
Chromium	Lab	ug/kg				--	--	--	--	DET	16800	DET	19000	DET	18000	--	--	DET	15000	DET	17400	--	--	DET	13000
Lead	Lab	ug/kg	250000			--	--	--	--	DET	32000	6000	ND	DET	12000	--	--	5000	ND	DET	12000	--	--	DET	16000
Mercury	Lab	ug/kg	2000			--	--	--	--	DET	150	DET	70	DET	70	--	--	DET	50	60	ND	--	--	40	ND
Selenium	Lab	ug/kg			400000	--	--	--	--	7000	ND	20000	ND	10000	ND	--	--	10000	ND	7000	ND	--	--	10000	ND
Silver	Lab	ug/kg			400000	--	--	--	--	400	ND	900	ND	800	ND	--	--	0.80	ND	400	ND	--	--	700	ND
SVOCs																									
1,2,4-Trichlorobenzene	Lab	ug/kg		34500	800000	64	ND	--	--	66	ND	66	ND	64	ND	190	ND	63	ND	680	ND	2000	ND	280	ND
1,2-Dichlorobenzene	Lab	ug/kg			7200000	64	ND	--	--	66	ND	66	ND	64	ND	190	ND	63	ND	680	ND	2000	ND	280	ND
1,3-Dichlorobenzene	Lab	ug/kg				64	ND	--	--	66	ND	66	ND	64	ND	190	ND	63	ND	680	ND	2000	ND	280	ND
1,4-Dichlorobenzene	Lab	ug/kg		185000	5600000	64	ND	--	--	66	ND	66	ND	64	ND	190	ND	63	ND	680	ND	2000	ND	280	ND
1-Methylnaphthalene	Lab	ug/kg		34500	5600000	64	ND	--	--	66	ND	66	ND	64	ND	190	ND	63	ND	680	ND	2000	ND	280	ND
2,2'-oxybis (1-chloropropane)	Lab	ug/kg		14300	3200000	64	ND	--	--	66	ND	66	ND	64	ND	190	ND	63	ND	680	ND	2000	ND	280	ND
2,4,5-Trichlorophenol	Lab	ug/kg			8000000	320	ND	--	--	330	ND	330	ND	320	ND	950	ND	320	ND	3400	ND	10000	ND	1400	ND
2,4,6-Trichlorophenol	Lab	ug/kg		90900	80000	320	ND	--	--	330	ND	330	ND	320	ND	950	ND	320	ND	3400	ND	10000	ND	1400	ND
2,4-Dichlorophenol	Lab	ug/kg			240000	320	ND	--	--	330	ND	330	ND	320	ND	950	ND	320	ND	3400	ND	10000	ND	1400	ND
2,4-Dimethylphenol	Lab	ug/kg			1600000	64	ND	--	--	66	ND	66	ND	64	ND	190	ND	63	ND	680	ND	2000	ND	280	ND
2,4-Dinitrophenol	Lab	ug/kg			160000	640	ND	--	--	660	ND *	660	ND	640	ND	1900	ND	630	ND	6800	ND	20000	ND	2800	ND
2,4-Dinitrotoluene	Lab	ug/kg		3230	160000	320	ND	--	--	330	ND	330	ND	320	ND	950	ND	320	ND	3400	ND	10000	ND	1400	ND
2,6-Dinitrotoluene	Lab	ug/kg		667	24000	320	ND	--	--	330	ND	330	ND	320	ND	950	ND	320	ND	3400	ND	10000	ND	1400	ND
2-Chloronaphthalene	Lab	ug/kg			6400000	64	ND	--	--	66	ND	66	ND	64	ND	190	ND	63	ND	680	ND	2000	ND	280	ND
2-Chlorophenol	Lab	ug/kg			400000	64	ND	--	--	66	ND	66	ND	64	ND	190	ND	63	ND	680	ND	2000	ND	280	ND
2-Methyl-4,6-dinitrophenol	Lab	ug/kg				640	ND	--	--	660	ND *	660	ND	640	ND	1900	ND	630	ND	6800	ND	20000	ND	2800	ND
2-Methylnaphthalene	Lab	ug/kg			320000	64	ND	--	--	66	ND	66	ND	64	ND	190	ND	63	ND	680	ND	2000	ND	280	ND
2-Methylphenol (o-cresol)	Lab	ug/kg			4000000	64	ND	--	--	66	ND	66	ND	64	ND	190	ND	63	ND	680	ND	2000	ND	280	ND
2-Nitroaniline	Lab	ug/kg			800000	320	ND	--	--	330	ND	330	ND	320	ND	950	ND	320	ND	3400	ND	10000	ND	1400	ND
2-Nitrophenol	Lab	ug/kg				320	ND	--	--	330	ND	330	ND	320	ND	950	ND	320	ND	3400	ND	10000	ND	1400	ND
3,3`-Dichlorobenzidine	Lab	ug/kg		2220		320	ND	--	--	330	ND	330	ND	320	ND	950	ND	320	ND	3400	ND	10000	ND	1400	ND
3-Nitroaniline	Lab	ug/kg				320	ND	--	--	330	ND *	330	ND	320	ND	950	ND	320	ND	3400	ND	10000	ND	1400	ND
4-Bromophenyl phenyl ether	Lab	ug/kg				64	ND	--	--	66	ND	66	ND	64	ND	190	ND	63	ND	680	ND	2000	ND	280	ND
4-Chloro-3-methylphenol	Lab	ug/kg				320	ND	--	--	330	ND	330	ND	320	ND	950	ND	320	ND	3400	ND	10000	ND	1400	ND
4-Chloroaniline	Lab	ug/kg		5000	320000	320	ND	--	--	330	ND *	330	ND	320	ND	950	ND	320	ND	3400	ND	10000	ND	1400	ND
4-Chlorophenyl phenyl ether	Lab	ug/kg				64	ND	--	--	66	ND	66	ND	64	ND	190	ND	63	ND	680	ND	2000	ND	280	ND
4-Methylphenol (p-cresol)	Lab	ug/kg			8000000	64	ND	--	--	DET	120	66	ND	64	ND	190	ND	63	ND	680	ND	2000	ND	280	ND
4-Nitroaniline	Lab	ug/kg				320	ND	--	--	330	ND *	330	ND	320	ND	950	ND	320	ND	3400	ND	10000	ND	1400	ND
4-Nitrophenol	Lab	ug/kg				320	ND	--	--	330	ND	330	ND	320	ND	950	ND	320	ND	3400	ND	10000	ND	1400	ND
Acenaphthene	Lab	ug/kg			4800000	64	ND	--	--	66	ND	66	ND	64	ND	190	ND	63	ND	680	ND	2000	ND	280	ND
Acenaphthylene	Lab	ug/kg				64	ND	--	--	66	ND	66	ND	64	ND	190	ND	63	ND	680	ND	2000	ND	280	ND
Anthracene	Lab	ug/kg			24000000	64	ND	--	--	66	ND	66	ND	64	ND	190	ND	63	ND	680	ND	2000	ND	280	ND
Benz(a)anthracene	Lab	ug/kg		1370		64	ND	--	--	66	ND	66	ND	64	ND	190	ND	63	ND	680	ND	2000	ND	280	ND
Benzo(a)pyrene	Lab	ug/kg	**100**	137		64	ND	--	--	66	ND	66	ND	64	ND	**190**	ND	63	ND	**680**	ND	**2000**	ND	**280**	ND
Benzo(b)fluoranthene	Lab	ug/kg		1370		64	ND	--	--	66	ND	66	ND	64	ND	190	ND	63	ND	680	ND	2000	ND	280	ND
Benzo(g,h,i)perylene	Lab	ug/kg				64	ND	--	--	66	ND *	66	ND	64	ND	190	ND	63	ND	680	ND	2000	ND	280	ND
Benzo(k)fluoranthene	Lab	ug/kg		13700		64	ND	--	--	66	ND	66	ND	64	ND	190	ND	63	ND	680	ND	2000	ND	280	ND
Benzoic acid	Lab	ug/kg			320000000	640	ND	--	--	660	ND	660	ND	640	ND	1900	ND	630	ND	6800	ND	20000	ND	2800	ND
Benzyl alcohol	Lab	ug/kg			8000000	320	ND	--	--	330	ND	330	ND	320	ND	950	ND	320	ND	3400	ND	10000	ND	1400	ND
Bis(2-chloroethoxy)methane	Lab	ug/kg				64	ND	--	--	66	ND	66	ND	64	ND	190	ND	63	ND	680	ND	2000	ND	280	ND
Bis(2-chloroethyl)ether	Lab	ug/kg		909		64	ND	--	--	66	ND	66	ND	64	ND	190	ND	63	ND	680	ND	2000	ND	280	ND
Bis(2-ethylhexyl)phthalate	Lab	ug/kg		71400	1600000	DET	400	--	--	66	ND	66	ND	64	ND	190	ND	63	ND	680	ND	2000	ND	280	ND
Butyl benzyl phthalate	Lab	ug/kg		526000	16000000	64	ND	--	--	66	ND	66	ND	64	ND	190	ND	63	ND	680	ND	2000	ND	280	ND
Carbazole	Lab	ug/kg				64	ND	--	--	66	ND	66	ND	64	ND	190	ND	63	ND	680	ND	2000	ND	280	ND
Chrysene	Lab	ug/kg		137000		64	ND	--	--	66	ND	66	ND	64	ND	190	ND	63	ND	680	ND	2000	ND	280	ND

Table 1
Historical Soil Data Review - 2008 Parametrix PQLs vs. MTCA Cleanup Levels
Yakima Mill Site

					Location	SS-6		SS-7		TP-8		TP-8		TP-9		TP-9		TP-9		TP-10		TP-10		TP-10	
					Date	3/06/2008		3/06/2008		2/27/2008		2/27/2008		2/27/2008		2/27/2008		2/27/2008		2/27/2008		2/27/2008		2/27/2008	
					Depth	1.5 ft		1.5 ft		2 ft		12.5 ft		1.5 ft		1.5 ft		13 ft		8 ft		8 ft		13 ft	
					Sample Type	N		N		N		N		N		N		N		N		N		N	
					Result Type	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	Diluted PQL	Diluted Result	PQL	Result	PQL	Result	Diluted PQL	Diluted Result	PQL	Result
					Data Status	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource
Parameter	Analysis Location	Units	Washington Method A Unrestricted Land Use	Washington Method B Cancer Direct Contact	Washington Method B Noncancer Direct Contact																				
Effective Date			07/01/2015	07/01/2015	07/01/2015																				
Exceedance Key			**Bold**	Shade	Border																				
Dibenz(a,h)anthracene	Lab	ug/kg		137		64	ND	--	--	66	ND *	66	ND	64	ND	190	ND	63	ND	680	ND	2000	ND	280	ND
Dibenzofuran	Lab	ug/kg			80000	64	ND	--	--	66	ND	66	ND	64	ND	190	ND	63	ND	680	ND	2000	ND	280	ND
Diethyl phthalate	Lab	ug/kg			64000000	64	ND	--	--	66	ND	66	ND	64	ND	190	ND	63	ND	680	ND	2000	ND	280	ND
Dimethyl phthalate	Lab	ug/kg				64	ND	--	--	66	ND	66	ND	64	ND	190	ND	63	ND	680	ND	2000	ND	280	ND
Di-n-butyl phthalate	Lab	ug/kg			8000000	64	ND	--	--	66	ND	66	ND	64	ND	190	ND	63	ND	680	ND	2000	ND	280	ND
Di-n-octyl phthalate	Lab	ug/kg			800000	64	ND	--	--	66	ND	66	ND	64	ND	190	ND	63	ND	680	ND	2000	ND	280	ND
Fluoranthene	Lab	ug/kg			3200000	64	ND	--	--	66	ND	66	ND	64	ND	190	ND	63	ND	680	ND	2000	ND	280	ND
Fluorene	Lab	ug/kg			3200000	64	ND	--	--	66	ND	66	ND	64	ND	190	ND	63	ND	680	ND	2000	ND	280	ND
Hexachlorobenzene	Lab	ug/kg		625	64000	64	ND	--	--	66	ND	66	ND	64	ND	190	ND	63	ND	680	ND	2000	ND	280	ND
Hexachlorobutadiene	Lab	ug/kg		12800	80000	64	ND	--	--	66	ND	66	ND	64	ND	190	ND	63	ND	680	ND	2000	ND	280	ND
Hexachlorocyclopentadiene	Lab	ug/kg			480000	320	ND	--	--	330	ND *	330	ND	320	ND	950	ND	320	ND	3400	ND	10000	ND	1400	ND
Hexachloroethane	Lab	ug/kg		25000	56000	64	ND	--	--	66	ND	66	ND	64	ND	190	ND	63	ND	680	ND	2000	ND	280	ND
Indeno(1,2,3-cd)pyrene	Lab	ug/kg		1370		64	ND	--	--	66	ND *	66	ND	64	ND	190	ND	63	ND	680	ND	2000	ND	280	ND
Isophorone	Lab	ug/kg		1053000	16000000	64	ND	--	--	66	ND	66	ND	64	ND	190	ND	63	ND	680	ND	2000	ND	280	ND
Naphthalene	Lab	ug/kg	5000		1600000	64	ND	--	--	66	ND	66	ND	64	ND	190	ND	63	ND	680	ND	2000	ND	280	ND
Nitrobenzene	Lab	ug/kg			160000	64	ND	--	--	66	ND	66	ND	64	ND	190	ND	63	ND	680	ND	2000	ND	280	ND
n-Nitrosodi-n-propylamine	Lab	ug/kg		143		320	ND	--	--	330	ND	330	ND	320	ND	950	ND	320	ND	3400	ND	10000	ND	1400	ND
n-Nitrosodiphenylamine	Lab	ug/kg		204000		64	ND	--	--	66	ND	66	ND	64	ND	190	ND	63	ND	680	ND	2000	ND	280	ND
Pentachlorophenol	Lab	ug/kg		2500	400000	320	ND	--	--	330	ND	330	ND	320	ND	950	ND	320	ND	3400	ND	10000	ND	1400	ND
Phenanthrene	Lab	ug/kg				64	ND	--	--	66	ND	66	ND	64	ND	190	ND	63	ND	680	ND	2000	ND	280	ND
Phenol	Lab	ug/kg			24000000	64	ND	--	--	66	ND	66	ND	64	ND	190	ND	63	ND	680	ND	2000	ND	280	ND
Pyrene	Lab	ug/kg			2400000	64	ND	--	--	66	ND	66	ND	64	ND	190	ND	63	ND	680	ND	2000	ND	280	ND
VOCs																									
1,1,1,2-Tetrachloroethane	Lab	ug/kg		38500	2400000	--	--	--	--	--	--	--	--	1.0	ND	--	--	1.2	ND	80	ND	--	--	1.1	ND
1,1,1-Trichloroethane	Lab	ug/kg	2000		160000000	--	--	--	--	--	--	--	--	1.0	ND	--	--	1.2	ND	80	ND	--	--	1.1	ND
1,1,2,2-Tetrachloroethane	Lab	ug/kg		5000	1600000	--	--	--	--	--	--	--	--	1.0	ND	--	--	1.2	ND	80	ND	--	--	1.1	ND
1,1,2-Trichloroethane	Lab	ug/kg		17500	320000	--	--	--	--	--	--	--	--	1.0	ND	--	--	1.2	ND	80	ND	--	--	1.1	ND
1,1-Dichloroethane	Lab	ug/kg		175000	16000000	--	--	--	--	--	--	--	--	1.0	ND	--	--	1.2	ND	80	ND	--	--	1.1	ND
1,1-Dichloroethylene	Lab	ug/kg			4000000	--	--	--	--	--	--	--	--	1.0	ND	--	--	1.2	ND	80	ND	--	--	1.1	ND
1,2,3-Trichloropropane	Lab	ug/kg		33.3	320000	--	--	--	--	--	--	--	--	1.9	ND	--	--	2.4	ND	160	ND	--	--	2.2	ND
1,2-Dibromo-3-chloropropane (DBCP)	Lab	ug/kg		1250	16000	--	--	--	--	--	--	--	--	4.8	ND	--	--	6.1	ND	400	ND	--	--	5.5	ND
1,2-Dibromoethane (EDB)	Lab	ug/kg	**5.00**	500	720000	--	--	--	--	--	--	--	--	1.0	ND	--	--	1.2	ND	**80**	ND	--	--	1.1	ND
1,2-Dichlorobenzene	Lab	ug/kg			7200000	--	--	--	--	--	--	--	--	1.0	ND	--	--	1.2	ND	80	ND	--	--	1.1	ND
1,2-Dichloroethane	Lab	ug/kg		11000	480000	--	--	--	--	--	--	--	--	1.0	ND	--	--	1.2	ND	80	ND	--	--	1.1	ND
1,2-Dichloroethylene, cis	Lab	ug/kg			160000	--	--	--	--	--	--	--	--	1.0	ND	--	--	1.2	ND	80	ND	--	--	1.1	ND
1,2-Dichloroethylene, trans	Lab	ug/kg			1600000	--	--	--	--	--	--	--	--	1.0	ND	--	--	1.2	ND	80	ND	--	--	1.1	ND
1,2-Dichloropropane	Lab	ug/kg		27800	7200000	--	--	--	--	--	--	--	--	1.0	ND	--	--	1.2	ND	80	ND	--	--	1.1	ND
1,3-Dichloropropene, cis	Lab	ug/kg		10000	2400000	--	--	--	--	--	--	--	--	1.0	ND	--	--	1.2	ND	80	ND	--	--	1.1	ND
1,3-Dichloropropene, trans	Lab	ug/kg		10000	2400000	--	--	--	--	--	--	--	--	1.0	ND	--	--	1.2	ND	80	ND	--	--	1.1	ND
1,4-Dichloro-2-butene, trans	Lab	ug/kg				--	--	--	--	--	--	--	--	4.8	ND	--	--	6.1	ND	400	ND	--	--	5.5	ND
1,4-Dichlorobenzene	Lab	ug/kg		185000	5600000	--	--	--	--	--	--	--	--	1.0	ND	--	--	1.2	ND	80	ND	--	--	DET	14
2-Hexanone	Lab	ug/kg				--	--	--	--	--	--	--	--	4.8	ND	--	--	6.1	ND	400	ND	--	--	5.5	ND
Acetone	Lab	ug/kg			72000000	--	--	--	--	--	--	--	--	DET	150	--	--	DET	17	400	ND	--	--	DET	220
Acrylonitrile	Lab	ug/kg		1850	3200000	--	--	--	--	--	--	--	--	4.8	ND	--	--	6.1	ND	400	ND	--	--	5.5	ND
Benzene	Lab	ug/kg	**30.0**	18200	320000	--	--	--	--	--	--	--	--	DET	4.2	--	--	1.2	ND	**80**	ND	--	--	DET	2.6
Bromochloromethane	Lab	ug/kg				--	--	--	--	--	--	--	--	1.0	ND	--	--	1.2	ND	80	ND	--	--	1.1	ND
Bromodichloromethane	Lab	ug/kg		16100	1600000	--	--	--	--	--	--	--	--	1.0	ND	--	--	1.2	ND	80	ND	--	--	1.1	ND
Bromoform	Lab	ug/kg		127000	1600000	--	--	--	--	--	--	--	--	1.0	ND	--	--	1.2	ND	80	ND	--	--	1.1	ND
Bromomethane	Lab	ug/kg			112000	--	--	--	--	--	--	--	--	1.0	ND	--	--	1.2	ND	80	ND	--	--	1.1	ND
Carbon disulfide	Lab	ug/kg			8000000	--	--	--	--	--	--	--	--	1.0	ND	--	--	1.2	ND	80	ND	--	--	DET	3.4
Carbon tetrachloride	Lab	ug/kg		14300	320000	--	--	--	--	--	--	--	--	1.0	ND	--	--	1.2	ND	80	ND	--	--	1.1	ND
Chlorobenzene	Lab	ug/kg			1600000	--	--	--	--	--	--	--	--	1.0	ND	--	--	1.2	ND	80	ND	--	--	1.1	ND
Chlorodibromomethane	Lab	ug/kg		11900	1600000	--	--	--	--	--	--	--	--	1.0	ND	--	--	1.2	ND	80	ND	--	--	1.1	ND
Chloroethane	Lab	ug/kg				--	--	--	--	--	--	--	--	1.0	ND	--	--	1.2	ND	80	ND	--	--	1.1	ND
Chloroform	Lab	ug/kg		32300	800000	--	--	--	--	--	--	--	--	1.0	ND	--	--	1.2	ND	80	ND	--	--	1.1	ND
Chloromethane	Lab	ug/kg				--	--	--	--	--	--	--	--	1.0	ND	--	--	1.2	ND	80	ND	--	--	1.1	ND
Dibromomethane (methylene bromide)	Lab	ug/kg			800000	--	--	--	--	--	--	--	--	1.0	ND	--	--	1.2	ND	80	ND	--	--	1.1	ND
Ethyl benzene	Lab	ug/kg	6000		8000000	--	--	--	--	--	--	--	--	1.0	ND	--	--	1.2	ND	80	ND	--	--	DET	2.7
Iodomethane	Lab	ug/kg				--	--	--	--	--	--	--	--	1.0	ND	--	--	1.2	ND	80	ND	--	--	1.1	ND

11-29-2017

Table 1
Historical Soil Data Review - 2008 Parametrix PQLs vs. MTCA Cleanup Levels
Yakima Mill Site

					Location	**SS-6**		**SS-7**		**TP-8**		**TP-8**		**TP-9**		**TP-9**		**TP-9**		**TP-10**		**TP-10**		**TP-10**	
					Date	**3/06/2008**		**3/06/2008**		**2/27/2008**		**2/27/2008**		**2/27/2008**		**2/27/2008**		**2/27/2008**		**2/27/2008**		**2/27/2008**		**2/27/2008**	
					Depth	**1.5 ft**		**1.5 ft**		**2 ft**		**12.5 ft**		**1.5 ft**		**1.5 ft**		**13 ft**		**8 ft**		**8 ft**		**13 ft**	
					Sample Type	**N**		**N**		**N**		**N**		**N**		**N**		**N**		**N**		**N**		**N**	
					Result Type	**PQL**	**Result**	**PQL**	**Result**	**PQL**	**Result**	**PQL**	**Result**	**PQL**	**Result**	**Diluted PQL**	**Diluted Result**	**PQL**	**Result**	**PQL**	**Result**	**Diluted PQL**	**Diluted Result**	**PQL**	**Result**
					Data Status	**SSource**	**SSource**	**SSource**	**SSource**	**SSource**	**SSource**	**SSource**	**SSource**	**SSource**	**SSource**	**SSource**	**SSource**	**SSource**	**SSource**	**SSource**	**SSource**	**SSource**	**SSource**	**SSource**	**SSource**
Parameter	Analysis Location	Units	Washington Method A Unrestricted Land Use	Washington Method B Cancer Direct Contact	Washington Method B Noncancer Direct Contact																				
Effective Date			07/01/2015	07/01/2015	07/01/2015																				
Exceedance Key			**Bold**	Shade	Border																				
Methyl ethyl ketone (2-butanone)	Lab	ug/kg			48000000	--	--	--	--	--	--	--	--	DET	15	--	--	6.1	ND	400	ND	--	--	DET	20
Methyl isobutyl ketone (MIBK)	Lab	ug/kg			6400000	--	--	--	--	--	--	--	--	4.8	ND	--	--	6.1	ND	400	ND	--	--	5.5	ND
Methylene chloride	Lab	ug/kg	20.0	500000	480000	--	--	--	--	--	--	--	--	1.9	ND	--	--	2.4	ND	DET	170	--	--	2.2	ND
Styrene	Lab	ug/kg			16000000	--	--	--	--	--	--	--	--	1.0	ND	--	--	1.2	ND	80	ND	--	--	1.1	ND
Tetrachloroethylene	Lab	ug/kg	**50.0**	476000	480000	--	--	--	--	--	--	--	--	1.0	ND	--	--	1.2	ND	**80**	ND	--	--	1.1	ND
Toluene	Lab	ug/kg	7000		6400000	--	--	--	--	--	--	--	--	DET	2.4	--	--	1.2	ND	DET	500	--	--	DET	2.9
Trichloroethylene (TCE)	Lab	ug/kg	**30.0**	12000	40000	--	--	--	--	--	--	--	--	1.0	ND	--	--	1.2	ND	**80**	ND	--	--	1.1	ND
Trichlorofluoromethane (Freon-11)	Lab	ug/kg			24000000	--	--	--	--	--	--	--	--	1.0	ND	--	--	1.2	ND	80	ND	--	--	1.1	ND
Vinyl acetate	Lab	ug/kg			80000000	--	--	--	--	--	--	--	--	4.8	ND	--	--	6.1	ND	400	ND	--	--	5.5	ND
Vinyl chloride	Lab	ug/kg			240000	--	--	--	--	--	--	--	--	1.0	ND	--	--	1.2	ND	80	ND	--	--	1.1	ND
Xylene, m & p	Lab	ug/kg			16000000	--	--	--	--	--	--	--	--	DET	1.8	--	--	1.2	ND	80	ND	--	--	DET	2.7
Xylene, o	Lab	ug/kg			16000000	--	--	--	--	--	--	--	--	1.0	ND	--	--	1.2	ND	80	ND	--	--	DET	2.5
PCBs																									
Aroclor 1016	Lab	ug/kg		14300	5600	32	ND	--	--	--	--	--	--	33	ND	--	--	33	ND	--	--	--	--	--	--
Aroclor 1221	Lab	ug/kg				32	ND	--	--	--	--	--	--	33	ND	--	--	33	ND	--	--	--	--	--	--
Aroclor 1232	Lab	ug/kg				32	ND	--	--	--	--	--	--	33	ND	--	--	33	ND	--	--	--	--	--	--
Aroclor 1242	Lab	ug/kg				32	ND	--	--	--	--	--	--	33	ND	--	--	33	ND	--	--	--	--	--	--
Aroclor 1248	Lab	ug/kg				32	ND	--	--	--	--	--	--	33	ND	--	--	33	ND	--	--	--	--	--	--
Aroclor 1254	Lab	ug/kg		500	1600	32	ND	--	--	--	--	--	--	33	ND	--	--	33	ND	--	--	--	--	--	--
Aroclor 1260	Lab	ug/kg		500		32	ND	--	--	--	--	--	--	33	ND	--	--	33	ND	--	--	--	--	--	--
Total Petroleum Hydrocarbons																									
Benzene	Lab	ug/kg	**30.0**	18200	320000	12	ND	--	--	**32**	ND	DET	27	14	ND	--	--	15	ND	26	ND	--	--	15	ND
Ethyl benzene	Lab	ug/kg	6000		8000000	12	ND	--	--	32	ND	22	ND	14	ND	--	--	15	ND	26	ND	--	--	15	ND
Toluene	Lab	ug/kg	7000		6400000	12	ND	--	--	DET	190 J	22	ND	14	ND	--	--	15	ND	DET	430 J	--	--	DET	66 J
Total Petroleum Hydrocarbons (as diesel)	Lab	ug/kg	2000000			DET	9400	DET	110000	DET	110000 J	6900	ND	DET	62000 J	--	--	5400	ND	DET	6300000 J	--	--	DET	2400000 J
Total Petroleum Hydrocarbons (as gasoline)	Lab	ug/kg	30000			DET	6200	--	--	DET	17000	8700	ND	5400	5400	--	--	6100	ND	DET	16000	--	--	DET	16000
Total Petroleum Hydrocarbons (as motor oil)	Lab	ug/kg	2000000			DET	62000	DET	540000	DET	430000 J	14000	ND	DET	560000 J	--	--	DET	14000 J	DET	57000000 J	--	--	DET	19000000 J
Xylene, m & p	Lab	ug/kg				25	ND	--	--	63	ND	44	ND	27	ND	--	--	30	ND	51	ND	--	--	30	ND
Xylene, o	Lab	ug/kg			16000000	12	ND	--	--	32	ND	22	ND	14	ND	--	--	15	ND	26	ND	--	--	15	ND

DET: Result is a detection, therefore no reporting detection limit is available.
Barr qualifier - *: Estimated value, QA/QC criteria not met.
J: Estimated concentration when the value is less than the ARI's established reporting limits.
N: Normal Sample.
FD: Field Duplicate Sample.
ND: Not detected.
PQL: Practical Quantitation Limit.
SSource: Laboratory and/or field data obtained from a secondary source external to Barr. Second source QA/QC evaluation procedures may or may not have been performed beyond the original data
Diluted PQL/Result: Samples required dilution by the laboratory due to high internal standards recoveries. Both sets of data were provided in lab report.

Table was updated (items in red) after original submittal to add Barr qualifiers to be consistent with the memo.

Table 1
Historical Soil Data Review - 2008 Parametrix PQLs vs. MTCA Cleanup Levels
Yakima Mill Site

Location						TP-11		TP-11		TP-11		TP-11		TP-12		TP-12		TP-12D		TP-12D		TP-13		TP-13		TP-16	
Date						2/27/2008		2/27/2008		2/27/2008		2/27/2008		2/27/2008		2/27/2008		2/27/2008		2/27/2008		2/27/2008		2/27/2008		4/09/2008	
Depth						4 ft		4 ft		14 ft		14 ft		13 ft		13 ft		13 ft		13 ft		8 ft		8 ft		2 ft	
Sample Type						N		N		N		N		N		N		N		N		N		N		N	
Result Type						PQL	Result	Diluted PQL	Diluted Result	PQL	Result	Diluted PQL	Diluted Result	PQL	Result	Diluted PQL	Diluted Result	PQL	Result	Diluted PQL	Diluted Result	PQL	Result	Diluted PQL	Diluted Result	PQL	Result
Data Status						SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource
Parameter	Analysis Location	Units	Washington Method A Unrestricted Land Use	Washington Method B Cancer Direct Contact	Washington Method B Noncancer Direct Contact																						
Effective Date			07/01/2015	07/01/2015	07/01/2015																						
Exceedance Key			**Bold**	Shade	Border																						
General Parameters																											
Carbon, total organic	Lab	%				--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
pH	Lab	pH units				--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Solids, total	Lab	%				--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Metals																											
Arsenic	Lab	ug/kg	20000	667	24000	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	10000	ND	--	--	--	--
Barium	Lab	ug/kg			16000000	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	DET	53900	--	--	--	--
Cadmium	Lab	ug/kg	2000		80000	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	500	ND	--	--	--	--
Chromium	Lab	ug/kg				--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	DET	19000	--	--	--	--
Lead	Lab	ug/kg	250000			DET	13000	--	--	DET	4000	--	--	DET	25000	--	--	DET	22000	--	--	DET	5000	--	--	--	--
Mercury	Lab	ug/kg	2000			--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	50	ND	--	--	--	--
Selenium	Lab	ug/kg			400000	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	10000	ND	--	--	--	--
Silver	Lab	ug/kg			400000	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	800	ND	--	--	--	--
SVOCs																											
1,2,4-Trichlorobenzene	Lab	ug/kg		34500	800000	66	ND	200	ND	64	ND	190	ND	220	ND	1100	ND	120	ND	350	ND	63	ND	190	ND	--	--
1,2-Dichlorobenzene	Lab	ug/kg			7200000	66	ND	200	ND	64	ND	190	ND	220	ND	1100	ND	120	ND	350	ND	63	ND	190	ND	--	--
1,3-Dichlorobenzene	Lab	ug/kg				66	ND	200	ND	64	ND	190	ND	220	ND	1100	ND	120	ND	350	ND	63	ND	190	ND	--	--
1,4-Dichlorobenzene	Lab	ug/kg		185000	5600000	66	ND	200	ND	64	ND	190	ND	220	ND	1100	ND	120	ND	350	ND	63	ND	190	ND	--	--
1-Methylnaphthalene	Lab	ug/kg		34500	5600000	66	ND	200	ND	64	ND	190	ND	DET	1600	DET	1700	DET	660	DET	700	63	ND	190	ND	--	--
2,2'-oxybis (1-chloropropane)	Lab	ug/kg		14300	3200000	66	ND	200	ND	64	ND	190	ND	220	ND	1100	ND	120	ND	350	ND	63	ND	190	ND	--	--
2,4,5-Trichlorophenol	Lab	ug/kg			8000000	330	ND	990	ND	320	ND	970	ND	1100	ND	5400	ND	580	ND	1700	ND	320	ND	950	ND	--	--
2,4,6-Trichlorophenol	Lab	ug/kg		90900	80000	330	ND	990	ND	320	ND	970	ND	1100	ND	5400	ND	580	ND	1700	ND	320	ND	950	ND	--	--
2,4-Dichlorophenol	Lab	ug/kg			240000	330	ND	990	ND	320	ND	970	ND	1100	ND	5400	ND	580	ND	1700	ND	320	ND	950	ND	--	--
2,4-Dimethylphenol	Lab	ug/kg			1600000	66	ND	200	ND	64	ND	190	ND	220	ND	1100	ND	120	ND	350	ND	63	ND	190	ND	--	--
2,4-Dinitrophenol	Lab	ug/kg			160000	660	ND	2000	ND	640	ND	1900	ND	2200	ND	11000	ND	1200	ND	3500	ND	630	ND	1900	ND	--	--
2,4-Dinitrotoluene	Lab	ug/kg		3230	160000	330	ND	990	ND	320	ND	970	ND	1100	ND	5400	ND	580	ND	1700	ND	320	ND	950	ND	--	--
2,6-Dinitrotoluene	Lab	ug/kg		667	24000	330	ND	990	ND	320	ND	970	ND	1100	ND	5400	ND	580	ND	1700	ND	320	ND	950	ND	--	--
2-Chloronaphthalene	Lab	ug/kg			6400000	66	ND	200	ND	64	ND	190	ND	220	ND	1100	ND	120	ND	350	ND	63	ND	190	ND	--	--
2-Chlorophenol	Lab	ug/kg			400000	66	ND	200	ND	64	ND	190	ND	220	ND	1100	ND	120	ND	350	ND	63	ND	190	ND	--	--
2-Methyl-4,6-dinitrophenol	Lab	ug/kg				660	ND	2000	ND	640	ND	1900	ND	2200	ND	11000	ND	1200	ND	3500	ND	630	ND	1900	ND	--	--
2-Methylnaphthalene	Lab	ug/kg			320000	66	ND	200	ND	64	ND	190	ND	DET	530	1100	ND	DET	400	DET	350	63	ND	190	ND	--	--
2-Methylphenol (o-cresol)	Lab	ug/kg			4000000	66	ND	200	ND	64	ND	190	ND	220	ND	1100	ND	120	ND	350	ND	63	ND	190	ND	--	--
2-Nitroaniline	Lab	ug/kg			800000	330	ND	990	ND	320	ND	970	ND	1100	ND	5400	ND	580	ND	1700	ND	320	ND	950	ND	--	--
2-Nitrophenol	Lab	ug/kg				330	ND	990	ND	320	ND	970	ND	1100	ND	5400	ND	580	ND	1700	ND	320	ND	950	ND	--	--
3,3`-Dichlorobenzidine	Lab	ug/kg		2220		330	ND	990	ND	320	ND	970	ND	1100	ND	5400	ND	580	ND	1700	ND	320	ND	950	ND	--	--
3-Nitroaniline	Lab	ug/kg				330	ND	990	ND	320	ND	970	ND	1100	ND	5400	ND	580	ND	1700	ND	320	ND	950	ND	--	--
4-Bromophenyl phenyl ether	Lab	ug/kg				66	ND	200	ND	64	ND	190	ND	220	ND	1100	ND	120	ND	350	ND	63	ND	190	ND	--	--
4-Chloro-3-methylphenol	Lab	ug/kg				330	ND	990	ND	320	ND	970	ND	1100	ND	5400	ND	580	ND	1700	ND	320	ND	950	ND	--	--
4-Chloroaniline	Lab	ug/kg		5000	320000	330	ND	990	ND	320	ND	970	ND	1100	ND	5400	ND	580	ND	1700	ND	320	ND	950	ND	--	--
4-Chlorophenyl phenyl ether	Lab	ug/kg				66	ND	200	ND	64	ND	190	ND	220	ND	1100	ND	120	ND	350	ND	63	ND	190	ND	--	--
4-Methylphenol (p-cresol)	Lab	ug/kg			8000000	66	ND	200	ND	64	ND	190	ND	220	ND	1100	ND	120	ND	350	ND	63	ND	190	ND	--	--
4-Nitroaniline	Lab	ug/kg				330	ND	990	ND	320	ND	970	ND	1100	ND	5400	ND	580	ND	1700	ND	320	ND	950	ND	--	--
4-Nitrophenol	Lab	ug/kg				330	ND	990	ND	320	ND	970	ND	1100	ND	5400	ND	580	ND	1700	ND	320	ND	950	ND	--	--
Acenaphthene	Lab	ug/kg			4800000	66	ND	200	ND	64	ND	190	ND	220	ND	1100	ND	120	ND	350	ND	63	ND	190	ND	--	--
Acenaphthylene	Lab	ug/kg				66	ND	200	ND	64	ND	190	ND	220	ND	1100	ND	120	ND	350	ND	63	ND	190	ND	--	--
Anthracene	Lab	ug/kg			24000000	66	ND	200	ND	64	ND	190	ND	220	ND	1100	ND	120	ND	350	ND	63	ND	190	ND	--	--
Benz(a)anthracene	Lab	ug/kg		1370		66	ND	200	ND	64	ND	190	ND	220	ND	1100	ND	120	ND	350	ND	63	ND	190	ND	--	--
Benzo(a)pyrene	Lab	ug/kg	**100**	137		66	ND	**200**	ND	64	ND	**190**	ND	**220**	ND	**1100**	ND	**120**	ND	**350**	ND	63	ND	**190**	ND	--	--
Benzo(b)fluoranthene	Lab	ug/kg		1370		66	ND	200	ND	64	ND	190	ND	220	ND	1100	ND	120	ND	350	ND	63	ND	190	ND	--	--
Benzo(g,h,i)perylene	Lab	ug/kg				66	ND	200	ND	64	ND	190	ND	220	ND	1100	ND	120	ND	350	ND	63	ND	190	ND	--	--
Benzo(k)fluoranthene	Lab	ug/kg		13700		66	ND	200	ND	64	ND	190	ND	220	ND	1100	ND	120	ND	350	ND	63	ND	190	ND	--	--
Benzoic acid	Lab	ug/kg			320000000	660	ND	2000	ND	640	ND	1900	ND	2200	ND	11000	ND	1200	ND	3500	ND	630	ND	1900	ND	--	--
Benzyl alcohol	Lab	ug/kg			8000000	330	ND	990	ND	320	ND	970	ND	1100	ND	5400	ND	580	ND	1700	ND	320	ND	950	ND	--	--
Bis(2-chloroethoxy)methane	Lab	ug/kg				66	ND	200	ND	64	ND	190	ND	220	ND	1100	ND	120	ND	350	ND	63	ND	190	ND	--	--
Bis(2-chloroethyl)ether	Lab	ug/kg		909		66	ND	200	ND	64	ND	190	ND	220	ND	1100	ND	120	ND	350	ND	63	ND	190	ND	--	--
Bis(2-ethylhexyl)phthalate	Lab	ug/kg		71400	1600000	66	ND	200	ND	64	ND	190	ND	220	ND	1100	ND	120	ND	350	ND	63	ND	190	ND	--	--
Butyl benzyl phthalate	Lab	ug/kg		526000	16000000	66	ND	200	ND	64	ND	190	ND	220	ND	1100	ND	120	ND	350	ND	63	ND	190	ND	--	--
Carbazole	Lab	ug/kg				66	ND	200	ND	64	ND	190	ND	220	ND	1100	ND	120	ND	350	ND	63	ND	190	ND	--	--
Chrysene	Lab	ug/kg		137000		66	ND	200	ND	64	ND	190	ND	220	ND	1100	ND	120	ND	350	ND	63	ND	190	ND	--	--

Table 1
Historical Soil Data Review - 2008 Parametrix PQLs vs. MTCA Cleanup Levels
Yakima Mill Site

					Location	TP-11		TP-11		TP-11		TP-11		TP-12		TP-12		TP-12D		TP-12D		TP-13		TP-13		TP-16	
					Date	2/27/2008		2/27/2008		2/27/2008		2/27/2008		2/27/2008		2/27/2008		2/27/2008		2/27/2008		2/27/2008		2/27/2008		4/09/2008	
					Depth	4 ft		4 ft		14 ft		14 ft		13 ft		13 ft		13 ft		13 ft		8 ft		8 ft		2 ft	
					Sample Type	N		N		N		N		N		N		N		N		N		N		N	
					Result Type	PQL	Result	Diluted PQL	Diluted Result	PQL	Result	Diluted PQL	Diluted Result	PQL	Result	Diluted PQL	Diluted Result	PQL	Result	Diluted PQL	Diluted Result	PQL	Result	Diluted PQL	Diluted Result	PQL	Result
					Data Status	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource
Parameter	Analysis Location	Units	Washington Method A Unrestricted Land Use	Washington Method B Cancer Direct Contact	Washington Method B Noncancer Direct Contact																						
Effective Date			07/01/2015	07/01/2015	07/01/2015																						
Exceedance Key			**Bold**	Shade	Border																						
Dibenz(a,h)anthracene	Lab	ug/kg		137		66	ND	200	ND	64	ND	190	ND	220	ND	1100	ND	120	ND	350	ND	63	ND	190	ND	--	--
Dibenzofuran	Lab	ug/kg			80000	66	ND	200	ND	64	ND	190	ND	DET	250	1100	ND	120	ND	350	ND	63	ND	190	ND	--	--
Diethyl phthalate	Lab	ug/kg			64000000	66	ND	200	ND	64	ND	190	ND	220	ND	1100	ND	120	ND	350	ND	63	ND	190	ND	--	--
Dimethyl phthalate	Lab	ug/kg				66	ND	200	ND	64	ND	190	ND	220	ND	1100	ND	120	ND	350	ND	63	ND	190	ND	--	--
Di-n-butyl phthalate	Lab	ug/kg			8000000	66	ND	200	ND	64	ND	190	ND	220	ND	1100	ND	120	ND	350	ND	63	ND	190	ND	--	--
Di-n-octyl phthalate	Lab	ug/kg			800000	66	ND	200	ND	64	ND	190	ND	220	ND	1100	ND	120	ND	350	ND	63	ND	190	ND	--	--
Fluoranthene	Lab	ug/kg			3200000	DET	72	200	ND	64	ND	190	ND	DET	320	1100	ND	DET	160	350	ND	63	ND	190	ND	--	--
Fluorene	Lab	ug/kg			3200000	66	ND	200	ND	64	ND	190	ND	DET	1400	DET	1200	DET	270	350	ND	63	ND	190	ND	--	--
Hexachlorobenzene	Lab	ug/kg		625	64000	66	ND	200	ND	64	ND	190	ND	220	ND	1100	ND	120	ND	350	ND	63	ND	190	ND	--	--
Hexachlorobutadiene	Lab	ug/kg		12800	80000	66	ND	200	ND	64	ND	190	ND	220	ND	1100	ND	120	ND	350	ND	63	ND	190	ND	--	--
Hexachlorocyclopentadiene	Lab	ug/kg			480000	330	ND	990	ND	320	ND	970	ND	1100	ND	5400	ND	580	ND	1700	ND	320	ND	950	ND	--	--
Hexachloroethane	Lab	ug/kg		25000	56000	66	ND	200	ND	64	ND	190	ND	220	ND	1100	ND	120	ND	350	ND	63	ND	190	ND	--	--
Indeno(1,2,3-cd)pyrene	Lab	ug/kg		1370		66	ND	200	ND	64	ND	190	ND	220	ND	1100	ND	120	ND	350	ND	63	ND	190	ND	--	--
Isophorone	Lab	ug/kg		1053000	16000000	66	ND	200	ND	64	ND	190	ND	220	ND	1100	ND	120	ND	350	ND	63	ND	190	ND	--	--
Naphthalene	Lab	ug/kg	5000		1600000	DET	73	200	ND	64	ND	190	ND	220	ND	1100	ND	DET	150	350	ND	63	ND	190	ND	--	--
Nitrobenzene	Lab	ug/kg			160000	66	ND	200	ND	64	ND	190	ND	220	ND	1100	ND	120	ND	350	ND	63	ND	190	ND	--	--
n-Nitrosodi-n-propylamine	Lab	ug/kg		143		330	ND	990	ND	320	ND	970	ND	1100	ND	5400	ND	580	ND	1700	ND	320	ND	950	ND	--	--
n-Nitrosodiphenylamine	Lab	ug/kg		204000		66	ND	200	ND	64	ND	190	ND	640	ND	DET	2300	340	ND	DET	710	63	ND	190	ND	--	--
Pentachlorophenol	Lab	ug/kg		2500	400000	330	ND	990	ND	320	ND	970	ND	1100	ND	5400	ND	580	ND	1700	ND	320	ND	950	ND	--	--
Phenanthrene	Lab	ug/kg				DET	68	200	ND	64	ND	190	ND	DET	2700	DET	2800 J	DET	640	DET	680 J	63	ND	190	ND	--	--
Phenol	Lab	ug/kg			24000000	66	ND	200	ND	64	ND	190	ND	220	ND	1100	ND	120	ND	350	ND	63	ND	190	ND	--	--
Pyrene	Lab	ug/kg			2400000	DET	68	200	ND	64	ND	190	ND	DET	580	1100	ND	DET	210	350	ND	63	ND	190	ND	--	--
VOCs																											
1,1,1,2-Tetrachloroethane	Lab	ug/kg		38500	2400000	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	1.0	ND	--	--	--	--
1,1,1-Trichloroethane	Lab	ug/kg	2000		160000000	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	1.0	ND	--	--	--	--
1,1,2,2-Tetrachloroethane	Lab	ug/kg		5000	1600000	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	1.0	ND	--	--	--	--
1,1,2-Trichloroethane	Lab	ug/kg		17500	320000	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	1.0	ND	--	--	--	--
1,1-Dichloroethane	Lab	ug/kg		175000	16000000	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	1.0	ND	--	--	--	--
1,1-Dichloroethylene	Lab	ug/kg			4000000	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	1.0	ND	--	--	--	--
1,2,3-Trichloropropane	Lab	ug/kg		33.3	320000	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	2.0	ND	--	--	--	--
1,2-Dibromo-3-chloropropane (DBCP)	Lab	ug/kg		1250	16000	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	4.9	ND	--	--	--	--
1,2-Dibromoethane (EDB)	Lab	ug/kg	**5.00**	500	720000	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	1.0	ND	--	--	--	--
1,2-Dichlorobenzene	Lab	ug/kg			7200000	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	1.0	ND	--	--	--	--
1,2-Dichloroethane	Lab	ug/kg		11000	480000	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	1.0	ND	--	--	--	--
1,2-Dichloroethylene, cis	Lab	ug/kg			160000	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	1.0	ND	--	--	--	--
1,2-Dichloroethylene, trans	Lab	ug/kg			1600000	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	1.0	ND	--	--	--	--
1,2-Dichloropropane	Lab	ug/kg		27800	7200000	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	1.0	ND	--	--	--	--
1,3-Dichloropropene, cis	Lab	ug/kg		10000	2400000	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	1.0	ND	--	--	--	--
1,3-Dichloropropene, trans	Lab	ug/kg		10000	2400000	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	1.0	ND	--	--	--	--
1,4-Dichloro-2-butene, trans	Lab	ug/kg				--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	4.9	ND	--	--	--	--
1,4-Dichlorobenzene	Lab	ug/kg		185000	5600000	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	1.0	ND	--	--	--	--
2-Hexanone	Lab	ug/kg				--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	4.9	ND	--	--	--	--
Acetone	Lab	ug/kg			72000000	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	DET	32	--	--	--	--
Acrylonitrile	Lab	ug/kg		1850	3200000	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	4.9	ND	--	--	--	--
Benzene	Lab	ug/kg	**30.0**	18200	320000	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	1.0	ND	--	--	--	--
Bromochloromethane	Lab	ug/kg				--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	1.0	ND	--	--	--	--
Bromodichloromethane	Lab	ug/kg		16100	1600000	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	1.0	ND	--	--	--	--
Bromoform	Lab	ug/kg		127000	1600000	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	1.0	ND	--	--	--	--
Bromomethane	Lab	ug/kg			112000	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	1.0	ND	--	--	--	--
Carbon disulfide	Lab	ug/kg			8000000	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	1.0	ND	--	--	--	--
Carbon tetrachloride	Lab	ug/kg		14300	320000	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	1.0	ND	--	--	--	--
Chlorobenzene	Lab	ug/kg			1600000	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	1.0	ND	--	--	--	--
Chlorodibromomethane	Lab	ug/kg		11900	1600000	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	1.0	ND	--	--	--	--
Chloroethane	Lab	ug/kg				--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	1.0	ND	--	--	--	--
Chloroform	Lab	ug/kg		32300	800000	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	1.0	ND	--	--	--	--
Chloromethane	Lab	ug/kg				--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	1.0	ND	--	--	--	--
Dibromomethane (methylene bromide)	Lab	ug/kg			800000	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	1.0	ND	--	--	--	--
Ethyl benzene	Lab	ug/kg	6000		8000000	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	1.0	ND	--	--	--	--
Iodomethane	Lab	ug/kg				--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	1.0	ND	--	--	--	--

Table 1
Historical Soil Data Review - 2008 Parametrix PQLs vs. MTCA Cleanup Levels
Yakima Mill Site

					Location	**TP-11**		**TP-11**		**TP-11**		**TP-11**		**TP-12**		**TP-12**		**TP-12D**		**TP-12D**		**TP-13**		**TP-13**		**TP-16**	
					Date	**2/27/2008**		**2/27/2008**		**2/27/2008**		**2/27/2008**		**2/27/2008**		**2/27/2008**		**2/27/2008**		**2/27/2008**		**2/27/2008**		**2/27/2008**		**4/09/2008**	
					Depth	**4 ft**		**4 ft**		**14 ft**		**14 ft**		**13 ft**		**13 ft**		**13 ft**		**13 ft**		**8 ft**		**8 ft**		**2 ft**	
					Sample Type	**N**		**N**		**N**		**N**		**N**		**N**		**N**		**N**		**N**		**N**		**N**	
					Result Type	**PQL**	**Result**	**Diluted PQL**	**Diluted Result**	**PQL**	**Result**	**Diluted PQL**	**Diluted Result**	**PQL**	**Result**	**Diluted PQL**	**Diluted Result**	**PQL**	**Result**	**Diluted PQL**	**Diluted Result**	**PQL**	**Result**	**Diluted PQL**	**Diluted Result**	**PQL**	**Result**
					Data Status	**SSource**	**SSource**	**SSource**	**SSource**	**SSource**	**SSource**	**SSource**	**SSource**	**SSource**	**SSource**	**SSource**	**SSource**	**SSource**	**SSource**	**SSource**	**SSource**	**SSource**	**SSource**	**SSource**	**SSource**	**SSource**	**SSource**
Parameter	Analysis Location	Units	Washington Method A Unrestricted Land Use	Washington Method B Cancer Direct Contact	Washington Method B Noncancer Direct Contact																						
Effective Date			07/01/2015	07/01/2015	07/01/2015																						
Exceedance Key			**Bold**	Shade	Border																						
Methyl ethyl ketone (2-butanone)	Lab	ug/kg			48000000	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	4.9	ND	--	--	--	--
Methyl isobutyl ketone (MIBK)	Lab	ug/kg			6400000	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	4.9	ND	--	--	--	--
Methylene chloride	Lab	ug/kg	20.0	500000	480000	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	2.0	ND	--	--	--	--
Styrene	Lab	ug/kg			16000000	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	1.0	ND	--	--	--	--
Tetrachloroethylene	Lab	ug/kg	**50.0**	476000	480000	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	1.0	ND	--	--	--	--
Toluene	Lab	ug/kg	7000		6400000	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	1.0	ND	--	--	--	--
Trichloroethylene (TCE)	Lab	ug/kg	**30.0**	12000	40000	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	1.0	ND	--	--	--	--
Trichlorofluoromethane (Freon-11)	Lab	ug/kg			24000000	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	1.0	ND	--	--	--	--
Vinyl acetate	Lab	ug/kg			80000000	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	4.9	ND	--	--	--	--
Vinyl chloride	Lab	ug/kg			240000	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	1.0	ND	--	--	--	--
Xylene, m & p	Lab	ug/kg			16000000	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	1.0	ND	--	--	--	--
Xylene, o	Lab	ug/kg			16000000	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	1.0	ND	--	--	--	--
PCBs																											
Aroclor 1016	Lab	ug/kg		14300	5600	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	33	ND	--	--	--	--
Aroclor 1221	Lab	ug/kg				--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	33	ND	--	--	--	--
Aroclor 1232	Lab	ug/kg				--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	33	ND	--	--	--	--
Aroclor 1242	Lab	ug/kg				--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	33	ND	--	--	--	--
Aroclor 1248	Lab	ug/kg				--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	33	ND	--	--	--	--
Aroclor 1254	Lab	ug/kg		500	1600	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	33	ND	--	--	--	--
Aroclor 1260	Lab	ug/kg		500		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	33	ND	--	--	--	--
Total Petroleum Hydrocarbons																											
Benzene	Lab	ug/kg	**30.0**	18200	320000	DET	29	--	--	29	ND	--	--	DET	23	--	--	21	ND	--	--	14	ND	--	--	--	--
Ethyl benzene	Lab	ug/kg	6000		8000000	24	ND	--	--	29	ND	--	--	DET	23	--	--	DET	67 J	--	--	14	ND	--	--	--	--
Toluene	Lab	ug/kg	7000		6400000	DET	230 J	--	--	DET	29 J	--	--	DET	64	--	--	21	ND	--	--	14	ND	--	--	--	--
Total Petroleum Hydrocarbons (as diesel)	Lab	ug/kg	2000000			DET	19000 J	--	--	DET	25000 J	--	--	DET	7200000	--	--	DET	3600000 J	--	--	5400	ND	--	--	DET	2900000
Total Petroleum Hydrocarbons (as gasoline)	Lab	ug/kg	30000			9400	ND	--	--	12000	ND	--	--	DET	260000	--	--	DET	320000	--	--	DET	17000	--	--	--	--
Total Petroleum Hydrocarbons (as motor oil)	Lab	ug/kg	2000000			DET	64000 J	--	--	DET	130000 J	--	--	DET	730000	--	--	DET	690000 J	--	--	11000	ND	--	--	DET	9300000
Xylene, m & p	Lab	ug/kg				47	ND	--	--	59	ND	--	--	DET	47	--	--	43	ND	--	--	28	ND	--	--	--	--
Xylene, o	Lab	ug/kg			16000000	24	ND	--	--	29	ND	--	--	DET	23	--	--	DET	60 J	--	--	14	ND	--	--	--	--

DET: Result is a detection, therefore no reporting detection limit is available.
Barr qualifier - *: Estimated value, QA/QC criteria not met.
J: Estimated concentration when the value is less than the ARI's established reporting limits.
N: Normal Sample.
FD: Field Duplicate Sample.
ND: Not detected.
PQL: Practical Quantitation Limit.
SSource: Laboratory and/or field data obtained from a secondary source external to Barr. Second source QA/QC evaluation procedures may or may not have been performed beyond the original data
Diluted PQL/Result: Samples required dilution by the laboratory due to high internal standards recoveries. Both sets of data were provided in lab report.

Table was updated (items in red) after original submittal to add Barr qualifiers to be consistent with the memo.

Table 1
Historical Soil Data Review - 2008 Parametrix PQLs vs. MTCA Cleanup Levels
Yakima Mill Site

					Location	TP-17		TP-17		TP-17		TP-20		TP-21		TP-22		TP-23		TP-24		TP-25		TP-26	
					Date	4/09/2008		4/09/2008		4/09/2008		5/19/2008		5/19/2008		5/19/2008		5/19/2008		5/19/2008		5/19/2008		5/19/2008	
					Depth	1.5 ft		2.5 ft		3.5 ft		10 ft		13 ft		13 ft		7 ft		4 ft		12 ft		7 ft	
					Sample Type	N		N		N		N		N		N		N		N		N		N	
					Result Type	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result
					Data Status	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource
Parameter	Analysis Location	Units	Washington Method A Unrestricted Land Use	Washington Method B Cancer Direct Contact	Washington Method B Noncancer Direct Contact																				
Effective Date			07/01/2015	07/01/2015	07/01/2015																				
Exceedance Key			**Bold**	Shade	Border																				
General Parameters																									
Carbon, total organic	Lab	%				--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
pH	Lab	pH units				--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Solids, total	Lab	%				--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Metals																									
Arsenic	Lab	ug/kg	20000	667	24000	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Barium	Lab	ug/kg			16000000	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Cadmium	Lab	ug/kg	2000		80000	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Chromium	Lab	ug/kg				--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Lead	Lab	ug/kg	250000			--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Mercury	Lab	ug/kg	2000			--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Selenium	Lab	ug/kg			400000	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Silver	Lab	ug/kg			400000	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
SVOCs																									
1,2,4-Trichlorobenzene	Lab	ug/kg		34500	800000	--	--	--	--	--	--	--	--	64	ND	--	--	--	--	--	--	--	--	--	--
1,2-Dichlorobenzene	Lab	ug/kg			7200000	--	--	--	--	--	--	--	--	64	ND	--	--	--	--	--	--	--	--	--	--
1,3-Dichlorobenzene	Lab	ug/kg				--	--	--	--	--	--	--	--	64	ND	--	--	--	--	--	--	--	--	--	--
1,4-Dichlorobenzene	Lab	ug/kg		185000	5600000	--	--	--	--	--	--	--	--	64	ND	--	--	--	--	--	--	--	--	--	--
1-Methylnaphthalene	Lab	ug/kg		34500	5600000	--	--	--	--	--	--	--	--	64	ND	--	--	--	--	--	--	--	--	--	--
2,2'-oxybis (1-chloropropane)	Lab	ug/kg		14300	3200000	--	--	--	--	--	--	--	--	64	ND	--	--	--	--	--	--	--	--	--	--
2,4,5-Trichlorophenol	Lab	ug/kg			8000000	--	--	--	--	--	--	--	--	320	ND	--	--	--	--	--	--	--	--	--	--
2,4,6-Trichlorophenol	Lab	ug/kg		90900	80000	--	--	--	--	--	--	--	--	320	ND	--	--	--	--	--	--	--	--	--	--
2,4-Dichlorophenol	Lab	ug/kg			240000	--	--	--	--	--	--	--	--	320	ND	--	--	--	--	--	--	--	--	--	--
2,4-Dimethylphenol	Lab	ug/kg			1600000	--	--	--	--	--	--	--	--	64	ND	--	--	--	--	--	--	--	--	--	--
2,4-Dinitrophenol	Lab	ug/kg			160000	--	--	--	--	--	--	--	--	640	ND	--	--	--	--	--	--	--	--	--	--
2,4-Dinitrotoluene	Lab	ug/kg		3230	160000	--	--	--	--	--	--	--	--	320	ND	--	--	--	--	--	--	--	--	--	--
2,6-Dinitrotoluene	Lab	ug/kg		667	24000	--	--	--	--	--	--	--	--	320	ND	--	--	--	--	--	--	--	--	--	--
2-Chloronaphthalene	Lab	ug/kg			6400000	--	--	--	--	--	--	--	--	64	ND	--	--	--	--	--	--	--	--	--	--
2-Chlorophenol	Lab	ug/kg			400000	--	--	--	--	--	--	--	--	64	ND	--	--	--	--	--	--	--	--	--	--
2-Methyl-4,6-dinitrophenol	Lab	ug/kg				--	--	--	--	--	--	--	--	640	ND	--	--	--	--	--	--	--	--	--	--
2-Methylnaphthalene	Lab	ug/kg			320000	--	--	--	--	--	--	--	--	64	ND	--	--	--	--	--	--	--	--	--	--
2-Methylphenol (o-cresol)	Lab	ug/kg			4000000	--	--	--	--	--	--	--	--	64	ND	--	--	--	--	--	--	--	--	--	--
2-Nitroaniline	Lab	ug/kg			800000	--	--	--	--	--	--	--	--	320	ND	--	--	--	--	--	--	--	--	--	--
2-Nitrophenol	Lab	ug/kg				--	--	--	--	--	--	--	--	320	ND	--	--	--	--	--	--	--	--	--	--
3,3`-Dichlorobenzidine	Lab	ug/kg		2220		--	--	--	--	--	--	--	--	320	ND	--	--	--	--	--	--	--	--	--	--
3-Nitroaniline	Lab	ug/kg				--	--	--	--	--	--	--	--	320	ND	--	--	--	--	--	--	--	--	--	--
4-Bromophenyl phenyl ether	Lab	ug/kg				--	--	--	--	--	--	--	--	64	ND	--	--	--	--	--	--	--	--	--	--
4-Chloro-3-methylphenol	Lab	ug/kg				--	--	--	--	--	--	--	--	320	ND	--	--	--	--	--	--	--	--	--	--
4-Chloroaniline	Lab	ug/kg		5000	320000	--	--	--	--	--	--	--	--	320	ND	--	--	--	--	--	--	--	--	--	--
4-Chlorophenyl phenyl ether	Lab	ug/kg				--	--	--	--	--	--	--	--	64	ND	--	--	--	--	--	--	--	--	--	--
4-Methylphenol (p-cresol)	Lab	ug/kg			8000000	--	--	--	--	--	--	--	--	DET	78	--	--	--	--	--	--	--	--	--	--
4-Nitroaniline	Lab	ug/kg				--	--	--	--	--	--	--	--	320	ND	--	--	--	--	--	--	--	--	--	--
4-Nitrophenol	Lab	ug/kg				--	--	--	--	--	--	--	--	320	ND	--	--	--	--	--	--	--	--	--	--
Acenaphthene	Lab	ug/kg			4800000	--	--	--	--	--	--	--	--	64	ND	--	--	--	--	--	--	--	--	--	--
Acenaphthylene	Lab	ug/kg				--	--	--	--	--	--	--	--	64	ND	--	--	--	--	--	--	--	--	--	--
Anthracene	Lab	ug/kg			24000000	--	--	--	--	--	--	--	--	64	ND	--	--	--	--	--	--	--	--	--	--
Benz(a)anthracene	Lab	ug/kg		1370		--	--	--	--	--	--	--	--	64	ND	--	--	--	--	--	--	--	--	--	--
Benzo(a)pyrene	Lab	ug/kg	**100**	137		--	--	--	--	--	--	--	--	64	ND	--	--	--	--	--	--	--	--	--	--
Benzo(b)fluoranthene	Lab	ug/kg		1370		--	--	--	--	--	--	--	--	64	ND	--	--	--	--	--	--	--	--	--	--
Benzo(g,h,i)perylene	Lab	ug/kg				--	--	--	--	--	--	--	--	64	ND	--	--	--	--	--	--	--	--	--	--
Benzo(k)fluoranthene	Lab	ug/kg		13700		--	--	--	--	--	--	--	--	64	ND	--	--	--	--	--	--	--	--	--	--
Benzoic acid	Lab	ug/kg			320000000	--	--	--	--	--	--	--	--	640	ND	--	--	--	--	--	--	--	--	--	--
Benzyl alcohol	Lab	ug/kg			8000000	--	--	--	--	--	--	--	--	320	ND	--	--	--	--	--	--	--	--	--	--
Bis(2-chloroethoxy)methane	Lab	ug/kg				--	--	--	--	--	--	--	--	64	ND	--	--	--	--	--	--	--	--	--	--
Bis(2-chloroethyl)ether	Lab	ug/kg		909		--	--	--	--	--	--	--	--	64	ND	--	--	--	--	--	--	--	--	--	--
Bis(2-ethylhexyl)phthalate	Lab	ug/kg		71400	1600000	--	--	--	--	--	--	--	--	DET	76	--	--	--	--	--	--	--	--	--	--
Butyl benzyl phthalate	Lab	ug/kg		526000	16000000	--	--	--	--	--	--	--	--	64	ND	--	--	--	--	--	--	--	--	--	--
Carbazole	Lab	ug/kg				--	--	--	--	--	--	--	--	64	ND	--	--	--	--	--	--	--	--	--	--
Chrysene	Lab	ug/kg		137000		--	--	--	--	--	--	--	--	64	ND	--	--	--	--	--	--	--	--	--	--

Table 1
Historical Soil Data Review - 2008 Parametrix PQLs vs. MTCA Cleanup Levels
Yakima Mill Site

					Location	TP-17		TP-17		TP-17		TP-20		TP-21		TP-22		TP-23		TP-24		TP-25		TP-26	
					Date	4/09/2008		4/09/2008		4/09/2008		5/19/2008		5/19/2008		5/19/2008		5/19/2008		5/19/2008		5/19/2008		5/19/2008	
					Depth	1.5 ft		2.5 ft		3.5 ft		10 ft		13 ft		13 ft		7 ft		4 ft		12 ft		7 ft	
					Sample Type	N		N		N		N		N		N		N		N		N		N	
					Result Type	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result
					Data Status	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource
Parameter	Analysis Location	Units	Washington Method A Unrestricted Land Use	Washington Method B Cancer Direct Contact	Washington Method B Noncancer Direct Contact																				
Effective Date			07/01/2015	07/01/2015	07/01/2015																				
Exceedance Key			**Bold**	Shade	Border																				
Dibenz(a,h)anthracene	Lab	ug/kg		137		--	--	--	--	--	--	--	--	64	ND	--	--	--	--	--	--	--	--	--	--
Dibenzofuran	Lab	ug/kg			80000	--	--	--	--	--	--	--	--	64	ND	--	--	--	--	--	--	--	--	--	--
Diethyl phthalate	Lab	ug/kg			64000000	--	--	--	--	--	--	--	--	64	ND	--	--	--	--	--	--	--	--	--	--
Dimethyl phthalate	Lab	ug/kg				--	--	--	--	--	--	--	--	64	ND	--	--	--	--	--	--	--	--	--	--
Di-n-butyl phthalate	Lab	ug/kg			8000000	--	--	--	--	--	--	--	--	64	ND	--	--	--	--	--	--	--	--	--	--
Di-n-octyl phthalate	Lab	ug/kg			800000	--	--	--	--	--	--	--	--	64	ND	--	--	--	--	--	--	--	--	--	--
Fluoranthene	Lab	ug/kg			3200000	--	--	--	--	--	--	--	--	DET	97	--	--	--	--	--	--	--	--	--	--
Fluorene	Lab	ug/kg			3200000	--	--	--	--	--	--	--	--	64	ND	--	--	--	--	--	--	--	--	--	--
Hexachlorobenzene	Lab	ug/kg		625	64000	--	--	--	--	--	--	--	--	64	ND	--	--	--	--	--	--	--	--	--	--
Hexachlorobutadiene	Lab	ug/kg		12800	80000	--	--	--	--	--	--	--	--	64	ND	--	--	--	--	--	--	--	--	--	--
Hexachlorocyclopentadiene	Lab	ug/kg			480000	--	--	--	--	--	--	--	--	320	ND	--	--	--	--	--	--	--	--	--	--
Hexachloroethane	Lab	ug/kg		25000	56000	--	--	--	--	--	--	--	--	64	ND	--	--	--	--	--	--	--	--	--	--
Indeno(1,2,3-cd)pyrene	Lab	ug/kg		1370		--	--	--	--	--	--	--	--	64	ND	--	--	--	--	--	--	--	--	--	--
Isophorone	Lab	ug/kg		1053000	16000000	--	--	--	--	--	--	--	--	64	ND	--	--	--	--	--	--	--	--	--	--
Naphthalene	Lab	ug/kg	5000		1600000	--	--	--	--	--	--	--	--	DET	150	--	--	--	--	--	--	--	--	--	--
Nitrobenzene	Lab	ug/kg			160000	--	--	--	--	--	--	--	--	64	ND	--	--	--	--	--	--	--	--	--	--
n-Nitrosodi-n-propylamine	Lab	ug/kg		143		--	--	--	--	--	--	--	--	320	ND	--	--	--	--	--	--	--	--	--	--
n-Nitrosodiphenylamine	Lab	ug/kg		204000		--	--	--	--	--	--	--	--	64	ND	--	--	--	--	--	--	--	--	--	--
Pentachlorophenol	Lab	ug/kg		2500	400000	--	--	--	--	--	--	--	--	320	ND	--	--	--	--	--	--	--	--	--	--
Phenanthrene	Lab	ug/kg				--	--	--	--	--	--	--	--	DET	82	--	--	--	--	--	--	--	--	--	--
Phenol	Lab	ug/kg			24000000	--	--	--	--	--	--	--	--	64	ND	--	--	--	--	--	--	--	--	--	--
Pyrene	Lab	ug/kg			2400000	--	--	--	--	--	--	--	--	64	ND	--	--	--	--	--	--	--	--	--	--
VOCs																									
1,1,1,2-Tetrachloroethane	Lab	ug/kg		38500	2400000	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,1,1-Trichloroethane	Lab	ug/kg	2000		160000000	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,1,2,2-Tetrachloroethane	Lab	ug/kg		5000	1600000	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,1,2-Trichloroethane	Lab	ug/kg		17500	320000	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,1-Dichloroethane	Lab	ug/kg		175000	16000000	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,1-Dichloroethylene	Lab	ug/kg			4000000	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,2,3-Trichloropropane	Lab	ug/kg		33.3	320000	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,2-Dibromo-3-chloropropane (DBCP)	Lab	ug/kg		1250	16000	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,2-Dibromoethane (EDB)	Lab	ug/kg	**5.00**	500	720000	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,2-Dichlorobenzene	Lab	ug/kg			7200000	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,2-Dichloroethane	Lab	ug/kg		11000	480000	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,2-Dichloroethylene, cis	Lab	ug/kg			160000	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,2-Dichloroethylene, trans	Lab	ug/kg			1600000	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,2-Dichloropropane	Lab	ug/kg		27800	7200000	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,3-Dichloropropene, cis	Lab	ug/kg		10000	2400000	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,3-Dichloropropene, trans	Lab	ug/kg		10000	2400000	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,4-Dichloro-2-butene, trans	Lab	ug/kg				--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,4-Dichlorobenzene	Lab	ug/kg		185000	5600000	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
2-Hexanone	Lab	ug/kg				--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Acetone	Lab	ug/kg			72000000	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Acrylonitrile	Lab	ug/kg		1850	3200000	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Benzene	Lab	ug/kg	**30.0**	18200	320000	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Bromochloromethane	Lab	ug/kg				--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Bromodichloromethane	Lab	ug/kg		16100	1600000	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Bromoform	Lab	ug/kg		127000	1600000	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Bromomethane	Lab	ug/kg			112000	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Carbon disulfide	Lab	ug/kg			8000000	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Carbon tetrachloride	Lab	ug/kg		14300	320000	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Chlorobenzene	Lab	ug/kg			1600000	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Chlorodibromomethane	Lab	ug/kg		11900	1600000	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Chloroethane	Lab	ug/kg				--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Chloroform	Lab	ug/kg		32300	800000	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Chloromethane	Lab	ug/kg				--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Dibromomethane (methylene bromide)	Lab	ug/kg			800000	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Ethyl benzene	Lab	ug/kg	6000		8000000	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Iodomethane	Lab	ug/kg				--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--

Table 1
Historical Soil Data Review - 2008 Parametrix PQLs vs. MTCA Cleanup Levels
Yakima Mill Site

					Location	TP-17		TP-17		TP-17		TP-20		TP-21		TP-22		TP-23		TP-24		TP-25		TP-26	
					Date	4/09/2008		4/09/2008		4/09/2008		5/19/2008		5/19/2008		5/19/2008		5/19/2008		5/19/2008		5/19/2008		5/19/2008	
					Depth	1.5 ft		2.5 ft		3.5 ft		10 ft		13 ft		13 ft		7 ft		4 ft		12 ft		7 ft	
					Sample Type	N		N		N		N		N		N		N		N		N		N	
					Result Type	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result
					Data Status	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource
Parameter	Analysis Location	Units	Washington Method A Unrestricted Land Use	Washington Method B Cancer Direct Contact	Washington Method B Noncancer Direct Contact																				
Effective Date			07/01/2015	07/01/2015	07/01/2015																				
Exceedance Key			**Bold**	Shade	Border																				
Methyl ethyl ketone (2-butanone)	Lab	ug/kg			48000000	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Methyl isobutyl ketone (MIBK)	Lab	ug/kg			6400000	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Methylene chloride	Lab	ug/kg	20.0	500000	480000	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Styrene	Lab	ug/kg			16000000	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Tetrachloroethylene	Lab	ug/kg	**50.0**	476000	480000	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Toluene	Lab	ug/kg	7000		6400000	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Trichloroethylene (TCE)	Lab	ug/kg	**30.0**	12000	40000	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Trichlorofluoromethane (Freon-11)	Lab	ug/kg			24000000	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Vinyl acetate	Lab	ug/kg			80000000	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Vinyl chloride	Lab	ug/kg			240000	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Xylene, m & p	Lab	ug/kg			16000000	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Xylene, o	Lab	ug/kg			16000000	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
PCBs																									
Aroclor 1016	Lab	ug/kg		14300	5600	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Aroclor 1221	Lab	ug/kg				--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Aroclor 1232	Lab	ug/kg				--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Aroclor 1242	Lab	ug/kg				--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Aroclor 1248	Lab	ug/kg				--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Aroclor 1254	Lab	ug/kg		500	1600	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Aroclor 1260	Lab	ug/kg		500		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Total Petroleum Hydrocarbons																									
Benzene	Lab	ug/kg	**30.0**	18200	320000	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Ethyl benzene	Lab	ug/kg	6000		8000000	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Toluene	Lab	ug/kg	7000		6400000	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Total Petroleum Hydrocarbons (as diesel)	Lab	ug/kg	2000000			DET	290000	DET	850000	DET	2000000	5400	ND	DET	210000	DET	92000	DET	240000	DET	340000	6400	ND	6800	ND
Total Petroleum Hydrocarbons (as gasoline)	Lab	ug/kg	30000			--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Total Petroleum Hydrocarbons (as motor oil)	Lab	ug/kg	2000000			DET	1900000	DET	3600000	DET	4200000	DET	12000	DET	240000	DET	320000	DET	380000	DET	410000	13000	ND	14000	ND
Xylene, m & p	Lab	ug/kg				--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Xylene, o	Lab	ug/kg			16000000	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--

DET: Result is a detection, therefore no reporting detection limit is available.
Barr qualifier - *: Estimated value, QA/QC criteria not met.
J: Estimated concentration when the value is less than the ARI's established reporting limits.
N: Normal Sample.
FD: Field Duplicate Sample.
ND: Not detected.
PQL: Practical Quantitation Limit.
SSource: Laboratory and/or field data obtained from a secondary source external to Barr. Second source QA/QC evaluation procedures may or may not have been performed beyond the original data
Diluted PQL/Result: Samples required dilution by the laboratory due to high internal standards recoveries. Both sets of data were provided in lab report.

Table was updated (items in red) after original submittal to add Barr qualifiers to be consistent with the memo.

Table 2
Historical Groundwater Data Review - 2008 Parametrix PQLs vs. MTCA Cleanup Levels
Yakima Mill Site

					Location	EVP-W		EVP-W		KILN1-W		KILN2-W		MW-1		MW-5		MW-6		MW-7		MW-7D		MW-8		MW-9A	
					Date	2/28/2008		2/28/2008		2/28/2008		2/28/2008		2/05/2008		2/07/2008		2/07/2008		2/06/2008		2/06/2008		2/06/2008		3/25/2008	
					Sample Type	N		FD		N		N		N		N		N		N		N		N		N	
					Result Type	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result
					Data Status	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource
.	Total or Dissolved	Units	Washington GW Method A	Washington GW Method B Cancer	Washington GW Method B Noncancer																						
Effective Date			07/01/2015	07/01/2015	07/01/2015																						
Exceedance Key			**Bold**	Shade	Border																						
General Parameters																											
Alkalinity, bicarbonate, as CaCO3	NA	ug/l				--	--	--	--	--	--	--	--	DET	99500	DET	196000	DET	194000	DET	274000	DET	274000	DET	306000	--	--
Alkalinity, carbonate, as CaCO3	NA	ug/l				--	--	--	--	--	--	--	--	1000	ND	1000	ND	1000	ND	1000	ND	1000	ND	1000	ND	--	--
Alkalinity, hydroxide, as CaCO3	NA	ug/l				--	--	--	--	--	--	--	--	1000	ND	1000	ND	1000	ND	1000	ND	1000	ND	1000	ND	--	--
Alkalinity, total, as CaCO3	NA	ug/l				--	--	--	--	--	--	--	--	DET	99500	DET	196000	DET	194000	DET	274000	DET	274000	DET	306000	DET	127000
Carbon, total organic	NA	ug/l				--	--	--	--	--	--	--	--	1500	ND	DET	8250	DET	7220	DET	6510	DET	6470	DET	8770	1500	ND
Chloride	NA	ug/l				--	--	--	--	--	--	--	--	DET	8900	DET	13100	DET	14200	DET	19400	DET	19000	DET	32800	DET	15600
Nitrogen, ammonia, as N	NA	ug/l				--	--	--	--	--	--	--	--	DET	44	DET	951	DET	720	DET	6350	DET	6180	DET	21200	DET	38
Nitrogen, nitrate + nitrite, as N	NA	ug/l				--	--	--	--	--	--	--	--	DET	1250	50	ND	DET	77	50	ND	50	ND	DET	215	DET	1630
Nitrogen, nitrate, as N	NA	ug/l			25600	--	--	--	--	--	--	--	--	DET	1250	50	ND	DET	77	50	ND	50	ND	DET	196	DET	1410
Nitrogen, nitrite, as N	NA	ug/l			1600	--	--	--	--	--	--	--	--	10	ND	50	ND	50	ND	50	ND	50	ND	DET	19	DET	223
pH	NA	pH units				DET	7.41	DET	7.37	DET	8	DET	8.89	DET	6.72	DET	6.99	DET	6.64	DET	6.49	DET	6.5	DET	6.76	DET	6.77
Solids, total dissolved	NA	ug/l				--	--	--	--	--	--	--	--	DET	161000	DET	278000	DET	253000	DET	336000	DET	318000	DET	333000	DET	210000
Sulfate, as SO4	NA	ug/l				--	--	--	--	--	--	--	--	DET	10200	DET	13500	DET	5100	DET	5500	DET	5500	DET	5600	DET	17900
Metals																											
Arsenic	Dissolved	ug/l	**5.00**	0.0583	4.80	**50**	ND	**50**	ND	**50**	ND	**50**	ND	**50**	ND	**50**	ND	**50**	ND	**50**	ND	**50**	ND	**50**	ND	**50**	ND
Arsenic	Total	ug/l	**5.00**	0.0583	4.80	**50**	ND	**50**	ND	**50**	ND	**50**	ND	**50**	ND	**50**	ND	**50**	ND	**50**	ND	**50**	ND	**50**	ND	**50**	ND
Barium	Dissolved	ug/l			3200	DET	8	DET	8	DET	55	DET	14	DET	8	DET	63	DET	47	DET	69	DET	71	DET	72	DET	13
Barium	Total	ug/l			3200	DET	7	DET	7	DET	139	DET	52	DET	18	DET	62	DET	45	DET	62	DET	64	DET	68	DET	404
Cadmium	Dissolved	ug/l	5.00		8.00	2	ND	2	ND	2	ND	2	ND	2	ND	2	ND	2	ND	2	ND	2	ND	2	ND	2	ND
Cadmium	Total	ug/l	5.00		8.00	2	ND	2	ND	2	ND	2	ND	2	ND	2	ND	2	ND	2	ND	2	ND	2	ND	2	ND
Calcium	Dissolved	ug/l				DET	8790	DET	8840	DET	27500	DET	14600	DET	24900	DET	41600	DET	37900	DET	48100	DET	48500	DET	39100	DET	29400
Calcium	Total	ug/l				DET	8620	DET	8480	DET	32500	DET	16300	DET	24600	DET	41000	DET	36000	DET	43300	DET	45500	DET	37200	DET	51500
Chromium	Dissolved	ug/l	50.0			5	ND	5	ND	5	ND	5	ND	5	ND	5	ND	5	ND	5	ND	5	ND	5	ND	5	ND
Chromium	Total	ug/l	50.0			5	ND	5	ND	5	ND	5	ND	5	ND	5	ND	5	ND	5	ND	5	ND	5	ND	DET	278
Iron	Dissolved	ug/l			11200	DET	210	DET	210	0.05	ND	0.05	ND	0.05	ND	DET	7030	DET	27500	DET	37500	DET	37700	DET	12200	DET	270
Iron	Total	ug/l			11200	DET	390	DET	450	DET	4290	DET	900	DET	1920	DET	7330	DET	26200	DET	33600	DET	35100	DET	11500	DET	96800
Lead	Dissolved	ug/l	**15.0**			**20**	ND	**20**	ND	**20**	ND	**20**	ND	**20**	ND	**20**	ND	**20**	ND	**20**	ND	**20**	ND	**20**	ND	**20**	ND
Lead	Total	ug/l	**15.0**			**20**	ND	**20**	ND	**20**	ND	**20**	ND	**20**	ND	**20**	ND	**20**	ND	**20**	ND	**20**	ND	**20**	ND	**20**	ND
Manganese	Dissolved	ug/l			2240	DET	45	DET	46	DET	98	0.001	ND	0.001	ND	DET	861	DET	2520	DET	2520	DET	2530	DET	2340	DET	872
Manganese	Total	ug/l			2240	DET	48	DET	49	DET	445	DET	114	DET	247	DET	863	DET	2380	DET	2260	DET	2360	DET	2240	DET	3240
Mercury	Dissolved	ug/l	2.00			0.1	ND	0.1	ND	0.1	ND	0.1	ND	0.1	ND	0.1	ND	0.1	ND	0.1	ND	0.1	ND	0.1	ND	0.1	ND
Mercury	Total	ug/l	2.00			0.1	ND	0.1	ND	0.1	ND	0.1	ND	0.1	ND	0.1	ND	0.1	ND	0.1	ND	0.1	ND	0.1	ND	DET	0.2
Potassium	Dissolved	ug/l				DET	3800	DET	3800	DET	19900	DET	5300	DET	2800	DET	25500	DET	10200	DET	11400	DET	11300	DET	29900	DET	4400
Potassium	Total	ug/l				DET	3800	DET	3700	DET	20000	DET	5500	DET	2800	DET	24600	DET	9800	DET	10300	DET	10700	DET	29000	DET	10300
Selenium	Dissolved	ug/l			80.0	50	ND	50	ND	50	ND	50	ND	50	ND	50	ND	50	ND	50	ND	50	ND	50	ND	50	ND
Selenium	Total	ug/l			80.0	50	ND	50	ND	50	ND	50	ND	50	ND	50	ND	50	ND	50	ND	50	ND	50	ND	50	ND
Silver	Dissolved	ug/l			80.0	3	ND	3	ND	3	ND	3	ND	3	ND	3	ND	3	ND	3	ND	3	ND	3	ND	3	ND
Silver	Total	ug/l			80.0	3	ND	3	ND	3	ND	3	ND	3	ND	3	ND	3	ND	3	ND	3	ND	3	ND	3	ND
Sodium	Dissolved	ug/l				DET	37400	DET	38100	DET	8200	DET	10300	DET	12700	DET	19000	DET	16500	DET	22900	DET	22900	DET	33800	DET	15700
Sodium	Total	ug/l				DET	36300	DET	36400	DET	8200	DET	9500	DET	12200	DET	18400	DET	15600	DET	20500	DET	21200	DET	32500	DET	21100
SVOCs																											
1,2,4-Trichlorobenzene	NA	ug/l		1.51	80.0	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND
1,2-Dichlorobenzene	NA	ug/l			720	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND
1,3-Dichlorobenzene	NA	ug/l				1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND
1,4-Dichlorobenzene	NA	ug/l		8.10	560	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND
1-Methylnaphthalene	NA	ug/l		1.51	560	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND
2,2'-oxybis (1-chloropropane)	NA	ug/l		0.625	320	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND
2,4,5-Trichlorophenol	NA	ug/l			800	5.0	ND	5.0	ND	5.0	ND	5.0	ND	5.0	ND	5.0	ND	5.0	ND	5.0	ND	5.0	ND	5.0	ND	5.0	ND
2,4,6-Trichlorophenol	NA	ug/l		3.98	8.00	5.0	ND	5.0	ND	5.0	ND	5.0	ND	5.0	ND	5.0	ND	5.0	ND	5.0	ND	5.0	ND	5.0	ND	5.0	ND
2,4-Dichlorophenol	NA	ug/l			24.0	5.0	ND	5.0	ND	5.0	ND	5.0	ND	5.0	ND	5.0	ND	5.0	ND	5.0	ND	5.0	ND	5.0	ND	5.0	ND
2,4-Dimethylphenol	NA	ug/l			160	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND
2,4-Dinitrophenol	NA	ug/l			32.0	10	ND	10	ND	10	ND	10	ND	10	ND	10	ND	10	ND	10	ND	10	ND	10	ND	10	ND
2,4-Dinitrotoluene	NA	ug/l		0.282	32.0	5.0	ND	5.0	ND	5.0	ND	5.0	ND	5.0	ND	5.0	ND	5.0	ND	5.0	ND	5.0	ND	5.0	ND	5.0	ND
2,6-Dinitrotoluene	NA	ug/l		0.0583	4.80	5.0	ND	5.0	ND	5.0	ND	5.0	ND	5.0	ND	5.0	ND	5.0	ND	5.0	ND	5.0	ND	5.0	ND	5.0	ND
2-Chloronaphthalene	NA	ug/l			640	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND
2-Chlorophenol	NA	ug/l			40.0	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND
2-Methyl-4,6-dinitrophenol	NA	ug/l				10	ND	10	ND	10	ND	10	ND	10	ND	10	ND	10	ND	10	ND	10	ND	10	ND	10	ND
2-Methylnaphthalene	NA	ug/l			32.0	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND
2-Methylphenol (o-cresol)	NA	ug/l			400	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND
2-Nitroaniline	NA	ug/l			160	5.0	ND	5.0	ND	5.0	ND	5.0	ND	5.0	ND	5.0	ND	5.0	ND	5.0	ND	5.0	ND	5.0	ND	5.0	ND
2-Nitrophenol	NA	ug/l				5.0	ND	5.0	ND	5.0	ND	5.0	ND	5.0	ND	5.0	ND	5.0	ND	5.0	ND	5.0	ND	5.0	ND	5.0	ND
3,3`-Dichlorobenzidine	NA	ug/l		0.194		5.0	ND	5.0	ND	5.0	ND	5.0	ND	5.0	ND	5.0	ND	5.0	ND	5.0	ND	5.0	ND	5.0	ND	5.0	ND
3-Nitroaniline	NA	ug/l				5.0	ND	5.0	ND	5.0	ND	5.0	ND	5.0	ND	5.0	ND	5.0	ND	5.0	ND	5.0	ND	5.0	ND	5.0	ND
4-Bromophenyl phenyl ether	NA	ug/l				1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND

Table 2
Historical Groundwater Data Review - 2008 Parametrix PQLs vs. MTCA Cleanup Levels
Yakima Mill Site

					Location	EVP-W		EVP-W		KILN1-W		KILN2-W		MW-1		MW-5		MW-6		MW-7		MW-7D		MW-8		MW-9A	
					Date	2/28/2008		2/28/2008		2/28/2008		2/28/2008		2/05/2008		2/07/2008		2/07/2008		2/06/2008		2/06/2008		2/06/2008		3/25/2008	
					Sample Type	N		FD		N		N		N		N		N		N		N		N		N	
					Result Type	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result
					Data Status	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource
.	Total or Dissolved	Units	Washington GW Method A	Washington GW Method B Cancer	Washington GW Method B Noncancer																						
Effective Date			07/01/2015	07/01/2015	07/01/2015																						
Exceedance Key			**Bold**	Shade	Border																						
4-Chloro-3-methylphenol	NA	ug/l				5.0	ND	5.0	ND	5.0	ND	5.0	ND	5.0	ND	5.0	ND	5.0	ND	5.0	ND	5.0	ND	5.0	ND	5.0	ND
4-Chloroaniline	NA	ug/l		0.219	32.0	5.0	ND	5.0	ND	5.0	ND	5.0	ND	5.0	ND	5.0	ND	5.0	ND	5.0	ND	5.0	ND	5.0	ND	5.0	ND
4-Chlorophenyl phenyl ether	NA	ug/l				1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND
4-Methylphenol (p-cresol)	NA	ug/l			800	1.0	ND	1.0	ND	DET	11	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND
4-Nitroaniline	NA	ug/l				5.0	ND	5.0	ND	5.0	ND	5.0	ND	5.0	ND	5.0	ND	5.0	ND	5.0	ND	5.0	ND	5.0	ND	5.0	ND
4-Nitrophenol	NA	ug/l				5.0	ND	5.0	ND	5.0	ND	5.0	ND	5.0	ND	5.0	ND	5.0	ND	5.0	ND	5.0	ND	5.0	ND	5.0	ND
Acenaphthene	NA	ug/l			960	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND
Acenaphthylene	NA	ug/l				1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND
Anthracene	NA	ug/l			4800	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND
Benz(a)anthracene	NA	ug/l		0.120		1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND
Benzo(a)pyrene	NA	ug/l	**0.100**	0.0120		**1.0**	ND	**1.0**	ND	**1.0**	ND	**1.0**	ND	**1.0**	ND	**1.0**	ND	**1.0**	ND	**1.0**	ND	**1.0**	ND	**1.0**	ND	**1.0**	ND
Benzo(b)fluoranthene	NA	ug/l		0.120		1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND
Benzo(g,h,i)perylene	NA	ug/l				1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND
Benzo(k)fluoranthene	NA	ug/l		1.20		1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND
Benzoic acid	NA	ug/l			64000	10	ND	10	ND	10	ND	10	ND	10	ND	10	ND	10	ND	10	ND	10	ND	10	ND	10	ND
Benzyl alcohol	NA	ug/l			800	5.0	ND	5.0	ND	5.0	ND	5.0	ND	5.0	ND	5.0	ND	5.0	ND	5.0	ND	5.0	ND	5.0	ND	5.0	ND
Bis(2-chloroethoxy)methane	NA	ug/l				1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND
Bis(2-chloroethyl)ether	NA	ug/l		0.0398		1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND
Bis(2-ethylhexyl)phthalate	NA	ug/l		6.25	320	1.0	ND	1.0	ND	1.0	ND	DET	35	1.0	ND	DET	1	1.0	ND	1.0	ND	1.0	ND	1.0	ND	DET	1.5
Butyl benzyl phthalate	NA	ug/l		46.1	3200	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND
Carbazole	NA	ug/l				1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND
Chrysene	NA	ug/l		12.0		1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND
Dibenz(a,h)anthracene	NA	ug/l		0.0120		1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND
Dibenzofuran	NA	ug/l			16.0	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND
Diethyl phthalate	NA	ug/l			12800	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND
Dimethyl phthalate	NA	ug/l				1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND
Di-n-butyl phthalate	NA	ug/l			1600	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND
Di-n-octyl phthalate	NA	ug/l			160	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND
Fluoranthene	NA	ug/l			640	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND
Fluorene	NA	ug/l			640	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND
Hexachlorobenzene	NA	ug/l		0.0547	12.8	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND
Hexachlorobutadiene	NA	ug/l		0.561	8.00	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND
Hexachlorocyclopentadiene	NA	ug/l			48.0	5.0	ND	5.0	ND	5.0	ND	5.0	ND	5.0	ND	5.0	ND	5.0	ND	5.0	ND	5.0	ND	5.0	ND	5.0	ND
Hexachloroethane	NA	ug/l		1.09	5.60	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND
Indeno(1,2,3-cd)pyrene	NA	ug/l		0.120		1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND
Isophorone	NA	ug/l		46.1	1600	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND
Naphthalene	NA	ug/l	160		160	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND
Nitrobenzene	NA	ug/l			16.0	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND
n-Nitrosodi-n-propylamine	NA	ug/l		0.0125		5.0	ND	5.0	ND	5.0	ND	5.0	ND	5.0	ND	5.0	ND	5.0	ND	5.0	ND	5.0	ND	5.0	ND	5.0	ND
n-Nitrosodiphenylamine	NA	ug/l		17.9		1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	DET	1.6	DET	1.5	1.0	ND	1.0	ND
Pentachlorophenol	NA	ug/l		0.219	80.0	5.0	ND	5.0	ND	5.0	ND	5.0	ND	5.0	ND	5.0	ND	5.0	ND	5.0	ND	5.0	ND	5.0	ND	5.0	ND
Phenanthrene	NA	ug/l				1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND
Phenol	NA	ug/l			2400	1.0	ND	1.0	ND	DET	2.0	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND
Pyrene	NA	ug/l			480	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND
VOCs																											
1,1,1,2-Tetrachloroethane	NA	ug/l		1.68	240	1.0	ND	1.0	ND	--	--	--	--	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND
1,1,1-Trichloroethane	NA	ug/l	200		16000	1.0	ND	1.0	ND	--	--	--	--	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND
1,1,2,2-Tetrachloroethane	NA	ug/l		0.219	160	1.0	ND	1.0	ND	--	--	--	--	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND
1,1,2-Trichloroethane	NA	ug/l		0.768	32.0	1.0	ND	1.0	ND	--	--	--	--	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND
1,1-Dichloroethane	NA	ug/l		7.68	1600	1.0	ND	1.0	ND	--	--	--	--	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	DET	2.4	1.0	ND
1,1-Dichloroethylene	NA	ug/l			400	1.0	ND	1.0	ND	--	--	--	--	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND
1,2,3-Trichloropropane	NA	ug/l		0.00146	32.0	2.0	ND	2.0	ND	--	--	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
1,2-Dibromo-3-chloropropane (DBCP)	NA	ug/l		0.0547	1.60	5.0	ND	5.0	ND	--	--	--	--	5.0	ND	5.0	ND	5.0	ND	5.0	ND	5.0	ND	5.0	ND	5.0	ND
1,2-Dibromoethane (EDB)	NA	ug/l	**0.0100**	0.0219	72.0	**1.0**	ND	**1.0**	ND	--	--	--	--	**1.0**	ND	**1.0**	ND	**1.0**	ND	**1.0**	ND	**1.0**	ND	**1.0**	ND	**1.0**	ND
1,2-Dichlorobenzene	NA	ug/l			720	1.0	ND	1.0	ND	--	--	--	--	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND
1,2-Dichloroethane	NA	ug/l	5.00	0.481	48.0	1.0	ND	1.0	ND	--	--	--	--	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND
1,2-Dichloroethylene, cis	NA	ug/l			16.0	1.0	ND	1.0	ND	--	--	--	--	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND
1,2-Dichloroethylene, trans	NA	ug/l			160	1.0	ND	1.0	ND	--	--	--	--	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND
1,2-Dichloropropane	NA	ug/l		1.22	720	1.0	ND	1.0	ND	--	--	--	--	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND
1,3-Dichloropropene, cis	NA	ug/l		0.438	240	1.0	ND	1.0	ND	--	--	--	--	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND
1,3-Dichloropropene, trans	NA	ug/l		0.438	240	1.0	ND	1.0	ND	--	--	--	--	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND
1,4-Dichloro-2-butene, trans	NA	ug/l				5.0	ND	5.0	ND	--	--	--	--	5.0	ND	5.0	ND	5.0	ND	5.0	ND	5.0	ND	5.0	ND	5.0	ND
1,4-Dichlorobenzene	NA	ug/l		8.10	560	1.0	ND	1.0	ND	--	--	--	--	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND
2-Chloroethyl vinyl ether	NA	ug/l				--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	5.0	ND
2-Hexanone	NA	ug/l				5.0	ND	5.0	ND	--	--	--	--	5.0	ND	5.0	ND	5.0	ND	5.0	ND	5.0	ND	5.0	ND	5.0	ND

Table 2
Historical Groundwater Data Review - 2008 Parametrix PQLs vs. MTCA Cleanup Levels
Yakima Mill Site

					Location	EVP-W		EVP-W		KILN1-W		KILN2-W		MW-1		MW-5		MW-6		MW-7		MW-7D		MW-8		MW-9A	
					Date	2/28/2008		2/28/2008		2/28/2008		2/28/2008		2/05/2008		2/07/2008		2/07/2008		2/06/2008		2/06/2008		2/06/2008		3/25/2008	
					Sample Type	N		FD		N		N		N		N		N		N		N		N		N	
					Result Type	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result
					Data Status	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource
.	Total or Dissolved	Units	Washington GW Method A	Washington GW Method B Cancer	Washington GW Method B Noncancer																						
Effective Date			07/01/2015	07/01/2015	07/01/2015																						
Exceedance Key			**Bold**	Shade	Border																						
Acetone	NA	ug/l			7200	DET	6.9	DET	6.4	--	--	--	--	5.0	ND	5.0	ND	5.0	ND	5.0	ND	5.0	ND	5.0	ND	5.0	ND
Acrylonitrile	NA	ug/l		0.0810	320	5.0	ND	5.0	ND	--	--	--	--	5.0	ND	5.0	ND	5.0	ND	5.0	ND	5.0	ND	5.0	ND	5.0	ND
Benzene	NA	ug/l	5.00	0.795	32.0	1.0	ND	1.0	ND	--	--	--	--	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND
Bromochloromethane	NA	ug/l				1.0	ND	1.0	ND	--	--	--	--	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	--	--
Bromodichloromethane	NA	ug/l		0.706	160	1.0	ND	1.0	ND	--	--	--	--	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND
Bromoform	NA	ug/l		5.54	160	1.0	ND	1.0	ND	--	--	--	--	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND
Bromomethane	NA	ug/l			11.2	1.0	ND	1.0	ND	--	--	--	--	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND
Carbon disulfide	NA	ug/l			800	1.0	ND	1.0	ND	--	--	--	--	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND
Carbon tetrachloride	NA	ug/l		0.625	32.0	1.0	ND	1.0	ND	--	--	--	--	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND
Chlorobenzene	NA	ug/l			160	1.0	ND	1.0	ND	--	--	--	--	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND
Chlorodibromomethane	NA	ug/l		0.521	160	1.0	ND	1.0	ND	--	--	--	--	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND
Chloroethane	NA	ug/l				1.0	ND	1.0	ND	--	--	--	--	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND
Chloroform	NA	ug/l		1.41	80.0	DET	4.9	DET	4.8	--	--	--	--	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	DET	3.3
Chloromethane	NA	ug/l				1.0	ND	1.0	ND	--	--	--	--	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND
Dibromomethane (methylene bromide)	NA	ug/l			80.0	1.0	ND	1.0	ND	--	--	--	--	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND
Ethyl benzene	NA	ug/l	700		800	1.0	ND	1.0	ND	--	--	--	--	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND
Iodomethane	NA	ug/l				1.0	ND	1.0	ND	--	--	--	--	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND
Methyl ethyl ketone (2-butanone)	NA	ug/l			4800	5.0	ND	5.0	ND	--	--	--	--	5.0	ND	5.0	ND	5.0	ND	5.0	ND	5.0	ND	5.0	ND	5.0	ND
Methyl isobutyl ketone (MIBK)	NA	ug/l			640	5.0	ND	5.0	ND	--	--	--	--	5.0	ND	5.0	ND	5.0	ND	5.0	ND	5.0	ND	5.0	ND	5.0	ND
Methylene chloride	NA	ug/l	5.00	21.9	48.0	2.0	ND	2.0	ND	--	--	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
Styrene	NA	ug/l			1600	1.0	ND	1.0	ND	--	--	--	--	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND
Tetrachloroethylene	NA	ug/l	5.00	20.8	48.0	1.0	ND	1.0	ND	--	--	--	--	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND
Toluene	NA	ug/l	1000		640	1.0	ND	1.0	ND	--	--	--	--	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND
Trichloroethylene (TCE)	NA	ug/l	5.00	0.540	4.00	1.0	ND	1.0	ND	--	--	--	--	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND
Trichlorofluoromethane (Freon-11)	NA	ug/l			2400	1.0	ND	1.0	ND	--	--	--	--	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND
Vinyl acetate	NA	ug/l			8000	5.0	ND	5.0	ND	--	--	--	--	5.0	ND	5.0	ND	5.0	ND	5.0	ND	5.0	ND	5.0	ND	5.0	ND
Vinyl chloride	NA	ug/l	**0.200**		24.0	**1.0**	ND	**1.0**	ND	--	--	--	--	0.020	ND	0.020	ND	0.020	ND	DET	0.06	DET	0.063	DET	0.034	**1.0**	ND
Xylene, m & p	NA	ug/l			1600	1.0	ND	1.0	ND	--	--	--	--	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND
Xylene, o	NA	ug/l			1600	1.0	ND	1.0	ND	--	--	--	--	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND
PCBs																											
Aroclor 1016	NA	ug/l		1.25	1.12	1.0	ND	1.0	ND	--	--	--	--	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND
Aroclor 1221	NA	ug/l				1.0	ND	1.0	ND	--	--	--	--	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND
Aroclor 1232	NA	ug/l				1.0	ND	1.0	ND	DET		--	--	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND
Aroclor 1242	NA	ug/l				1.0	ND	1.0	ND	--	--	--	--	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND
Aroclor 1248	NA	ug/l				1.0	ND	1.0	ND	--	--	--	--	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND
Aroclor 1254	NA	ug/l		0.0438	0.320	1.0	ND	1.0	ND	--	--	--	--	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND
Aroclor 1260	NA	ug/l		0.0438		1.0	ND	1.0	ND	--	--	--	--	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND
Total Petroleum Hydrocarbons																											
Benzene	NA	ug/l	5.00	0.795	32.0	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND
Ethyl benzene	NA	ug/l	700		800	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND
Toluene	NA	ug/l	1000		640	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND
Total Petroleum Hydrocarbons (as diesel)	NA	ug/l	500			DET	1300	DET	1300	DET	280	250	ND	250	ND	250	ND	250	ND	250	ND	250	ND	250	ND	250	ND
Total Petroleum Hydrocarbons (as gasoline)	NA	ug/l	800			250	ND	250	ND	250	ND	250	ND	250	ND	250	ND	250	ND	250	ND	250	ND	250	ND	250	ND
Total Petroleum Hydrocarbons (as motor oil)	NA	ug/l	500			DET	2100	DET	1800	DET	980	500	ND	500	ND	500	ND	500	ND	500	ND	500	ND	500	ND	500	ND
Xylene, m & p	NA	ug/l				1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND
Xylene, o	NA	ug/l			1600	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND

DET: Result is a detection, therefore no reporting detection limit is available.
J: Estimated concentration when the value is less than the ARI's established reporting limits.
N: Normal Sample.
FD: Field Duplicate Sample.
ND: Not detected.
PQL: Practical Quantitation Limit.
SSource: Laboratory and/or field data obtained from a secondary source external to Barr. Second source QA/QC evaluation procedures may or may not have been performed beyond the original data generator.

Table 2
Historical Groundwater Data Review - 2008 Parametrix PQLs vs. MTCA Cleanup Levels
Yakima Mill Site

					Location	**MW-10**		**REC-W**		**STL-W**	
					Date	**2/06/2008**		**2/28/2008**		**2/28/2008**	
					Sample Type	**N**		**N**		**N**	
					Result Type	**PQL**	**Result**	**PQL**	**Result**	**PQL**	**Result**
					Data Status	**SSource**	**SSource**	**SSource**	**SSource**	**SSource**	**SSource**
.	Total or Dissolved	Units	Washington GW Method A	Washington GW Method B Cancer	Washington GW Method B Noncancer						
Effective Date			07/01/2015	07/01/2015	07/01/2015						
Exceedance Key			**Bold**	Shade	Border						
General Parameters											
Alkalinity, bicarbonate, as CaCO3	NA	ug/l				DET	283000	--	--	--	--
Alkalinity, carbonate, as CaCO3	NA	ug/l				1000	ND	--	--	--	--
Alkalinity, hydroxide, as CaCO3	NA	ug/l				1000	ND	--	--	--	--
Alkalinity, total, as CaCO3	NA	ug/l				DET	283000	--	--	--	--
Carbon, total organic	NA	ug/l				DET	9170	--	--	--	--
Chloride	NA	ug/l				DET	14800	--	--	--	--
Nitrogen, ammonia, as N	NA	ug/l				DET	965	--	--	--	--
Nitrogen, nitrate + nitrite, as N	NA	ug/l				50	ND	--	--	--	--
Nitrogen, nitrate, as N	NA	ug/l			25600	50	ND	--	--	--	--
Nitrogen, nitrite, as N	NA	ug/l			1600	50	ND	--	--	--	--
pH	NA	pH units				DET	6.81	--	--	--	--
Solids, total dissolved	NA	ug/l				DET	361000	--	--	--	--
Sulfate, as SO4	NA	ug/l				DET	8900	--	--	--	--
Metals											
Arsenic	Dissolved	ug/l	**5.00**	0.0583	4.80	**50**	ND	**50**	ND	**50**	ND
Arsenic	Total	ug/l	**5.00**	0.0583	4.80	**50**	ND	**50**	ND	**50**	ND
Barium	Dissolved	ug/l			3200	DET	29	DET	31	DET	24
Barium	Total	ug/l			3200	DET	29	DET	99	DET	34
Cadmium	Dissolved	ug/l	5.00		8.00	2	ND	2	ND	2	ND
Cadmium	Total	ug/l	5.00		8.00	2	ND	2	ND	2	ND
Calcium	Dissolved	ug/l				DET	57400	DET	43500	DET	14800
Calcium	Total	ug/l				DET	57000	DET	47900	DET	14900
Chromium	Dissolved	ug/l	50.0			5	ND	5	ND	5	ND
Chromium	Total	ug/l	50.0			5	ND	DET	5	5	ND
Iron	Dissolved	ug/l			11200	DET	8340	DET	500	DET	2930
Iron	Total	ug/l			11200	DET	8840	DET	9150	DET	7950
Lead	Dissolved	ug/l	**15.0**			**20**	ND	**20**	ND	**20**	ND
Lead	Total	ug/l	**15.0**			**20**	ND	**20**	ND	**20**	ND
Manganese	Dissolved	ug/l			2240	DET	4890	DET	807	DET	581
Manganese	Total	ug/l			2240	DET	4790	DET	1080	DET	631
Mercury	Dissolved	ug/l	2.00			0.1	ND	0.1	ND	0.1	ND
Mercury	Total	ug/l	2.00			0.1	ND	0.1	ND	0.1	ND
Potassium	Dissolved	ug/l				DET	11500	DET	46400	DET	22200
Potassium	Total	ug/l				DET	11100	DET	47100	DET	22300
Selenium	Dissolved	ug/l			80.0	50	ND	50	ND	50	ND
Selenium	Total	ug/l			80.0	50	ND	50	ND	50	ND
Silver	Dissolved	ug/l			80.0	3	ND	3	ND	3	ND
Silver	Total	ug/l			80.0	3	ND	3	ND	3	ND
Sodium	Dissolved	ug/l				DET	26500	DET	33500	DET	29600
Sodium	Total	ug/l				DET	26100	DET	34100	DET	28600
SVOCs											
1,2,4-Trichlorobenzene	NA	ug/l		1.51	80.0	1.0	ND	--	--	--	--
1,2-Dichlorobenzene	NA	ug/l			720	1.0	ND	--	--	--	--
1,3-Dichlorobenzene	NA	ug/l				1.0	ND	--	--	--	--
1,4-Dichlorobenzene	NA	ug/l		8.10	560	1.0	ND	--	--	--	--
1-Methylnaphthalene	NA	ug/l		1.51	560	1.0	ND	--	--	--	--
2,2'-oxybis (1-chloropropane)	NA	ug/l		0.625	320	1.0	ND	--	--	--	--
2,4,5-Trichlorophenol	NA	ug/l			800	5.0	ND	--	--	--	--
2,4,6-Trichlorophenol	NA	ug/l		3.98	8.00	5.0	ND	--	--	--	--
2,4-Dichlorophenol	NA	ug/l			24.0	5.0	ND	--	--	--	--
2,4-Dimethylphenol	NA	ug/l			160	1.0	ND	--	--	--	--
2,4-Dinitrophenol	NA	ug/l			32.0	10	ND	--	--	--	--
2,4-Dinitrotoluene	NA	ug/l		0.282	32.0	5.0	ND	--	--	--	--
2,6-Dinitrotoluene	NA	ug/l		0.0583	4.80	5.0	ND	--	--	--	--
2-Chloronaphthalene	NA	ug/l			640	1.0	ND	--	--	--	--
2-Chlorophenol	NA	ug/l			40.0	1.0	ND	--	--	--	--
2-Methyl-4,6-dinitrophenol	NA	ug/l				10	ND	--	--	--	--
2-Methylnaphthalene	NA	ug/l			32.0	1.0	ND	--	--	--	--
2-Methylphenol (o-cresol)	NA	ug/l			400	1.0	ND	--	--	--	--
2-Nitroaniline	NA	ug/l			160	5.0	ND	--	--	--	--
2-Nitrophenol	NA	ug/l				5.0	ND	--	--	--	--
3,3`-Dichlorobenzidine	NA	ug/l		0.194		5.0	ND	--	--	--	--
3-Nitroaniline	NA	ug/l				5.0	ND	--	--	--	--
4-Bromophenyl phenyl ether	NA	ug/l				1.0	ND	--	--	--	--

Table 2
Historical Groundwater Data Review - 2008 Parametrix PQLs vs. MTCA Cleanup Levels
Yakima Mill Site

					Location	MW-10		REC-W		STL-W	
					Date	2/06/2008		2/28/2008		2/28/2008	
					Sample Type	N		N		N	
					Result Type	PQL	Result	PQL	Result	PQL	Result
					Data Status	SSource	SSource	SSource	SSource	SSource	SSource
.	Total or Dissolved	Units	Washington GW Method A	Washington GW Method B Cancer	Washington GW Method B Noncancer						
Effective Date			07/01/2015	07/01/2015	07/01/2015						
Exceedance Key			**Bold**	Shade	Border						
4-Chloro-3-methylphenol	NA	ug/l				5.0	ND	--	--	--	--
4-Chloroaniline	NA	ug/l		0.219	32.0	5.0	ND	--	--	--	--
4-Chlorophenyl phenyl ether	NA	ug/l				1.0	ND	--	--	--	--
4-Methylphenol (p-cresol)	NA	ug/l			800	1.0	ND	--	--	--	--
4-Nitroaniline	NA	ug/l				5.0	ND	--	--	--	--
4-Nitrophenol	NA	ug/l				5.0	ND	--	--	--	--
Acenaphthene	NA	ug/l			960	1.0	ND	--	--	--	--
Acenaphthylene	NA	ug/l				1.0	ND	--	--	--	--
Anthracene	NA	ug/l			4800	1.0	ND	--	--	--	--
Benz(a)anthracene	NA	ug/l		0.120		1.0	ND	--	--	--	--
Benzo(a)pyrene	NA	ug/l	**0.100**	0.0120		**1.0**	ND	--	--	--	--
Benzo(b)fluoranthene	NA	ug/l		0.120		1.0	ND	--	--	--	--
Benzo(g,h,i)perylene	NA	ug/l				1.0	ND	--	--	--	--
Benzo(k)fluoranthene	NA	ug/l		1.20		1.0	ND	--	--	--	--
Benzoic acid	NA	ug/l			64000	10	ND	--	--	--	--
Benzyl alcohol	NA	ug/l			800	5.0	ND	--	--	--	--
Bis(2-chloroethoxy)methane	NA	ug/l				1.0	ND	--	--	--	--
Bis(2-chloroethyl)ether	NA	ug/l		0.0398		1.0	ND	--	--	--	--
Bis(2-ethylhexyl)phthalate	NA	ug/l		6.25	320	1.0	ND	--	--	--	--
Butyl benzyl phthalate	NA	ug/l		46.1	3200	1.0	ND	--	--	--	--
Carbazole	NA	ug/l				1.0	ND	--	--	--	--
Chrysene	NA	ug/l		12.0		1.0	ND	--	--	--	--
Dibenz(a,h)anthracene	NA	ug/l		0.0120		1.0	ND	--	--	--	--
Dibenzofuran	NA	ug/l			16.0	1.0	ND	--	--	--	--
Diethyl phthalate	NA	ug/l			12800	1.0	ND	--	--	--	--
Dimethyl phthalate	NA	ug/l				1.0	ND	--	--	--	--
Di-n-butyl phthalate	NA	ug/l			1600	1.0	ND	--	--	--	--
Di-n-octyl phthalate	NA	ug/l			160	1.0	ND	--	--	--	--
Fluoranthene	NA	ug/l			640	1.0	ND	--	--	--	--
Fluorene	NA	ug/l			640	1.0	ND	--	--	--	--
Hexachlorobenzene	NA	ug/l		0.0547	12.8	1.0	ND	--	--	--	--
Hexachlorobutadiene	NA	ug/l		0.561	8.00	1.0	ND	--	--	--	--
Hexachlorocyclopentadiene	NA	ug/l			48.0	5.0	ND	--	--	--	--
Hexachloroethane	NA	ug/l		1.09	5.60	1.0	ND	--	--	--	--
Indeno(1,2,3-cd)pyrene	NA	ug/l		0.120		1.0	ND	--	--	--	--
Isophorone	NA	ug/l		46.1	1600	1.0	ND	--	--	--	--
Naphthalene	NA	ug/l	160		160	1.0	ND	--	--	--	--
Nitrobenzene	NA	ug/l			16.0	1.0	ND	--	--	--	--
n-Nitrosodi-n-propylamine	NA	ug/l		0.0125		5.0	ND	--	--	--	--
n-Nitrosodiphenylamine	NA	ug/l		17.9		1.0	ND	--	--	--	--
Pentachlorophenol	NA	ug/l		0.219	80.0	5.0	ND	--	--	--	--
Phenanthrene	NA	ug/l				1.0	ND	--	--	--	--
Phenol	NA	ug/l			2400	1.0	ND	--	--	--	--
Pyrene	NA	ug/l			480	1.0	ND	--	--	--	--
VOCs											
1,1,1,2-Tetrachloroethane	NA	ug/l		1.68	240	1.0	ND	--	--	--	--
1,1,1-Trichloroethane	NA	ug/l	200		16000	1.0	ND	--	--	--	--
1,1,2,2-Tetrachloroethane	NA	ug/l		0.219	160	1.0	ND	--	--	--	--
1,1,2-Trichloroethane	NA	ug/l		0.768	32.0	1.0	ND	--	--	--	--
1,1-Dichloroethane	NA	ug/l		7.68	1600	1.0	ND	--	--	--	--
1,1-Dichloroethylene	NA	ug/l			400	1.0	ND	--	--	--	--
1,2,3-Trichloropropane	NA	ug/l		0.00146	32.0	2.0	ND	--	--	--	--
1,2-Dibromo-3-chloropropane (DBCP)	NA	ug/l		0.0547	1.60	5.0	ND	--	--	--	--
1,2-Dibromoethane (EDB)	NA	ug/l	**0.0100**	0.0219	72.0	**1.0**	ND	--	--	--	--
1,2-Dichlorobenzene	NA	ug/l			720	1.0	ND	--	--	--	--
1,2-Dichloroethane	NA	ug/l	5.00	0.481	48.0	1.0	ND	--	--	--	--
1,2-Dichloroethylene, cis	NA	ug/l			16.0	1.0	ND	--	--	--	--
1,2-Dichloroethylene, trans	NA	ug/l			160	1.0	ND	--	--	--	--
1,2-Dichloropropane	NA	ug/l		1.22	720	1.0	ND	--	--	--	--
1,3-Dichloropropene, cis	NA	ug/l		0.438	240	1.0	ND	--	--	--	--
1,3-Dichloropropene, trans	NA	ug/l		0.438	240	1.0	ND	--	--	--	--
1,4-Dichloro-2-butene, trans	NA	ug/l				5.0	ND	--	--	--	--
1,4-Dichlorobenzene	NA	ug/l		8.10	560	1.0	ND	--	--	--	--
2-Chloroethyl vinyl ether	NA	ug/l				--	--	--	--	--	--
2-Hexanone	NA	ug/l				5.0	ND	--	--	--	--

11-06-2017

Table 2
Historical Groundwater Data Review - 2008 Parametrix PQLs vs. MTCA Cleanup Levels
Yakima Mill Site

					Location	MW-10		REC-W		STL-W	
					Date	2/06/2008		2/28/2008		2/28/2008	
					Sample Type	N		N		N	
					Result Type	PQL	Result	PQL	Result	PQL	Result
					Data Status	SSource	SSource	SSource	SSource	SSource	SSource
.	Total or Dissolved	Units	Washington GW Method A	Washington GW Method B Cancer	Washington GW Method B Noncancer						
Effective Date			07/01/2015	07/01/2015	07/01/2015						
Exceedance Key			**Bold**	Shade	Border						
Acetone	NA	ug/l			7200	5.0	ND	--	--	--	--
Acrylonitrile	NA	ug/l		0.0810	320	5.0	ND	--	--	--	--
Benzene	NA	ug/l	5.00	0.795	32.0	1.0	ND	--	--	--	--
Bromochloromethane	NA	ug/l				1.0	ND	--	--	--	--
Bromodichloromethane	NA	ug/l		0.706	160	1.0	ND	--	--	--	--
Bromoform	NA	ug/l		5.54	160	1.0	ND	--	--	--	--
Bromomethane	NA	ug/l			11.2	1.0	ND	--	--	--	--
Carbon disulfide	NA	ug/l			800	1.0	ND	--	--	--	--
Carbon tetrachloride	NA	ug/l		0.625	32.0	1.0	ND	--	--	--	--
Chlorobenzene	NA	ug/l			160	1.0	ND	--	--	--	--
Chlorodibromomethane	NA	ug/l		0.521	160	1.0	ND	--	--	--	--
Chloroethane	NA	ug/l				1.0	ND	--	--	--	--
Chloroform	NA	ug/l		1.41	80.0	1.0	ND	--	--	--	--
Chloromethane	NA	ug/l				1.0	ND	--	--	--	--
Dibromomethane (methylene bromide)	NA	ug/l			80.0	1.0	ND	--	--	--	--
Ethyl benzene	NA	ug/l	700		800	1.0	ND	--	--	--	--
Iodomethane	NA	ug/l				1.0	ND	--	--	--	--
Methyl ethyl ketone (2-butanone)	NA	ug/l			4800	5.0	ND	--	--	--	--
Methyl isobutyl ketone (MIBK)	NA	ug/l			640	5.0	ND	--	--	--	--
Methylene chloride	NA	ug/l	5.00	21.9	48.0	2.0	ND	--	--	--	--
Styrene	NA	ug/l			1600	1.0	ND	--	--	--	--
Tetrachloroethylene	NA	ug/l	5.00	20.8	48.0	1.0	ND	--	--	--	--
Toluene	NA	ug/l	1000		640	1.0	ND	--	--	--	--
Trichloroethylene (TCE)	NA	ug/l	5.00	0.540	4.00	1.0	ND	--	--	--	--
Trichlorofluoromethane (Freon-11)	NA	ug/l			2400	1.0	ND	--	--	--	--
Vinyl acetate	NA	ug/l			8000	5.0	ND	--	--	--	--
Vinyl chloride	NA	ug/l	**0.200**		24.0	0.020	ND	--	--	--	--
Xylene, m & p	NA	ug/l			1600	1.0	ND	--	--	--	--
Xylene, o	NA	ug/l			1600	1.0	ND	--	--	--	--
PCBs											
Aroclor 1016	NA	ug/l		1.25	1.12	1.0	ND	--	--	--	--
Aroclor 1221	NA	ug/l				1.0	ND	--	--	--	--
Aroclor 1232	NA	ug/l				1.0	ND	--	--	--	--
Aroclor 1242	NA	ug/l				1.0	ND	--	--	--	--
Aroclor 1248	NA	ug/l				1.0	ND	--	--	--	--
Aroclor 1254	NA	ug/l		0.0438	0.320	1.0	ND	--	--	--	--
Aroclor 1260	NA	ug/l		0.0438		1.0	ND	--	--	--	--
Total Petroleum Hydrocarbons											
Benzene	NA	ug/l	5.00	0.795	32.0	1.0	ND	1.0	ND	1.0	ND
Ethyl benzene	NA	ug/l	700		800	1.0	ND	1.0	ND	1.0	ND
Toluene	NA	ug/l	1000		640	1.0	ND	1.0	ND	DET	7.3
Total Petroleum Hydrocarbons (as diesel)	NA	ug/l	500			250	ND	DET	1400	DET	2600
Total Petroleum Hydrocarbons (as gasoline)	NA	ug/l	800			250	ND	250	ND	250	ND
Total Petroleum Hydrocarbons (as motor oil)	NA	ug/l	500			500	ND	DET	1100	DET	2300
Xylene, m & p	NA	ug/l				1.0	ND	1.0	ND	1.0	ND
Xylene, o	NA	ug/l			1600	1.0	ND	1.0	ND	1.0	ND

DET: Result is a detection, therefore no reporting detection limit is available.
J: Estimated concentration when the value is less than the ARI's established reporting limits.
N: Normal Sample.
FD: Field Duplicate Sample.
ND: Not detected.
PQL: Practical Quantitation Limit.
SSource: Laboratory and/or field data obtained from a secondary source external to Barr. Second source QA/QC evaluation procedures may or may not have been performed beyond the original data generator.

Attachment A

Data Quality Review of Laboratory Results – Parametrix September 2008 Draft Phase II ESA Report – Yakima Mill Site (prepared by: Marta Smith, Barr Engineering Co., Sept/Oct 2008)

This document summarizes a data quality review of the analytical data reports included in Appendix G of the September 2008 draft of the Parametrix Phase II report on the Yakima Mill Property. Appendix G contains the following ten ARI analytical reports: MI25, MK72, ML66, ML68, MM10, MK75, MT18, MY41, MY43, and MZ98.

In general, the data meet an acceptable level of QA/QC. Quality control samples including method or preparation blank samples, laboratory control samples (LCS) and LCSD (duplicates) and sample duplicates (for inorganics), were analyzed by the laboratory at the frequencies specified in the methods. While no acceptance criteria were provided in the reports for surrogate standards (organic analyses), LCS/MS recoveries and/or RPDs, most of the observed percent recoveries fall within expected ranges of 75-125% for LCS/MS with RPDs ~20% or less and 80-120% for surrogates for VOCs and ~30-150% for surrogates for SVOC. Matrix spikes (MS) and MSD (duplicates) appear to be performed at acceptable intervals except for one package with several water samples (MK72). This analytical event for the water samples did not have any MS/MSD samples to represent the matrix. Notable deviations in the MS/MSD sample recoveries/RPDs and general observations are discussed below. No field blank samples appear to have been collected or analyzed. Trip blanks were submitted and in all but one case were ND. The same is true for method blanks; in all but one case, the method blank samples were ND. Neither of the detectable concentrations in the corresponding blanks indicates a gross systematic contamination issue. Except in one case, all samples were extracted, prepared and analyzed within the recommended EPA holding times. The laboratory reports are in good shape.

There are a few issues that should be noted:

- For laboratory package MI25, no results were found for groundwater samples MW-7, MW-7D and MW-8. Additionally, Appendix G only contains data through May 2008, while the report indicates that an additional set of groundwater samples were collected from well MW-7, -8 in August 2008.
- The arsenic reporting limit for water was 50 ug/L, which is fairly high considering the MCL of 10 ug/L was used as a screening criterion.
- Random hits of common laboratory contaminants such as bis(2-ethyl)hexyl phthalate and acetone, but ND in all associated method blanks (method blank had small conc. of methylene chloride, trip blank had small concentration of acetone).
- For the metals samples reported in package MK72, the sample noted to be a MB has the lab sample number of a field sample. The field sample is then reported a few pages later with the same lab sample number but with concentrations of metals more consistent with expected concentrations.
- The PID chromatograms were not provided for the BTEX/Gas analyses in packages ML66 and ML68. This is mentioned because the laboratory appears to be quantitating BTEX concentrations from this detector and quantitating gasoline range organics from the FID – but BTEX should be present on both detectors and it sometimes was not. For example: the Fly Ash (ML66) sample had a reported benzene concentration of 160 ug/kg, but a benzene peak was not observed in the chromatograms from the FID that were provided. This sample was re-analyzed due to low surrogate recoveries of 63.5% and 34.0%. The re-analyzed sample had benzene results of <72 ug/kg, however surrogate recoveries were <9% and this data should not be considered usable. A similar

situation occurred in the SVOC analyses, with several of the surrogate recoveries below established acceptance criteria and upon re-analysis, do not improve significantly. In summary, the fly ash sample results for BTEX/Gas as well as SVOCs and PCBs should be qualified as estimated due to the failure of surrogate standard recoveries (in one case for SVOCs, the surrogate standard recovery was 0%) and the PID chromatograms should be obtained and reviewed if this data becomes important..

- For the VOC results in ML66 and ML68, the narrative indicates that the area counts of the internal standards (IS) and surrogate standard recoveries were not within control limits. In one case (SS-1-2) the IS area counts are stated to not have improved during reanalysis. In these cases, is may be important to ascertain the degree of failure. For samples with low IS area counts, non-detect data may not be valid. In general however, all reanalysis data should be reported.

- For the MS/MSD sample (sample SS-1-2 in ML66), compounds failing MS/MSD criteria should be qualified in the field samples, as matrix effects were clearly displayed.

- For package MM10, poor correlation was noted between toluene concentrations quantitated from the BTEX/Gas and VOC analyses in sample SS-5-2. The VOC toluene was 11 ug/kg and BTEX toluene was 190 ug/kg.

- For packages MM10 and MK75, an unidentified peak is present in both the FID and PID chromatograms at approximately 12.1 minutes. This may be xylenes.

- In package MK75, again the narrative indicates IS failures, this time for the SVOC fraction. However, the VOCs were also re-analyzed. The laboratory should discuss the reason for the VOC reanalysis to help determine which data should be reported. In general however, all reanalyses data should be reported.

- Sample TP-10-8 (package MK75) for VOC was reanalyzed. The initial toluene result was 4.6 ug/L and the reanalysis result was 500 ug/kg. It may be that the dilution factor was not correctly applied to this result but this should be confirmed. Additionally, the toluene on the BTEX/Gas analysis was 430 ug/kg for this sample.

- Sample TP-12D-13 (package MK75) is apparently the duplicate of TP-12-13. Poor qualitative correlation is seen in the BTEX/Gas analysis with o- and p-xylene detected in the original sample and only toluene detected in the duplicate sample. Gasoline range organic results of 260 ug/kg and 320 ug/kg, respectively meet an approximate 20% RPD.

- Samples TP-13-8 and TP-8-12.5 (MK75) again have an unidentified peak at approximately 12.1 minutes in the BTEX/Gas analyses.

- The SVOC MS/MSD for sample TP-8-2 (MK75) displays matrix effects with generally low percent recoveries ~50-65%; but in some cases percent recoveries were <10% and RPDs >50%. Data from the field sample should be qualified as estimated for these compounds.

One PCB sample in Package MZ98 was extracted beyond the EPA recommended holding time. While this may not greatly impact the usability of the results, it should be qualified accordingly.

BARR

Standard Operating Procedure

Routine Level General Chemistry Data Evaluation

Revision 6

January 8, 2016

Approved By:

James Taraldsen — James Taraldsen — 01/08/16
Print — Technical Reviewer — Signature — Date

Terri Olson — Terri A. Olson — 01/08/16
Print — QA Manager — Signature — Date

Review of the SOP has been performed and the SOP still reflects current practice.

Initials: ______________ Date: ______________
Initials: ______________ Date: ______________
Initials: ______________ Date: ______________
Initials: ______________ Date: ______________

Minneapolis, MN ● Hibbing, MN ● Duluth, MN ● Ann Arbor, MI ● Jefferson City, MO ● Bismarck, ND ● Calgary, AB, Canada ● Grand Rapids, MI ● Salt Lake City, UT

Routine Level General Chemistry Data Evaluation

1.0 Scope and Applicability

This SOP is intended as a guidance document for the routine level evaluation of general chemistry data provided by laboratories to be used in Barr Engineering Company (Barr) projects.

This SOP is based on the recommendations of the associated approved analytical methods from USEPA, ASTM, and *Standard Methods for the Examination of Water and Wastewate*r and applies to routine general chemistry data evaluation including a variety of approved methods not limited to the following parameters:

Alkalinity as $CaCO_3$
Ammonia, total (NH_3 + NH_4^-)
Biological Oxygen Demand (BOD)
Chemical Oxygen Demand (COD)
Chloride
Chromium VI (Hexavalent Chromium)
Conductance, Specific – *in lab*
Cyanide (as CN^-)
Fluoride
Hardness
Oil and Grease (as HEM)
Nitrate (or Nitrite) only
Nitrate + Nitrite
pH – *in lab*
Phosphorus, total
Sulfate
Sulfide
Total Dissolved Solids (TDS)
Total Kjeldahl Nitrogen (TKN)
Total Organic Carbon (TOC)
Total Suspended Solids (TSS)

In the case of specific parameters not listed above, the guidelines within this document will provide the basis upon which to make adequate professional judgment in the evaluation of data submitted for review.

The recommended procedures in this SOP should be followed unless conditions make it impractical or inappropriate to do so. Modifications should be noted in the applicable documentation and communicated to appropriate personnel. Significant changes may result in a revision or newly created SOP.

2.0 Limitations

- Level IV data evaluation is not covered in this SOP and should be performed in accordance with project specific requirements.

3.0 Responsibilities

The laboratory is responsible for generating data from the samples submitted for analysis. In instances where QC criteria are not met for the analysis of samples, the laboratory is responsible for reanalysis of the samples, provided reanalysis is possible (considering matrix interference, holding times and sample volume, etc.), or documenting the impact to the data.

The Data Quality Specialist is responsible for evaluating the data in accordance with this document, in addition to using professional judgment where necessary or appropriate. Project specific requirements, such as those specified in a Quality Assurance Project Plan (QAPP) or Sampling and Analysis Plan (SAP), may differ from these recommendations and professional judgment should be applied before qualifying any data.

4.0 Procedure

The Quality Assurance/Quality Control (QA/QC) data detailed below are the most typical found in a routine level laboratory report. Other QA/QC data may be provided by the laboratory within the laboratory report case narrative, data qualifiers, or cover sheet and should be evaluated using professional judgment (e.g., initial calibration, calibration verification, internal standards, post digestion, serial dilution).

Definitions to common QA/QC terms and terms used within this SOP along with a list of Barr 'Data Qualifiers/Footnotes' that may be applied during review can be found in Barr's "Compendium of Data Quality Assessment Documentation".

4.1 Holding Time and Preservation

The purpose of holding time and preservation evaluation is to ascertain the validity of the analytical results based on the sample condition, preservation, and time elapsed between the date of sample collection and date of analysis.

40 CFR Part 136 and the *Test Methods for Evaluating Solid Waste (SW-846)* are used as guidance for the recommended holding time and preservation acceptance criteria listed in *Table 1*.

Table 1 - Recommended Holding Times and Preservation

Parameter *(Alternate Name)*	**Recommended Hold Time**						**Preservation**					
	24 Hour	48 Hour	7 Day	14 Day	28 Day	180 Day	Ice Only (< 6 °C)	HCl	HNO_3	H_2SO_4	NaOH	ZnAc + NaOH
Alkalinity, as $CaCO_3$				X			X					
Ammonia as N					X		X			X		
Biochemical Oxygen Demand *(BOD)*		X					X					
Chemical Oxygen Demand *(COD)*					X		X			X		
Chloride					X		X					
Chromium, hexavalent	X				a		X					
Conductance, specific - in lab					X		X					
Cyanide				X			X				X	
Dissolved Organic Carbon *(DOC)*					X		X	X[c]		X[c]		
Fluoride					X		X					
Hardness						X			X[c]	X[c]		

(Table 1 continued on next page)

Table 1 - Recommended Holding Times and Preservation

Parameter *(Alternate Name)*	Recommended Hold Time						Preservation					
	24 Hour	48 Hour	7 Day	14 Day	28 Day	180 Day	Ice Only (< 6 °C)	HCl	HNO_3	H_2SO_4	NaOH	ZnAc + NaOH
Nitrate or Nitrite		X					X					
Nitrate + Nitrite as N					X		X			X		
Oil & Grease, HEM					X		X	X[c]		X[c]		
pH[b] - in lab			X				X					
Phosphorus, total					X		X			X		
Sulfate					X		X					
Sulfide			X				X					X
Total Dissolved Solids *(TDS)*			X				X					
Total Kjeldahl Nitrogen *(TKN)*					X		X			X		
Total Organic Carbon *(TOC)*					X		X	X[c]		X[c]		
Total Suspended Solids *(TSS)*			X				X					

a = Per 40 CFR Part 136.3, a 28-day holding time may be achieved if the ammonium sulfate buffer solution specified in EPA Method 218.6 is used. This footnote supersedes preservation and holding time requirements in approved hexavalent chromium methods, unless this would compromise the measurement and then the method must be followed.
b = Method recommends pH should be measured in the field.; however, for confirmation measurements in the laboratory, a maximum holding time of 7 days from sample collection will be used as a guideline for qualification.
c = Either preservative may be used ($pH < 2$) - for hardness, HNO_3 only if calculated from Ca and Mg.

If samples do not meet holding time, preservation and analysis recommendations in *Table 1*, consider qualification with an "**h**". Other matrices, such as product samples (e.g. oil, waste rock, drill cores) may not be subjected to the same holding time recommendations.

If the sample was stored on ice upon collection and delivered to the laboratory the same day, the sample may exceed recommended temperature at the time of laboratory receipt. Professional judgment should be applied (considering temperature, matrix, magnitude of the exceedance, etc.) when evaluating the application of qualifiers when criteria are not met.

4.2 Blank Samples

Blank sample evaluation is conducted to determine the existence and magnitude of target analyte contamination as a result of activities in the field during collection and transport or from inter-laboratory sources.

- While not required for all methods, method blanks are recommended for all but the pH analysis. Evaluation pertains to the batch of samples analyzed with the method blank.
- Field or equipment blank collection and analysis frequency is project specific. Evaluation pertains to the field samples associated with the field or equipment blank.
- Blank analyses may not have involved the same weights, volumes, or dilution factors as the associated samples. It may be easier to work with the raw data and/or convert the data to the same units for comparison purposes.

Table 2 – Guidelines for Blank Contamination

Sample Result	Recommended Action for Associated Data
Non-detect	No action required
< 5x blank concentration	Qualify with ‘b’
≥ 5x blank concentration	Use professional judgment

b = Reported value may be a potential false positive based on blank data evaluation procedures

Note: Other multipliers of the blank contamination may be used based on professional judgment (reporting to the MDL, common lab contaminant, etc.)

Professional judgment regarding the usability of the data should be used in cases where gross detections of target analytes are found in the blank sample. A number of factors may be considered including historical data, prior knowledge of the site conditions, target analytes involved, type of blank sample, etc. In such cases, it may be appropriate to qualify the affected data with ‘*****’ (estimated value, QA/QC criteria not met) or ‘******’ (unusable value, QA/QC criteria not met).

4.3 Laboratory Control Samples (LCS) and Laboratory Control Sample Duplicate Samples (LCSD)

The laboratory control sample is used to monitor the overall performance of each step during analysis, including sample preparation. The LCS should be analyzed:

- Once every preparation batch (typically 20 or less samples of the same matrix).
- Once for each matrix.

Laboratory control samples contain a known amount of each target compound and the percent recoveries are evaluated based on the criteria within the laboratory report or project specific requirements. Percent recoveries are calculated for accuracy and the relative percent difference (RPD) is calculated for precision (when an LCSD was analyzed). Accuracy and precision equations can be found in ‘Definitions’ from Barr’s “Compendium of Data Quality Assessment Documentation”.

Table 3 – Guidelines for Laboratory Control Samples

Criteria	Recommended Action for Associated Data	
	Detect	Non-Detect
%R and RPD > Upper Limit	Qualify with ‘*’	No qualification
%R < Lower Limit	Qualify with ‘*’ or ‘**’, use professional judgment	
%R and RPD within Limits	No qualification	

* = Reported value is estimated and QA/QC criteria were not met
** = Reported value is unusable and QA/QC criteria were not met

4.4 Laboratory Duplicate Samples

Laboratory duplicate samples are separate aliquots of field samples analyzed to demonstrate acceptable method precision by the laboratory at the time of analysis. Field blanks and proficiency testing (PT) samples should not be used for duplicate analysis. The RPDs are calculated using the equation as provided in 'Definitions' from Barr's "Compendium of Data Quality Assessment Documentation" and are not calculated where data are already qualified with b, U, <, or **. RPD results are dependent on the homogeneity of the samples.

Duplicates should be analyzed (whichever is more frequent):

- One from each matrix (soil or water)
- One from each SDG

The MS/MSD duplicate pairs may be substituted for laboratory duplicates.

Laboratory acceptance criteria or project specific requirement are used to evaluate RPDs. If criteria are not available, use professional judgment when considering qualification of associated results.

Higher RPDs are expected when results are at or near the reporting limits and are not always indicative of poor precision. RPDs are typically only evaluated for samples where both the native and duplicate sample concentrations are greater than five times (>5x) the RL. In cases where either of the samples (native or duplicate) is non-detect for a parameter and the other corresponding sample has detectable concentrations much greater than five times (>5x) the RL, professional judgment should be used to determine if qualification is appropriate.

Table 4 – Guidelines for Laboratory Duplicates

% RPD	**Recommended Action for Associated Data**
RPD < Upper Limit	No action is required
RPD > Upper Limit	Both results are ≤ 5x RL, no action is required
RPD > Upper Limit	Both results are > 5x RL, consider qualifying with '*****'

* = Reported value is estimated and QA/QC criteria were not met

4.5 Field Duplicate Samples

Field duplicate samples (also known as "masked" or "blind" duplicate samples) are used to demonstrate acceptable precision and reproducibility of the field and laboratory procedures. Frequency of collection is project specific. The RPDs are calculated using the equation as provided under precision in 'Definitions' from Barr's "Compendium of Data Quality Assessment Documentation" and are not calculated where data is already qualified with b, U, <, or **. RPD results are dependent on the homogeneity of the samples.

Acceptance criteria for field duplicate samples are subject to the professional judgment of the Data Quality Specialist but typically RPDs ≤ 30% for aqueous samples and ≤ 40% for soil and sediment samples are considered acceptable unless other project specific requirements are defined.

Higher RPDs are expected when results are at or near the reporting limits and are not always indicative of poor precision. RPDs are typically only evaluated for samples where both the native and duplicate sample

concentrations are greater than five times (>5x) the RL. In cases where either of the samples (native or field duplicate) is non-detect for a parameter and the other corresponding sample has detectable concentrations much greater than five times (>5x) the RL, professional judgment should be used to determine if qualification is appropriate.

4.6 Matrix Spikes (MS) and Matrix Spike Duplicate (MSD) Samples

Matrix spike samples contain a known amount of a target compound and provide information about the effect of each samples' matrix on the sample preparation procedures and analytical results. Matrix spikes are typically analyzed at the following frequencies:

- 1 (MS/MSD pair) in every 20 samples
- 1 per preparation batch per matrix
- 1 per SDG

However, the frequency may be project specific and the documents outlining the needs of the project (SAP, QAPP, etc.) should be reviewed. In some cases, MS/MSD analysis is not required.

The percent recoveries are evaluated based on the criteria within the laboratory report or project specific requirements. If a matrix spike recovery does not meet acceptance criteria and is not associated with a project sample, no further action is required unless other systematic evidence warrants qualification.

If the native concentration of a spiked sample is significantly greater than the spike added (>4x), spike recovery cannot be accurately evaluated, therefore the criteria do not apply. Professional judgment should be used for percent recoveries nominally outside laboratory acceptance criteria prior to qualifying data.

If criteria are not available, use guidance found in the NFG. Percent recoveries of matrix spike (and matrix spike duplicate) samples should be calculated using the equation provided under accuracy in 'Definitions' from Barr's "Compendium of Data Quality Assessment Documentation".

Solid samples may have highly variable concentrations of target analytes and percent recoveries (%R) may be influenced by the sampling precision and inherent sample homogeneity. Professional judgment should be used for difficult matrices and the acceptance criteria adjusted accordingly.

Table 5 – Guidelines for Matrix Spikes

Criteria	Recommended Action for Associated Data	
	Detect	Non-Detect
%R and RPD > Upper Limit	Qualify with '*'	No qualification
%R < Lower Limit	Qualify with '*' or '**', use professional judgment	
%R and RPD within Limits	No qualification	

* = Reported value is estimated and QA/QC criteria were not met
** = Reported value is unusable and QA/QC criteria were not met

While matrix spike duplicates are not required by all methods, if results for MSD analyses are reported, evaluate the RPD for MS and MSD pairs using the equation as provided under precision in 'Definitions' from Barr's "Compendium of Data Quality Assessment Documentation".

4.7 Overall Assessment

The chain-of-custody should be reviewed to determine if the laboratory report matches the requested analyses and that project specific parameters were analyzed as requested. The narrative and other supporting documentation should be evaluated to ensure that sample condition was appropriately documented by the laboratory upon receipt. If available, historical data should be used to assist with data evaluation. Any additional anomalies should be documented and evaluated, if necessary.

5.0 Quality Control and Quality Assurance (QA/QC)

Depending on the project objectives, the data review may include the completion of a Routine Level Quality Control Report (see Barr's "Compendium of Data Quality Assessment Documentation") as part of the evaluation process. Within each QC data section, the reviewer should include references to whether the QC data met or exceeded the acceptance criteria. The qualifiers, added, removed, or retained, should be documented also. Where multiple qualifiers may be applicable to a sample/analyte result, professional judgment should be used to determine if all qualifiers are necessary or if one qualifier would be sufficient to represent the deviations. A statement as to whether the data are acceptable as reported or acceptable with qualification(s) should also be included. If revised reports are required and the revision affects the sample results, notification should be given to the appropriate data management personnel and/or project team members.

The Data Quality Specialist will verify that the qualifiers associated with data tables match the Routine Level Quality Control Report.

6.0 Records

The Routine Level Quality Control Report should be saved to the appropriate internal Barr file and the link uploaded to the tracking system. Periodically, Data Quality staff should check for missing Routine Level Quality Control Reports in the tracking system to help maintain the most current information.

Documentation specific to this SOP are listed below and are available in Barr's "Compendium of Data Quality Assessment Documentation".

- Definitions
- Barr Qualifiers/Footnotes
- Routine Level Quality Control Report

Additional records information can be found in Barr's "Records Management System Manual".

7.0 References

Environmental Protection Agency. *Title 40 of the Code of Federal Regulations, Part 136.3.*

Environmental Protection Agency, *National Functional Guidelines for Inorganic Superfund Data Review.*

Analytical methods listed under the 'Scope and Applicability' section of this SOP.

Attachment 1

Revision History

Revision Number	Date of Revision	Section	Revision Made
3.1	02/2009	Document Wide	Edits to references, formatting; minor language additions and corrections;
		IX	Changed to Section X
		Attachments	Added Attachment 3
		IX (new)	Added Table 9.
3.2	04/2011	Document Wide	Added missing analytical method references.
		Attachments	Updated Attachments to current forms.
3.3	04/2011	References	Update the reference to the current NFG Metals data validation document.
4.0	04/06/12	Document Wide	Major revision
5.0	06/17/13	Cover page	Added Calgary office
		Applicability	Added US to EPA reference
		I	Added waste rock and drill cores to examples of product sample
		III	Added LCSD information
		III, IV, V, VI	Added 'project specific requirements' as possible criteria source
		V	Added 'field and laboratory procedures' to clarify that it's not only a laboratory item
		V	Clarified field duplicate criteria as < one value and not a range
		VIII	Added statement regarding multiple qualifiers
6.0	01/07/16	Document Wide	SOP restructuring, new format

BARR

Standard Operating Procedure

Routine Level Metals Data Evaluation

Revision 6

January 7, 2016

Approved By:

Michael Dupay 01/07/16
Print Technical Reviewer Signature Date

Terri Olson Terri A. Olson 01/07/16
Print QA Manager Signature Date

Review of the SOP has been performed and the SOP still reflects current practice.

Initials: ____________ Date: ____________
Initials: ____________ Date: ____________
Initials: ____________ Date: ____________
Initials: ____________ Date: ____________

Routine Level Metals Data Evaluation

1.0 Scope and Applicability

This SOP is intended as a guidance document for the routine level evaluation of metals data provided by laboratories to be used in Barr Engineering Company (Barr) projects.

This SOP is based on quality assurance elements, not the specific criteria, of *USEPA Contract Laboratory Program National Functional Guidelines (NFG) for Inorganic Data* and applies to routine metals data evaluation for analyses by the following technologies:

- Inductively Coupled Plasma/Atomic Emission Spectroscopy (ICP/AES)
  - Method examples: EPA 200.7, EPA 6010
- Inductively Coupled Plasma/Mass Spectrometry (ICP/MS)
  - Method examples: EPA 200.8, EPA 6020
- Cold Vapor Atomic Absorption (CVAA)
  - Method examples: EPA 245.1, EPA 7470, EPA 7471, SM 3112 B
- Cold Vapor Atomic Fluorescence Spectrometry (CVAF)
  - Method examples: EPA 245.7, EPA 1631 (low-level mercury), EPA 7474
- Thermal Decomposition / Atomic Absorption Spectrophotometer
  - EPA 7473
- Graphite Furnace Atomic Absorption (GFAA)
  - Method examples: EPA 7010, SM 3113 B
- Methods above in conjunction with Toxicity Characteristic Leachate Procedure (TCLP), EPA 1311
- Methods above in conjunction with Synthetic Precipitation Leachate Procedure (SPLP), EPA 1312

In the case of specific technologies and/or methods not listed above, the guidelines within this document will provide the basis upon which to make adequate professional judgment in the evaluation of data submitted for review.

The recommended procedures in this SOP should be followed unless conditions make it impractical or inappropriate to do so. Modifications should be noted in the applicable documentation and communicated to appropriate personnel. Significant changes may result in a revision or newly created SOP.

2.0 Limitations

- Level IV data evaluation is not covered in this SOP and should be performed in accordance with NFG or project specific requirements.

3.0 Responsibilities

The laboratory is responsible for generating data from the samples submitted for analysis. In instances where QC criteria are not met for the analysis of samples, the laboratory is responsible for reanalysis of the samples, provided reanalysis is possible (considering matrix interference, holding times and sample volume, etc.), or documenting the impact to the data.

The Data Quality Specialist is responsible for evaluating the data in accordance with this document, in addition to using professional judgment where necessary or appropriate. Project specific requirements, such as those specified in a Quality Assurance Project Plan (QAPP) or Sampling and Analysis Plan (SAP), may differ from these recommendations and professional judgment should be applied before qualifying any data.

4.0 Procedure

The Quality Assurance/Quality Control (QA/QC) data detailed below are the most typical found in a routine level laboratory report. Other QA/QC data may be provided by the laboratory within the laboratory report case narrative, data qualifiers, or cover sheet and should be evaluated using professional judgment (e.g., initial calibration, calibration verification, internal standards, post digestion, serial dilution).

Definitions to common QA/QC terms and terms used within this SOP along with a list of Barr 'Data Qualifiers/Footnotes' that may be applied during review can be found in Barr's "Compendium of Data Quality Assessment Documentation".

4.1 Holding Time and Preservation

The purpose of holding time and preservation evaluation is to ascertain the validity of the analytical results based on the sample condition, preservation, and time elapsed between the date of sample collection and date of analysis.

40 CFR Part 136 and the *Test Methods for Evaluating Solid Waste (SW-846)* are used as guidance for the recommended holding time and preservation acceptance criteria listed in *Table 1*.

Table 1 – Recommended Holding Times and Preservation

Compound	Matrix	Temp.	Preservative	Maximum Holding Time
Mercury	Aqueous	--	HNO_3 < 2 pH	28 days
	Aqueous (low level)	--	Pre-tested hydrochloric acid or bromine chloride	48 hours preserve or analyze if not oxidized in sample bottle/28 days preserve if oxidized in sample bottle 90 days analysis (from collection) if preserved
	Sediment/Soil	Cool, ≤ 6 °C	Ice	28 days
	Wipe/Air	--	NA	28 days

(Table 1 continued on next page)

Table 1 – Recommended Holding Times and Preservation

Compound	Matrix	Temp.	Preservative	Maximum Holding Time
Mercury	TCLP	--	NA	28 days TCLP Extraction/ 28 days analysis
All other metals	Aqueous	--	HNO_3 < 2 pH	180 days
	Sediment/Soil	Cool, ≤ 6 °C	Ice	180 days
	Wipe/Air	--	NA	180 days
	TCLP	--	NA	180 days TCLP Extraction/ 180 days analysis

Note: When analyzing boron or silica, do not collect samples in borosilicate glass bottles.

If samples do not meet holding time, preservation and analysis recommendations in *Table 1*, consider qualification with an "**h**". Other matrices, such as product samples (e.g. oil, waste rock, drill cores) may not be subjected to the same holding time recommendations.

If the sample was stored on ice upon collection and delivered to the laboratory the same day, the sample may exceed recommended temperature at the time of laboratory receipt. Professional judgment should be applied (considering temperature, matrix, magnitude of the exceedance, etc.) when evaluating the application of qualifiers when criteria are not met.

Special considerations for low-level mercury

Low-level mercury must be collected directly into a specially cleaned, pretested, fluoropolymer or glass bottle using sample handling techniques specially designed for collection of mercury at trace levels and preserved with pre-tested hydrochloric acid (required for methyl mercury) or bromine chloride. Samples not collected in the correct type of container may be qualified with an "**h**". These samples may be shipped unpreserved provided:

- Sample is collected in a fluoropolymer or glass bottle.
- Bottle contains no headspace and is capped tightly.
- Sample temperature was maintained at ≤ 6 °C.
- Samples are preserved or analyzed within 48 hours or oxidized in the bottle within 28 days.

4.2 Blank Samples

Blank sample evaluation is conducted to determine the existence and magnitude of target analyte contamination as a result of activities in the field during collection and transport or from inter-laboratory sources.

- For each matrix, at least one method blank should be prepared and analyzed with each sample delivery group (SDG), or each batch digested (whichever is more frequent). Evaluation pertains to the batch of samples analyzed with the method blank.
- Field or equipment blank collection and analysis frequency is project specific. Evaluation pertains to the field samples associated with the field or equipment, blank.

- Blank analyses may not have involved the same weights, volumes, or dilution factors as the associated samples. It may be easier to work with the raw data and/or convert the data to the same units for comparison purposes.
- Low-level mercury method requires *at least* three method blanks per run per analytical batch.

Table 2 – Guidelines for Blank Contamination

Sample Result	Recommended Action for Associated Data
Non-detect	No action required
< 5x blank concentration	Qualify with 'b'
≥ 5x blank concentration	Use professional judgment

b = Reported value may be a potential false positive based on blank data evaluation procedures

Note: Other multipliers of the blank contamination may be used based on professional judgment (reporting to the MDL, common lab contaminant, etc.)

Professional judgment regarding the usability of the data should be used in cases where gross detections of target analytes are found in the blank sample. A number of factors may be considered including historical data, prior knowledge of the site conditions, target analytes involved, type of blank sample, etc. In such cases, it may be appropriate to qualify the affected data with '*****' (estimated value, QA/QC criteria not met) or '******' (unusable value, QA/QC criteria not met).

4.3 Laboratory Control Samples (LCS) and Laboratory Control Sample Duplicate Samples (LCSD)

The laboratory control sample is used to monitor the overall performance of each step during analysis, including sample preparation. The LCS should be analyzed:

- Once every preparation batch (typically 20 or less samples of the same matrix).
- Once for each matrix.
- For low-level mercury, ongoing precision and recovery (OPR) samples are run before and after each analytical batch - quality control samples (QCS) should be from a different source and analyzed once per analytical batch.

Laboratory control samples contain a known amount of each target compound and the percent recoveries are evaluated based on the criteria within the laboratory report or project specific requirements. If criteria are not available, use guidance found in the NFG. Percent recoveries are calculated for accuracy and the relative percent difference (RPD) is calculated for precision (when an LCSD was analyzed). Accuracy and precision equations can be found in 'Definitions' from Barr's "Compendium of Data Quality Assessment Documentation".

Table 3 – Guidelines for Laboratory Control Samples		
Criteria	**Recommended Action for Associated Data**	
	Detect	**Non-Detect**
%R and RPD > Upper Limit	Qualify with '*'	No qualification
%R < Lower Limit	Qualify with '*' or '**', use professional judgment	
%R and RPD within Limits	No qualification	

* = Reported value is estimated and QA/QC criteria were not met
** = Reported value is unusable and QA/QC criteria were not met

4.4 Laboratory Duplicate Samples

Laboratory duplicate samples are separate aliquots of field samples analyzed to demonstrate acceptable method precision by the laboratory at the time of analysis. Field blanks and proficiency testing (PT) samples should not be used for duplicate analysis. The RPDs are calculated using the equation as provided in 'Definitions' from Barr's "Compendium of Data Quality Assessment Documentation" and are not calculated where data are already qualified with b, U, <, or **. RPD results are dependent on the homogeneity of the samples.

Duplicates should be analyzed (whichever is more frequent):

- One from each matrix (soil or water)
- One from each SDG

The MS/MSD duplicate pairs may be substituted for laboratory duplicates.

Laboratory acceptance criteria or project specific requirement are used to evaluate RPDs. If criteria are not available, use guidance found in NFG or use professional judgment when considering qualification of associated results.

Higher RPDs are expected when results are at or near the reporting limits and are not always indicative of poor precision. RPDs are typically only evaluated for samples where both the native and duplicate sample concentrations are greater than five times (>5x) the RL. In cases where either of the samples (native or duplicate) is non-detect for a parameter and the other corresponding sample has detectable concentrations much greater than five times (>5x) the RL, professional judgment should be used to determine if qualification is appropriate.

Table 4 – Guidelines for Laboratory Duplicates	
% RPD	**Recommended Action for Associated Data**
RPD < Upper Limit	No action is required
RPD > Upper Limit	Both results are ≤ 5x RL, no action is required
RPD > Upper Limit	Both results are > 5x RL, consider qualifying with '*'

* = Reported value is estimated and QA/QC criteria were not met

4.5 Field Duplicate Samples

Field duplicate samples (also known as “masked” or “blind” duplicate samples) are used to demonstrate acceptable precision and reproducibility of the field and laboratory procedures. Frequency of collection is project specific. The RPDs are calculated using the equation as provided under precision in ‘Definitions’ from Barr’s “Compendium of Data Quality Assessment Documentation” and are not calculated where data is already qualified with b, U, <, or **. RPD results are dependent on the homogeneity of the samples.

Acceptance criteria for field duplicate samples are subject to the professional judgment of the Data Quality Specialist but typically RPDs ≤ 30% for aqueous samples and ≤ 40% for soil and sediment samples are considered acceptable unless other project specific requirements are defined.

Higher RPDs are expected when results are at or near the reporting limits and are not always indicative of poor precision. RPDs are typically only evaluated for samples where both the native and duplicate sample concentrations are greater than five times (>5x) the RL. In cases where either of the samples (native or field duplicate) is non-detect for a parameter and the other corresponding sample has detectable concentrations much greater than five times (>5x) the RL, professional judgment should be used to determine if qualification is appropriate.

4.6 Matrix Spikes (MS) and Matrix Spike Duplicate (MSD) Samples

Matrix spike samples contain a known amount of a target compound and provide information about the effect of each samples’ matrix on the sample preparation procedures and analytical results. Matrix spikes are typically analyzed at the following frequencies:

- 1 (MS/MSD pair) in every 20 samples
- 1 per preparation batch per matrix
- 1 per SDG

However, the frequency may be project specific and the documents outlining the needs of the project (SAP, QAPP, etc.) should be reviewed. In some cases, MS/MSD analysis is not required.

The percent recoveries are evaluated based on the criteria within the laboratory report or project specific requirements. If a matrix spike recovery does not meet acceptance criteria and is not associated with a project sample, no further action is required unless other systematic evidence warrants qualification.

If the native concentration of a spiked sample is significantly greater than the spike added (>4x), spike recovery cannot be accurately evaluated, therefore the criteria do not apply. Professional judgment should be used for percent recoveries nominally outside laboratory acceptance criteria prior to qualifying data.

If criteria are not available, use guidance found in the NFG. Percent recoveries of matrix spike (and matrix spike duplicate) samples should be calculated using the equation provided under accuracy in ‘Definitions’ from Barr’s “Compendium of Data Quality Assessment Documentation”.

Solid samples may have highly variable concentrations of target analytes and percent recoveries (%R) may be influenced by the sampling precision and inherent sample homogeneity. Professional judgment should be used for difficult matrices and the acceptance criteria adjusted accordingly.

Table 5 – Guidelines for Matrix Spikes

Criteria	Recommended Action for Associated Data	
	Detect	Non-Detect
%R and RPD > Upper Limit	Qualify with '*'	No qualification
%R < Lower Limit	Qualify with '*' or '**', use professional judgment	
%R and RPD within Limits	No qualification	

* = Reported value is estimated and QA/QC criteria were not met
** = Reported value is unusable and QA/QC criteria were not met

While matrix spike duplicates are not required by all methods, if results for MSD analyses are reported, evaluate the RPD for MS and MSD pairs using the equation as provided under precision in 'Definitions' from Barr's "Compendium of Data Quality Assessment Documentation".

4.7 Overall Assessment

The chain-of-custody should be reviewed to determine if the laboratory report matches the requested analyses and that project specific parameters were analyzed as requested. The narrative and other supporting documentation should be evaluated to ensure that sample condition was appropriately documented by the laboratory upon receipt. If available, historical data should be used to assist with data evaluation. Any additional anomalies should be documented and evaluated, if necessary.

4.8 Total vs. Dissolved

Occasionally, the measurements for dissolved metals are equivalent to or greater than the associated results reported for the total metals analysis. When this occurs, the variation between the total and dissolved results may indicate that the majority of the target metals present in the sample were in the dissolved phase and normal analytical variability may account for the difference. Professional judgment should be used to determine if the variation is significant enough to be qualified.

5.0 Quality Control and Quality Assurance (QA/QC)

Depending on the project objectives, the data review may include the completion of a Routine Level Quality Control Report (see Barr's "Compendium of Data Quality Assessment Documentation") as part of the evaluation process. Within each QC data section, the reviewer should include references to whether the QC data met or exceeded the acceptance criteria. The qualifiers, added, removed, or retained, should be documented. Where multiple qualifiers may be applicable to a sample/analyte result, professional judgment should be used to determine if all qualifiers are necessary or if one qualifier would be sufficient to represent the deviations. A statement as to whether the data are acceptable as reported or acceptable with qualification(s) should also be included. If revised reports are required and the revision affects the sample results, notification should be given to the appropriate data management personnel and/or project team members.

The Data Quality Specialist will verify that the qualifiers associated with data tables match the Routine Level Quality Control Report.

6.0 Records

The Routine Level Quality Control Report should be saved to the appropriate internal Barr file and the link uploaded to the tracking system. Periodically, Data Quality staff should check for missing Routine Level Quality Control Reports in the tracking system to help maintain the most current information.

Documentation specific to this SOP are listed below and are available in Barr's "Compendium of Data Quality Assessment Documentation".

- Definitions
- Barr Qualifiers/Footnotes
- Routine Level Quality Control Report

Additional records information can be found in Barr's "Records Management System Manual".

7.0 References

Environmental Protection Agency. *Title 40 of the Code of Federal Regulations, Part 136.3.*

Environmental Protection Agency, *National Functional Guidelines for Inorganic Superfund Data Review.*

Analytical methods listed under the 'Scope and Applicability' section of this SOP.

Attachment 1

Revision History

Revision Number	Date of Revision	Section	Revision Made
3.2	04/2011	Document Wide	Added missing analytical method references.
		Attachments	Updated Attachments to current forms.
3.3	04/2011	References	Update the reference to the current NFG Metals data validation document.
4.0	04/06/12	Document Wide	Major revision
5.0	06/17/13	Cover page	Added Calgary office
		Applicability	Added US to EPA reference
		I	Added waste rock and drill cores to examples of product sample
		III, IV, V, VI	Added 'project specific requirements' as possible criteria source
		V	Added 'field and laboratory procedures' to clarify that it's not only a laboratory item
		V	Clarified field duplicate criteria as < one value and not a range
		VIII	Added statement regarding multiple qualifiers
6.0	01/07/16	Document Wide	SOP restructuring, new format

BARR

Standard Operating Procedure

Routine Level Polychlorinated Biphenyl (PCB), Aroclor, Pesticide, and Herbicide Data Evaluation

Revision 4

January 22, 2016

Approved By:

Michael Dupay — 01/22/16

Print — Technical Reviewer — Signature — Date

Terri Olson — Terri A. Olson — 01/22/16

Print — QA Manager — Signature — Date

Review of the SOP has been performed and the SOP still reflects current practice.

Initials: ______ Date: ______

Initials: ______ Date: ______

Initials: ______ Date: ______

Initials: ______ Date: ______

Minneapolis, MN ● Hibbing, MN ● Duluth, MN ● Ann Arbor, MI ● Jefferson City, MO ● Bismarck, ND ● Calgary, AB, Canada ● Grand Rapids, MI ● Salt Lake City, UT

Routine Level Polychlorinated Biphenyl (PCB), Aroclor, Pesticide, and Herbicide Data Evaluation

1.0 Scope and Applicability

This SOP is intended as a guidance SOP for the routine level evaluation of polychlorinated biphenyl (PCB), Aroclor, pesticide, and herbicide data provided by laboratories to be used in Barr Engineering Company (Barr) projects.

This SOP is based on quality assurance elements, not the specific criteria, of *USEPA Contract Laboratory Program National Functional Guidelines (NFG) for Organic Data* and applies to routine level PCB, Aroclor, pesticide, and herbicide data evaluation for analyses by the following technologies:

- Gas Chromatography/Electron Capture Detector (GC/ECD)
    - Method examples: EPA 608, EPA 8081, EPA 8082, EPA 8151
- Gas Chromatography/Electrolytic Conductivity Detector (GC/ELCD)
    - Method examples: EPA 8081, EPA 8082
- Gas Chromatography/Flame Photometric Detector (GC/FPD)
    - Method example: EPA 1657, EPA 8141
- Gas Chromatography/Nitrogen Phosphorus Detector (GC/NPD)
    - Method example: EPA 8141
- GC/ECD for Herbicides
    - Method example: EPA 8151
- Methods above with Toxicity Characteristic Leachate Procedure (TCLP), EPA 1311
- Methods above with Synthetic Precipitation Leachate Procedure (SPLP), EPA 1312

In the case of specific technologies and/or methods not listed above, the guidelines within this document will provide the basis upon which to make adequate professional judgment in the evaluation of data submitted for review.

The recommended procedures in this SOP should be followed unless conditions make it impractical or inappropriate to do so. Modifications should be noted in the applicable documentation and communicated to appropriate personnel. Significant changes may result in a revision or newly created SOP.

2.0 Limitations

- Level IV data evaluation is not covered in this SOP and should be performed in accordance with NFG or project specific requirements.

3.0 Responsibilities

The laboratory is responsible for generating data from the samples submitted for analysis. In instances where QC criteria are not met for the analysis of samples, the laboratory is responsible for reanalysis of the samples, provided reanalysis is possible (considering matrix interference, holding times and sample volume, etc.), or documenting the impact to the data.

The Data Quality Specialist is responsible for evaluating the data in accordance with this document, in addition to using professional judgment where necessary or appropriate. Project specific requirements, such as those specified in a Quality Assurance Project Plan (QAPP) or Sampling and Analysis Plan (SAP), may differ from these recommendations and professional judgment should be applied before qualifying any data.

4.0 Procedure

The Quality Assurance/Quality Control (QA/QC) data detailed below are the most typical found in a routine level laboratory report. Other QA/QC data may be provided by the laboratory within the laboratory report case narrative, data qualifiers, or cover sheet and should be evaluated using professional judgment (e.g., initial calibration, calibration verification, internal standards).

Definitions to common QA/QC terms and terms used within this SOP along with a list of Barr 'Data Qualifiers/Footnotes' that may be applied during review can be found in Barr's "Compendium of Data Quality Assessment Documentation".

4.1 Holding Time and Preservation

The purpose of holding time and preservation evaluation is to ascertain the validity of the analytical results based on the sample condition, preservation, and time elapsed between the date of sample collection and date of analysis.

40 CFR Part 136 and the *Test Methods for Evaluating Solid Waste (SW-846)* are used as guidance for the recommended holding time and preservation acceptance criteria listed in *Table 1*.

Table 1 – Recommended Holding Times and Preservation

Compound	Matrix	Temp.	Preservative	Maximum Hold Time
PCBs (EPA 608)	Aqueous	≤ 6° C	Ice	1 year extraction/ addl. 1 year analysis
Organochlorine Pesticides (EPA 608)	Aqueous	≤ 6° C	Ice (if >72 hrs. to extraction, preserve to pH 5-9 with NaOH and/or H_2SO_4)	72 hrs. extraction unpreserved, 7 days extraction preserved/ addl. 40 days analysis
Organochlorine Pesticides (EPA 8081)	Aqueous	≤ 6° C	Ice	7 days extraction/ addl. 40 days analysis
	Sediment/Soil	≤ 6° C	Ice	14 days extraction/ addl. 40 days analysis

(Table 1 continued on next page)

Table 1 – Recommended Holding Times and Preservation

Compound	Matrix	Temp.	Preservative	Maximum Hold Time
Organochlorine Pesticides (EPA 8081)	TCLP	--	NA	14 days TCLP extraction/ 7 days extraction/ addl. 40 days analysis
PCBs/Aroclor (EPA 8082)	Aqueous	≤ 6° C	Ice	None
	Sediment/Soil	≤ 6° C	Ice	None
Organophosphorus Compounds (EPA 8141)	Aqueous and Sediment/Soil	≤ 6° C	Ice	7 days extraction/ addl. 40 days analysis
Herbicides (EPA 8151)	Aqueous	≤ 6° C	Ice	7 days extraction/ addl. 40 days analysis
	Sediment/Soil	≤ 6° C	Ice	14 days extraction/ addl. 40 days analysis

If samples do not meet holding time, preservation and analysis recommendations in *Table 1*, consider qualification with an "**h**". Other matrices, such as product samples (e.g. oil, waste rock, drill cores) may not be subjected to the same holding time recommendations.

If the sample was stored on ice upon collection and delivered to the laboratory the same day, the sample may exceed recommended temperature at the time of laboratory receipt. Professional judgment should be applied (considering temperature, matrix, magnitude of the exceedance, etc.) when evaluating the application of qualifiers when criteria are not met.

4.2 Blank Samples

Blank sample evaluation is conducted to determine the existence and magnitude of target analyte contamination as a result of activities in the field during collection and transport or from inter-laboratory sources.

- For each matrix, at least one method blank should be prepared and analyzed with each sample delivery group (SDG). Evaluation pertains to the batch of samples analyzed with the method blank.
- Field or equipment blank collection and analysis frequency is project specific. Evaluation pertains to the field samples associated with the field or equipment blank.
- Blank analyses may not have involved the same weights, volumes, or dilution factors as the associated samples. It may be easier to work with the raw data and/or convert the data to the same units for comparison purposes.

Table 2 – Guidelines for Blank Contamination	
Sample Result	**Recommended Action for Associated Data**
Non-detect	No action required
< 5x blank concentration	Qualify with ‘b’
≥ 5x blank concentration	Use professional judgment

b = Reported value may be a potential false positive based on blank data evaluation procedures

Note: Other multipliers of the blank contamination may be used based on professional judgment (reporting to the MDL, common lab contaminant, etc.)

Professional judgment regarding the usability of the data should be used in cases where gross detections of target analytes are found in the blank sample. A number of factors may be considered including historical data, prior knowledge of the site conditions, target analytes involved, type of blank sample, etc. In such cases, it may be appropriate to qualify the affected data with ‘*****’ (estimated value, QA/QC criteria not met) or ‘******’ (unusable value, QA/QC criteria not met).

4.3 Surrogates

Surrogates are similar to analytes of interest in chemical composition, extraction, and chromatography but are not typically found in environmental samples. All samples (blanks, spiked samples, project samples, QC samples) should contain surrogates. If a sample does not contain surrogates, professional judgment should be used to determine if the reported results are useable or not. Acceptable evaluation of surrogate spikes may not be applicable if dilution of the sample was required. Percent recoveries are calculated for each surrogate and these are evaluated based on the criteria within the laboratory report or project specific requirements. If criteria are not reported, use guidance found in the NFG, if available. Percent recoveries are calculated using the equation provided under accuracy in ‘Definitions’ from Barr’s “Compendium of Data Quality Assessment Documentation”.

Table 3 includes guidance to evaluate the surrogate recovery where a single surrogate is analyzed.

Table 3 – Guidelines for Single Surrogate		
Criteria	**Recommended Action for Associated Data**	
	Detect	**Non-Detect**
%R > Upper Limit	Qualify with ‘*’	No qualification
%R < Lower Limit	Qualify with ‘*’ or ‘**’, use professional judgment	
%R within Limits	No qualification	

‘*’ = reported value is estimated and QA/QA criteria were not met
‘**’ = reported value is unusable and QA/QC criteria were not met

Table 4 includes guidance where multiple surrogates are analyzed.

Table 4 – Guidelines for Multiple Surrogates

Criteria	Recommended Action for Associated Data	
	Detect	Non-Detect
One %R < Lower Limit	No qualification may be necessary, use professional judgment	
Two or more %R < Lower Limit	Qualify with '*' or '**', use professional judgment	
Two or more %R > Upper Limit	Qualify fraction with '*'	No qualification
One %R > Upper Limit	No qualification may be necessary, use professional judgment	No qualification
All %R within Limits	No qualification	

'*' = Reported value is estimated and QA/QA criteria were not met
'**' = Reported value is unusable and QA/QC criteria were not met

4.4 Laboratory Control Samples (LCS) and Laboratory Control Sample Duplicate Samples (LCSD)

The laboratory control sample is used to monitor the overall performance of each step during analysis, including sample preparation. The LCS should be analyzed:

- Once every preparation batch (typically 20 or less samples of the same matrix).
- Once for each matrix.

Laboratory control samples may contain all target compounds or a subset (see *Table 5* for guidance) and the percent recoveries are evaluated based on the criteria within the laboratory report or project specific requirements. If criteria are not available, use guidance found in the NFG. Percent recoveries are calculated for accuracy and the relative percent difference (RPD) is calculated for precision (when an LCSD was analyzed). Accuracy and precision equations can be found in 'Definitions' from Barr's "Compendium of Data Quality Assessment Documentation".

Table 5 – Number of Suggested Target Compounds - LCS/LCSD and MS/MSD

Number of Target Parameters	Number of Spiked Compounds
1-10 analytes	Spike all compounds
11-20 analytes	At least 10 compounds or 80% of all analytes, whichever is greater
More than 20 analytes	Spike at least 16 compounds

Table 6 – Guidelines for Laboratory Control Samples		
Criteria	**Recommended Action for Associated Data**	
	Detect	**Non-Detect**
%R and RPD > Upper Limit	Qualify with '*'	No qualification
%R < Lower Limit	Qualify with '*' or '**', use professional judgment	
%R and RPD within Limits	No qualification	

'*' = Reported value is estimated and QA/QA criteria were not met
'**' = Reported value is unusable and QA/QC criteria were not met

4.5 Laboratory Duplicate Samples

Laboratory duplicate samples are separate aliquots of field samples analyzed to demonstrate acceptable method precision by the laboratory at the time of analysis. Field blanks and proficiency testing (PT) samples should not be used for duplicate analysis. The RPDs are calculated using the equation as provided in 'Definitions' from Barr's "Compendium of Data Quality Assessment Documentation" and are not calculated where data are already qualified with b, U, <, or **. RPD results are dependent on the homogeneity of the samples.

Duplicates should be analyzed (whichever is more frequent):

- One from each matrix (soil or water)
- One from each SDG

The MS/MSD duplicate pairs may be substituted for laboratory duplicates.

Laboratory acceptance criteria or project specific requirement are used to evaluate RPDs. If criteria are not available, use guidance found in NFG or use professional judgment when considering qualification of associated results.

Higher RPDs are expected when results are at or near the reporting limits and are not always indicative of poor precision. RPDs are typically only evaluated for samples where both the native and duplicate sample concentrations are greater than five times (>5x) the RL. In cases where either of the samples (native or duplicate) is non-detect for a parameter and the other corresponding sample has detectable concentrations much greater than five times (>5x) the RL, professional judgment should be used to determine if qualification is appropriate.

Table 7 – Guidelines for Laboratory Duplicates	
% RPD	**Recommended Action for Associated Data**
RPD < Upper Limit	No action is required
RPD > Upper Limit	Both results are ≤ 5x RL, no action is required
RPD > Upper Limit	Both results are > 5x RL, consider qualifying with '*****'

* = Reported value is estimated and QA/QC criteria were not met

4.6 Field Duplicate Samples

Field duplicate samples (also known as "masked" or "blind" duplicate samples) are used to demonstrate acceptable precision and reproducibility of the field and laboratory procedures. Frequency of collection is project specific. The RPDs are calculated using the equation as provided under precision in 'Definitions' from Barr's "Compendium of Data Quality Assessment Documentation" and are not calculated where data is already qualified with b, U, <, or **. RPD results are dependent on the homogeneity of the samples.

Acceptance criteria for field duplicate samples are subject to the professional judgment of the Data Quality Specialist but typically RPDs ≤ 30% for aqueous samples and ≤ 40% for soil and sediment samples are considered acceptable unless other project specific requirements are defined.

Higher RPDs are expected when results are at or near the reporting limits and are not always indicative of poor precision. RPDs are typically only evaluated for samples where both the native and duplicate sample concentrations are greater than five times (>5x) the RL. In cases where either of the samples (native or field duplicate) is non-detect for a parameter and the other corresponding sample has detectable concentrations much greater than five times (>5x) the RL, professional judgment should be used to determine if qualification is appropriate.

4.7 Matrix Spikes (MS) and Matrix Spike Duplicate (MSD) Samples

Matrix spike samples may contain all target compounds or a subset (see *Table 5*) and provide information about the effect of each samples' matrix on the sample preparation procedures and analytical results. Matrix spikes are typically analyzed at the following frequencies:

- 1 (MS/MSD pair) in every 20 samples
- 1 per preparation batch per matrix
- 1 per SDG

However, the frequency may be project specific and the documents outlining the needs of the project (SAP, QAPP, etc.) should be reviewed. In some cases, MS/MSD analysis is not required.

The percent recoveries are evaluated based on the criteria within the laboratory report or project specific requirements. If a matrix spike recovery does not meet acceptance criteria and is not associated with a project sample, no further action is required unless other systematic evidence warrants qualification.

If the native concentration of a spiked sample is significantly greater than the spike added (>4x), spike recovery cannot be accurately evaluated, therefore the criteria do not apply. Professional judgment should be used for percent recoveries nominally outside laboratory acceptance criteria prior to qualifying data.

If criteria are not available, use guidance found in the NFG. Percent recoveries of matrix spike (and matrix spike duplicate) samples should be calculated using the equation provided under accuracy in 'Definitions' from Barr's "Compendium of Data Quality Assessment Documentation".

Solid samples may have highly variable concentrations of target analytes and percent recoveries (%R) may be influenced by the sampling precision and inherent sample homogeneity. Professional judgment should be used for difficult matrices and the acceptance criteria adjusted accordingly.

Table 7 – Guidelines for Matrix Spikes

Criteria	Recommended Action for Associated Data	
	Detect	Non-Detect
%R and RPD > Upper Limit	Qualify with '*'	No qualification
%R < Lower Limit	Qualify with '*' or '**', use professional judgment	
%R and RPD within Limits	No qualification	

'*' = Reported value is estimated and QA/QA criteria were not met
'**' = Reported value is unusable and QA/QC criteria were not met

While matrix spike duplicates are not required by all methods, if results for MSD analyses are reported, evaluate the RPD for MS and MSD pairs using the equation as provided under precision in 'Definitions' from Barr's "Compendium of Data Quality Assessment Documentation".

4.8 Overall Assessment

The chain-of-custody should be reviewed to determine if the laboratory report matches the requested analyses and that project specific parameters were analyzed as requested. The narrative and other supporting documentation should be evaluated to ensure that sample condition was appropriately documented by the laboratory upon receipt. If available, historical data should be used to assist with data evaluation. Any additional anomalies should be documented and evaluated, if necessary.

Note: Pesticides, herbicides, PCBs and Aroclors require additional ECD or GC/MS confirmation of tentatively identified compounds (TIC), using a separate column. This may occur at the same time as the initial analysis using a dual-column GC with an additional detector; or a second, separate analysis via EPA 8270 (see Barr SOP for Routine Level SVOC Data Evaluation if positive detections occur). Herbicides are sufficiently identified by a single column if a GC/MS is used for analysis. If there is indication that conformational analysis was not performed for the remaining parameters, professional judgment should be used to critically evaluate the usability of the data as reported.

5.0 Quality Control and Quality Assurance (QA/QC)

Depending on the project objectives, the data review may include the completion of a Routine Level Quality Control Report (see Barr's "Compendium of Data Quality Assessment Documentation") as part of the evaluation process. Within each QC data section, the reviewer should include references to whether the QC data met or exceeded the acceptance criteria. The qualifiers, added, removed, or retained, should be documented also. Where multiple qualifiers may be applicable to a sample/analyte result, professional judgment should be used to determine if all qualifiers are necessary or if one qualifier would be sufficient to represent the deviations. A statement as to whether the data are acceptable as reported or acceptable with qualification(s) should also be included. If revised reports are required and the revision affects the sample results, notification should be given to the appropriate data management personnel and/or project team members.

The Data Quality Specialist will verify that the qualifiers associated with data tables match the Routine Level Quality Control Report.

6.0 Records

The Routine Level Quality Control Report should be saved to the appropriate internal Barr file and the link uploaded to the tracking system. Periodically, Data Quality staff should check for missing Routine Level Quality Control Reports in the tracking system to help maintain the most current information.

Documentation specific to this SOP are listed below and are available in Barr's "Compendium of Data Quality Assessment Documentation".

- Definitions
- Barr Qualifiers/Footnotes
- Routine Level Quality Control Report

Additional records information can be found in Barr's "Records Management System Manual".

7.0 References

Environmental Protection Agency. *Title 40 of the Code of Federal Regulations, Part 136.3.*

Environmental Protection Agency, *National Functional Guidelines for Superfund Organic Methods Data Review.*

Analytical methods listed under the 'Scope and Applicability' section of this SOP.

Attachment 1

Revision History

Revision Number	Date of Revision	Section	Revision Made
1.1	02/2009	Document Wide	Edits to references, formatting; minor language additions and corrections
		Attachments	Added Attachment 3
1.2	04/2011	Attachments	Updated Attachment 1 and 2 to current forms.
2.0	04/06/12	Document Wide	Major revision
3.0	06/17/13	Cover page	Added Calgary office
		I	Added waste rock and drill cores to examples of product sample
		III, IV, V, VI	Added 'project specific requirements' as possible criteria source
		V	Added 'field and laboratory procedures' to clarify that it's not only a laboratory item
		V	Clarified field duplicate criteria as < one value and not a range
		VIII	Added statement regarding multiple qualifiers
4	01/22/16	Document Wide	SOP restructuring, new format

BARR

Standard Operating Procedure

Routine Level Semivolatile Organic Compounds (SVOC), Polycyclic Aromatic Hydrocarbons (PAH), Diesel Range Organics (DRO), and Total Petroleum Hydrocarbons (TPH) Data Evaluation

Revision 6

January 19, 2016

Approved By:

Michael Dupay ______ ______ 01/19/16
Print Technical Reviewer Signature Date

Terri Olson Terri A. Olson 01/19/16
Print QA Manager Signature Date

Review of the SOP has been performed and the SOP still reflects current practice.

Initials: ____________ Date: ____________
Initials: ____________ Date: ____________
Initials: ____________ Date: ____________
Initials: ____________ Date: ____________

Minneapolis, MN ● Hibbing, MN ● Duluth, MN ● Ann Arbor, MI ● Jefferson City, MO ● Bismarck, ND ● Calgary, AB, Canada ● Grand Rapids, MI ● Salt Lake City, UT

Routine Level Semivolatile Organic Compounds (SVOC), Polycyclic Aromatic Hydrocarbons (PAH), Diesel Range Organics (DRO), and Total Petroleum Hydrocarbons (TPH) Data Evaluation

1.0 Scope and Applicability

This SOP is intended as a guidance SOP for the routine level evaluation of semivolatile organic compounds data provided by laboratories to be used in Barr Engineering Company (Barr) projects.

This SOP is based on quality assurance elements, not the specific criteria, of *USEPA Contract Laboratory Program National Functional Guidelines (NFG) for Organic Data* and applies to routine SVOC (including PAHs and phenols), TPH at various carbon ranges (e.g., TPH as fuel oil, TPH as motor oil, TPH as jet fuel), and DRO data evaluation for analyses by the following technologies:

- Gas Chromatography/Flame Ionization Detector (GC/FID)
    - Method examples: EPA 8015, EPA 8100, WI DRO
- Gas Chromatography/Mass Spectrometry (GC/MS)
    - Method example: EPA 625, EPA 8270
- Gas Chromatography/Mass Spectrometry-Selective Ion Monitoring (GC/MS-SIM)
    - Method example: EPA 8270
- High Performance Liquid Chromatography (HPLC)
    - Method example: EPA 610, EPA 8310
- Methods above with Toxicity Characteristic Leachate Procedure (TCLP), EPA 1311
- Methods above with Synthetic Precipitation Leachate Procedure (SPLP), EPA 1312

In the case of specific technologies and/or methods not listed above, the guidelines within this document will provide the basis upon which to make adequate professional judgment in the evaluation of data submitted for review.

The recommended procedures in this SOP should be followed unless conditions make it impractical or inappropriate to do so. Modifications should be noted in the applicable documentation and communicated to appropriate personnel. Significant changes may result in a revision or newly created SOP.

2.0 Limitations

- Level IV data evaluation is not covered in this SOP and should be performed in accordance with NFG or project specific requirements.

3.0 Responsibilities

The laboratory is responsible for generating data from the samples submitted for analysis. In instances where QC criteria are not met for the analysis of samples, the laboratory is responsible for reanalysis of the samples, provided reanalysis is possible (considering matrix interference, holding times and sample volume, etc.), or documenting the impact to the data.

The Data Quality Specialist is responsible for evaluating the data in accordance with this document, in addition to using professional judgment where necessary or appropriate. Project specific requirements, such as those specified in a Quality Assurance Project Plan (QAPP) or Sampling and Analysis Plan (SAP), may differ from these recommendations and professional judgment should be applied before qualifying any data.

4.0 Procedure

The Quality Assurance/Quality Control (QA/QC) data detailed below are the most typical found in a routine level laboratory report. Other QA/QC data may be provided by the laboratory within the laboratory report case narrative, data qualifiers, or cover sheet and should be evaluated using professional judgment (e.g., initial calibration, calibration verification, internal standards).

Definitions to common QA/QC terms and terms used within this SOP along with a list of Barr 'Data Qualifiers/Footnotes' that may be applied during review can be found in Barr's "Compendium of Data Quality Assessment Documentation".

4.1 Holding Time and Preservation

The purpose of holding time and preservation evaluation is to ascertain the validity of the analytical results based on the sample condition, preservation, and time elapsed between the date of sample collection and date of analysis.

40 CFR Part 136, WI GRO method, and the *Test Methods for Evaluating Solid Waste (SW-846)* are used as guidance for the recommended holding time and preservation acceptance criteria listed in *Table 1*.

Table 1 – Recommended Holding Times and Preservation

Compound	Matrix	Temp.	Preservative	Maximum Hold Time
SVOC/PAH/TPH	Aqueous	≤6° C	Ice	7 days extraction/ addl. 40 days analysis
	Sediment/Soil	≤ 6° C	Ice	14 days extraction/ addl. 40 days analysis
DRO	Aqueous	≤ 6° C	Ice, HCl < 2 pH	7 days extraction/ 47 days collection to analysis
	Sediment/Soil	≤ 6° C	Ice	10 days solvent addition/ 47 days collection to extraction and analysis
TCLP SVOC	Various	--	NA	14 days TCLP extraction/ 7 days extraction/ addl. 40 days analysis

If samples do not meet holding time, preservation and analysis recommendations in *Table 1*, consider qualification with an "**h**". Other matrices, such as product samples (e.g. oil, waste rock, drill cores) may not be subjected to the same holding time recommendations.

If the sample was stored on ice upon collection and delivered to the laboratory the same day, the sample may exceed recommended temperature at the time of laboratory receipt. Professional judgment should be applied (considering temperature, matrix, magnitude of the exceedance, etc.) when evaluating the application of qualifiers when criteria are not met.

4.2 Blank Samples

Blank sample evaluation is conducted to determine the existence and magnitude of target analyte contamination as a result of activities in the field during collection and transport or from inter-laboratory sources.

- For each matrix, at least one method blank should be prepared and analyzed with each sample delivery group (SDG). Evaluation pertains to the batch of samples analyzed with the method blank.
- Field or equipment blank collection and analysis frequency is project specific. Evaluation pertains to the field samples associated with the field or equipment blank.
- Blank analyses may not have involved the same weights, volumes, or dilution factors as the associated samples. It may be easier to work with the raw data and/or convert the data to the same units for comparison purposes.

Table 2 – Guidelines for Blank Contamination

Sample Result	Recommended Action for Associated Data
Non-detect	No action required
< 5x blank concentration	Qualify with 'b'
≥ 5x blank concentration	Use professional judgment

b = Reported value may be a potential false positive based on blank data evaluation procedures

Note: Other multipliers of the blank contamination may be used based on professional judgment (reporting to the MDL, common lab contaminant, etc.)

Professional judgment regarding the usability of the data should be used in cases where gross detections of target analytes are found in the blank sample. A number of factors may be considered including historical data, prior knowledge of the site conditions, target analytes involved, type of blank sample, etc. In such cases, it may be appropriate to qualify the affected data with '*****' (estimated value, QA/QC criteria not met) or '******' (unusable value, QA/QC criteria not met).

4.3 Deuterated Monitoring Compounds (DMC) and Surrogates

DMCs are isotopically labeled (deuterated) analogs of native target compounds. DMCs are only used for the SVOC GC/MS analysis. *Table 3* presents the recommended DMCs with their associated target compounds.

Table 3 – DMC and Associated Target Compounds

DMC (alphabetical)	Associated Target Compounds	
2,4-Dichlorophenol-d_3	2,4-Dichlorophenol Hexachlorobutadiene 4-Chloro-3-methylphenol 2,4,6-Trichlorophenol	2,4,5-Trichlorophenol 1,2,4,5-Tetrachlorobenzene Pentachlorophenol 2,3,4,6-Tetrachlorophenol
2-Chlorophenol-d_4	2-Chlorophenol	
2-Nitrophenol-d_4	Isophorone	2-Nitrophenol
4-6-Dinitro-2-methylphenol-d_2	4,6-Ditritro-2-methylphenol	
4-Chloroaniline-d_4	4-Chloroaniline Hexachlorocyclopentadiene	3,3′-Dichlorobenzidine
4-Methylphenol-d_8	2-Methylphenol 4-Methylphenol	2,4-Dimethylphenol
4-Nitrophenol-d_4	2-Nitroaniline 3-Nitroaniline 2,4-Dinitrophenol	4-Nitrophenol 4-Nitroaniline
Acenaphthylene-d_8	Naphthalene 2-Methylnaphthalene 2-Chloronapthalene	Acenaphthylene Acenaphthene
Anthracene-d_{10}	Hexachlorobenzene Atrazine	Phenanthrene Anthracene
Benzo(a)pyrene-d_{12}	Benzo(b)fluoranthene Benzo(k)fluoranthene Benzo(a)pyrene	Indeno(1,2,3-cd)pyrene Dibenzo(a,h)anthracene Benzo(g,h,i)perylene
Bis-(2-chloroethyl) ether-d_8	Bis-(2-chloroethyl) ether 2,2′-oxybis(1-chloropropane)*	bis(2-Choloethoxy) methane
Dimethylphthalate-d_6	Caprolactum 1,1′-Biphenyl Dimethylphthalate Diethylphthalate	Di-n-butylphthalate Butylbenzylphthalate bis(2-ethylhexyl)phthalate Di-n-octylphthalate
Fluorene-d_{10}	Dibenzofuran Fluorene 4-Chlorophenyl-phenylether	4-Bromophenyl-phenylether Carbazole
Nitrobenzene-d_5	Acetophenone N-Nitroso-di-n-propylamine Hexachloroethane Nitrobenzene	2,6-Dinitrotoluene 2,4-Dinitrotoluene N-Nitrosdiphenylamine

(Table 3 continued on next page)

Table 3 – DMC and Associated Target Compounds

DMC (alphabetical)	**Associated Target Compounds**	
Phenol-d_5	Benzaldehyde	Phenol
Pyrene-d_{10}	Fluoranthrene Pyrene	Benzo(a)anthracene Chrysene
SIM DMC and Associated Target Compounds		
Fluoranthene-d_{10}	Fluoranthene Pyrene Benzo(a)anthracene Chrysene Benzo(b)fluoranthene	Benzo(k)fluoranthene Benzo(a)pyrene Indeno(1,2,3-cd)pyrene Dibenzo(a,h)anthracene Benzo(g,h,i)perylene
2-Methylnaphthalene-d_{10}	Naphthalene 2-Methylnaphthalene Acenaphthylene Acenaphthene	Fluorene Pentachlorophenol Phenanthrene Anthracene

* = Bis(2-chloroisopropyl)ether

Surrogates are similar to analytes of interest in chemical composition, extraction, and chromatography but are not typically found in environmental samples. Other DMC or surrogates may be used by a laboratory based on their experience provided adequate chromatographic separations can be demonstrated. All samples (blanks, spiked samples, project samples, QC samples) should contain DMC or surrogates. If a sample does not contain DMC or surrogates or the method does not require surrogates (WI DRO), professional judgment should be used to determine if the reported results are useable or not. Acceptable evaluation of DMC or surrogate spikes may not be applicable if dilution of the sample was required. Percent recoveries are calculated for each DMC or surrogate and these are evaluated based on the criteria within the laboratory report or project specific requirements. If criteria are not reported, use guidance found in the NFG, if available. Percent recoveries are calculated using the equation provided under accuracy in 'Definitions' from Barr's "Compendium of Data Quality Assessment Documentation".

For the WI DRO analysis, surrogates are not required by the method. If used, the method requires that the surrogates must not elute within the WI DRO window (C_{10}-C_{28}). If the laboratory report includes a surrogate spike recovery for WI DRO, use professional judgment to assess the data.

Table 4 includes guidance to evaluate the surrogate recovery where a single surrogate is analyzed.

Table 4 – Guidelines for Single DMC or Surrogate		
Criteria	**Recommended Action for Associated Data**	
	Detect	**Non-Detect**
%R > Upper Limit	Qualify with '*'	No qualification
%R < Lower Limit	Qualify with '*' or '**', use professional judgment	
%R within Limits	No qualification	

'*' = reported value is estimated and QA/QA criteria were not met
'**' = reported value is unusable and QA/QC criteria were not met

Table 5 includes guidance where multiple surrogates are analyzed per analytical fraction.

Table 5 – Guidelines for Multiple DMC or Surrogates		
Criteria	**Recommended Action for Associated Data**	
	Detect	**Non-Detect**
One %R < Lower Limit	No qualification may be necessary, use professional judgment	
Two or more %R < Lower Limit	Qualify with '*' or '**', use professional judgment	
Two or more %R > Upper Limit	Qualify fraction with '*'	No qualification
One %R > Upper Limit	No qualification may be necessary, use professional judgment	No qualification
All %R within Limits	No qualification	

'*' = reported value is estimated and QA/QA criteria were not met
'**' = reported value is unusable and QA/QC criteria were not met

4.4 Laboratory Control Samples (LCS) and Laboratory Control Sample Duplicate Samples (LCSD)

The laboratory control sample is used to monitor the overall performance of each step during analysis, including sample preparation. The LCS should be analyzed:

- Once every preparation batch (20 or less samples of the same matrix - WI DRO requires an additional LCSD analyzed at the end of 20 samples).
- Once for each matrix.

Laboratory control samples may contain all target compounds or a subset (see *Table 6* for guidance) and the percent recoveries are evaluated based on the criteria within the laboratory report or project specific requirements. If criteria are not available, use guidance found in the NFG. Percent recoveries are calculated for accuracy and the relative percent difference (RPD) is calculated for precision (when an LCSD was analyzed). Accuracy and precision equations can be found in 'Definitions' from Barr's "Compendium of Data Quality Assessment Documentation".

Table 6 – Number of Suggested Target Compounds - LCS/LCSD and MS/MSD	
Number of Target Parameters	**Number of Spiked Compounds**
1-10 analytes	Spike all compounds
11-20 analytes	At least 10 compounds or 80% of all analytes, whichever is greater
More than 20 analytes	Spike at least 16 compounds

Table 7 – Guidelines for Laboratory Control Samples		
Criteria	**Recommended Action for Associated Data**	
	Detect	**Non-Detect**
%R and RPD > Upper Limit	Qualify with '*'	No qualification
%R < Lower Limit	Qualify with '*' or '**', use professional judgment	
%R and RPD within Limits	No qualification	

* = Reported value is estimated and QA/QC criteria were not met
** = Reported value is unusable and QA/QC criteria were not met

4.5 Laboratory Duplicate Samples

Laboratory duplicate samples are separate aliquots of field samples analyzed to demonstrate acceptable method precision by the laboratory at the time of analysis. Field blanks and proficiency testing (PT) samples should not be used for duplicate analysis. The RPDs are calculated using the equation as provided in 'Definitions' from Barr's "Compendium of Data Quality Assessment Documentation" and are not calculated where data are already qualified with b, U, <, or **. RPD results are dependent on the homogeneity of the samples.

Duplicates should be analyzed (whichever is more frequent):

- One from each matrix (soil or water)
- One from each SDG

The MS/MSD duplicate pairs may be substituted for laboratory duplicates.

Laboratory acceptance criteria or project specific requirement are used to evaluate RPDs. If criteria are not available, use guidance found in NFG or use professional judgment when considering qualification of associated results.

Higher RPDs are expected when results are at or near the reporting limits and are not always indicative of poor precision. RPDs are typically only evaluated for samples where both the native and duplicate sample concentrations are greater than five times (>5x) the RL. In cases where either of the samples (native or duplicate) is non-detect for a parameter and the other corresponding sample has detectable

concentrations much greater than five times (>5x) the RL, professional judgment should be used to determine if qualification is appropriate.

Table 8 – Guidelines for Laboratory Duplicates	
% RPD	**Recommended Action for Associated Data**
RPD < Upper Limit	No action is required
RPD > Upper Limit	Both results are ≤ 5x RL, no action is required
RPD > Upper Limit	Both results are > 5x RL, consider qualifying with '*****'

* = Reported value is estimated and QA/QC criteria were not met

4.6 Field Duplicate Samples

Field duplicate samples (also known as "masked" or "blind" duplicate samples) are used to demonstrate acceptable precision and reproducibility of the field and laboratory procedures. Frequency of collection is project specific. The RPDs are calculated using the equation as provided under precision in 'Definitions' from Barr's "Compendium of Data Quality Assessment Documentation" and are not calculated where data is already qualified with b, U, <, or **. RPD results are dependent on the homogeneity of the samples.

Acceptance criteria for field duplicate samples are subject to the professional judgment of the Data Quality Specialist but typically RPDs ≤ 30% for aqueous samples and ≤ 40% for soil and sediment samples are considered acceptable unless other project specific requirements are defined.

Higher RPDs are expected when results are at or near the reporting limits and are not always indicative of poor precision. RPDs are typically only evaluated for samples where both the native and duplicate sample concentrations are greater than five times (>5x) the RL. In cases where either of the samples (native or field duplicate) is non-detect for a parameter and the other corresponding sample has detectable concentrations much greater than five times (>5x) the RL, professional judgment should be used to determine if qualification is appropriate.

4.7 Matrix Spikes (MS) and Matrix Spike Duplicate (MSD) Samples

Matrix spike samples may contain all target compounds or a subset (see *Table 6*) and provide information about the effect of each samples' matrix on the sample preparation procedures and analytical results. Matrix spikes are typically analyzed at the following frequencies:

- 1 (MS/MSD pair) in every 20 samples (does not apply to DRO in the WI method)
- 1 per preparation batch per matrix
- 1 per SDG

However, the frequency may be project specific and the documents outlining the needs of the project (SAP, QAPP, etc.) should be reviewed. In some cases, MS/MSD analysis is not required.

The percent recoveries are evaluated based on the criteria within the laboratory report or project specific requirements. If a matrix spike recovery does not meet acceptance criteria and is not associated with a project sample, no further action is required unless other systematic evidence warrants qualification.

If the native concentration of a spiked sample is significantly greater than the spike added (>4x), spike recovery cannot be accurately evaluated, therefore the criteria do not apply. Professional judgment should be used for percent recoveries nominally outside laboratory acceptance criteria prior to qualifying data.

If criteria are not available, use guidance found in the NFG. Percent recoveries of matrix spike (and matrix spike duplicate) samples should be calculated using the equation provided under accuracy in 'Definitions' from Barr's "Compendium of Data Quality Assessment Documentation".

Solid samples may have highly variable concentrations of target analytes and percent recoveries (%R) may be influenced by the sampling precision and inherent sample homogeneity. Professional judgment should be used for difficult matrices and the acceptance criteria adjusted accordingly.

Table 9 – Guidelines for Matrix Spikes

Criteria	**Recommended Action for Associated Data**	
	Detect	**Non-Detect**
%R and RPD > Upper Limit	Qualify with '*'	No qualification
%R < Lower Limit	Qualify with '*' or '**', use professional judgment	
%R and RPD within Limits	No qualification	

* = Reported value is estimated and QA/QC criteria were not met
** = Reported value is unusable and QA/QC criteria were not met

While matrix spike duplicates are not required by all methods, if results for MSD analyses are reported, evaluate the RPD for MS and MSD pairs using the equation as provided under precision in 'Definitions' from Barr's "Compendium of Data Quality Assessment Documentation".

4.8 Overall Assessment

The chain-of-custody should be reviewed to determine if the laboratory report matches the requested analyses and that project specific parameters were analyzed as requested. The narrative and other supporting documentation should be evaluated to ensure that sample condition was appropriately documented by the laboratory upon receipt. If available, historical data should be used to assist with data evaluation. Any additional anomalies should be documented and evaluated, if necessary.

5.0 Quality Control and Quality Assurance (QA/QC)

Depending on the project objectives, the data review may include the completion of a Routine Level Quality Control Report (see Barr's "Compendium of Data Quality Assessment Documentation") as part of the evaluation process. Within each QC data section, the reviewer should include references to whether the QC data met or exceeded the acceptance criteria. The qualifiers, added, removed, or retained, should be documented also. Where multiple qualifiers may be applicable to a sample/analyte result, professional judgment should be used to determine if all qualifiers are necessary or if one qualifier would be sufficient to represent the deviations. A statement as to whether the data are acceptable as reported or acceptable with qualification(s) should also be included. If revised reports are required and the revision affects the

sample results, notification should be given to the appropriate data management personnel and/or project team members.

The Data Quality Specialist will verify that the qualifiers associated with data tables match the Routine Level Quality Control Report.

6.0 Records

The Routine Level Quality Control Report should be saved to the appropriate internal Barr file and the link uploaded to the tracking system. Periodically, Data Quality staff should check for missing Routine Level Quality Control Reports in the tracking system to help maintain the most current information.

Documentation specific to this SOP are listed below and are available in Barr's "Compendium of Data Quality Assessment Documentation".

- Definitions
- Barr Qualifiers/Footnotes
- Routine Level Quality Control Report

Additional records information can be found in Barr's "Records Management System Manual".

7.0 References

Environmental Protection Agency. *Title 40 of the Code of Federal Regulations, Part 136.3.*

Environmental Protection Agency, *National Functional Guidelines for Superfund Organic Methods Data Review.*

Analytical methods listed under the 'Scope and Applicability' section of this SOP.

Attachment 1

Revision History

Revision Number	Date of Revision	Section	Revision Made
3.1	02/2009	Document Wide	Edits to references, formatting; minor language additions and corrections
		IX	Added Table 10
		Attachments	Added Attachment 3
3.2	04/2011	Document Wide	Added analytical methods to applicability section.
		Attachments	Updated Attachment 1 and 2 to include current forms.
4.0	04/06/12	Document Wide	Major revision
5.0	0601//17/13	Cover page	Added Calgary office
		I	Added waste rock and drill cores to examples of product sample
		III, IV, V, VI, VII	Added 'project specific requirements' as possible criteria source
		VI	Added 'field and laboratory procedures' to clarify that it's not only a laboratory item
		VI	Clarified field duplicate criteria as < one value and not a range
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BARR

Standard Operating Procedure

Routine Level Volatile Organic Compounds (VOC), Gasoline Range Organics (GRO), and Total Petroleum Hydrocarbons (TPH) Data Evaluation

Revision 6

January 15, 2016

Approved By:

Michael Dupay		01/15/16
Print	Technical Reviewer Signature	Date
Terri Olson	Terri A. Olson	01/15/16
Print	QA Manager Signature	Date

Review of the SOP has been performed and the SOP still reflects current practice.

Initials:		Date:	
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Initials:		Date:	

Minneapolis, MN ● Hibbing, MN ● Duluth, MN ● Ann Arbor, MI ● Jefferson City, MO ● Bismarck, ND ● Calgary, AB, Canada ● Grand Rapids, MI ● Salt Lake City, UT

Routine Level Volatile Organic Compounds (VOC), Gasoline Range Organics (GRO), and Total Petroleum Hydrocarbons (TPH) Data Evaluation

1.0 Scope and Applicability

This SOP is intended as a guidance SOP for the routine level evaluation of VOC, GRO, and TPH data provided by laboratories to be used in Barr Engineering Company (Barr) projects.

This SOP is based on quality assurance elements, not the specific criteria, of *USEPA Contract Laboratory Program National Functional Guidelines (NFG) for Organic Data* and applies to routine VOC (including BTEX), GRO, and TPH (in the approximate gasoline carbon range, C_6-C_{10}) data evaluation for analyses by the following technologies:

- Gas Chromatography/Flame Ionization Detector (GC/FID)
    - Method examples: EPA 8015, WI GRO (GRO)
- Gas Chromatography/Photoionization Detector (GC/PID)
    - Method example: EPA 8021, WI GRO (PVOC)
- Gas Chromatography/Electrolytic Conductivity Detector (GC/ELCD)
    - Method example: EPA 8021
- Gas Chromatography/Mass Spectrometry (GC/MS)
    - Method example: EPA 624, EPA 8260
- Gas Chromatography/Mass Spectrometry-Selective Ion Monitoring (GC/MS-SIM)
    - Method example: EPA 8260
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3.0 Responsibilities

The laboratory is responsible for generating data from the samples submitted for analysis. In instances where QC criteria are not met for the analysis of samples, the laboratory is responsible for reanalysis of the samples, provided reanalysis is possible (considering matrix interference, holding times and sample volume, etc.), or documenting the impact to the data.

The Data Quality Specialist is responsible for evaluating the data in accordance with this document, in addition to using professional judgment where necessary or appropriate. Project specific requirements, such as those specified in a Quality Assurance Project Plan (QAPP) or Sampling and Analysis Plan (SAP), may differ from these recommendations and professional judgment should be applied before qualifying any data.

4.0 Procedure

The Quality Assurance/Quality Control (QA/QC) data detailed below are the most typical found in a routine level laboratory report. Other QA/QC data may be provided by the laboratory within the laboratory report case narrative, data qualifiers, or cover sheet and should be evaluated using professional judgment (e.g., initial calibration, calibration verification, internal standards).

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4.1 Holding Time and Preservation

The purpose of holding time and preservation evaluation is to ascertain the validity of the analytical results based on the sample condition, preservation, and time elapsed between the date of sample collection and date of analysis.

40 CFR Part 136, WI GRO method, and the *Test Methods for Evaluating Solid Waste (SW-846)* are used as guidance for the recommended holding time and preservation acceptance criteria listed in *Table 1*.

Table 1 – Recommended Holding Times and Preservation

Compound	Matrix	Temp.	Preservative	Maximum Hold Time
VOC/PVOC	Aqueous	≤ 6 °C	HCl < 2 pH	14 days
	Aqueous	≤ 6 °C	Unpreserved	7 days
	Sediment/Soil	≤ 6 °C	1:1 soil:solvent (e.g., 10 g soil:10 mL MeOH in lab pre-weighed vial)	14 days
GRO (WI Method)	Aqueous	≤ 6 °C	HCl < 2 pH	14 days
	Sediment/Soil	≤ 6 °C	1:1 soil:solvent (e.g., 10 g soil:10 mL MeOH in lab pre-weighed vial)	21 days

(Table 1 continued on next page)

Table 1 – Recommended Holding Times and Preservation				
Compound	**Matrix**	**Temp.**	**Preservative**	**Maximum Hold Time**
TPH	Aqueous	≤ 6 °C	HCl or H_2SO_4 < 2 pH	7 day extraction/ addl. 40 days analysis
	Sediment/Soil	≤ 6 °C	Zero headspace*	14 days extraction/ addl. 40 days analysis
TCLP	Various	≤ 6 °C	No preservative	14 days TCLP extraction/ addl. 14 days analysis

* = Alternatively, samples may be collected as per the VOC analysis.

If samples do not meet holding time, preservation and analysis recommendations in *Table 1*, consider qualification with an "**h**". Other matrices, such as product samples (e.g. oil, waste rock, drill cores) may not be subjected to the same holding time recommendations.

If the sample was stored on ice upon collection and delivered to the laboratory the same day, the sample may exceed recommended temperature at the time of laboratory receipt. Professional judgment should be applied (considering temperature, matrix, magnitude of the exceedance, etc.) when evaluating the application of qualifiers when criteria are not met.

4.2 Blank Samples

Blank sample evaluation is conducted to determine the existence and magnitude of target analyte contamination as a result of activities in the field during collection and transport or from inter-laboratory sources.

- For each matrix, at least one method blank should be prepared and analyzed with each sample delivery group (SDG) – laboratories should analyze a method blank at least once every 12 hours. Evaluation pertains to the batch of samples analyzed with the method blank.
- Field or equipment blank collection and analysis frequency is project specific. Evaluation pertains to the field samples associated with the field or equipment blank.
- Trip blanks should be placed in each transport cooler containing VOC sample containers prior to shipment into the field and remain with the associated VOC samples submitted to the laboratory for VOC analysis; including sample storage through analysis.
- Blank analyses may not have involved the same weights, volumes, or dilution factors as the associated samples. It may be easier to work with the raw data and/or convert the data to the same units for comparison purposes.

Table 2 – Guidelines for Blank Contamination	
Sample Result	**Recommended Action for Associated Data**
Non-detect	No action required
< 5x blank concentration	Qualify with 'b'
≥ 5x blank concentration	Use professional judgment

b = Reported value may be a potential false positive based on blank data evaluation procedures

Note: Other multipliers of the blank contamination may be used based on professional judgment (reporting to the MDL, common lab contaminant, etc.)

Professional judgment regarding the usability of the data should be used in cases where gross detections of target analytes are found in the blank sample. A number of factors may be considered including historical data, prior knowledge of the site conditions, target analytes involved, type of blank sample, etc. In such cases, it may be appropriate to qualify the affected data with '*****' (estimated value, QA/QC criteria not met) or '******' (unusable value, QA/QC criteria not met).

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DMCs are isotopically labeled (deuterated) analogs of native target compounds. DMCs are only used for the VOC GC/MS analysis. *Table 3* presents the recommended DMCs with their associated target compounds.

Table 3 –DMC and Associated Target Compounds

DMC (alphabetical)	Associated Target Compounds	
1,1,2,2-Tetrachloroethane-d_2	1,1,2,2-Tetrachloroethane	1,2-Dibromo-3-chloropropane
1,1-Dichloroethane-d_2	trans-1,2-Dichloroethene 1,1-Dichloroethene	cis-1,2-Dichloroethene
1,2-Dichlorobenzene-d_4	Chlorobenzene 1,3-Dichlorobenzene 1,4-Dichlorobenzene	1,2-Dichlorobenzene 1,2,4-Trichlorobenzene 1,2,3-Trichlorobenzene
1,2-Dichloroethane-d_4	Trichlorofluoromethane 1,1,2-Trichloro-1,2,2-trifluoroethane Methyl acetate Methylene chloride Methyl-tert-butyl ether	1,1,1-Trichloroethane Carbon tetrachloride 1,2-Dibromoethane 1,2-Dichloroethane
1,2-Dicloropropane-d_6	Cyclohexane Methylcyclohexane	1,2-Dichloropropane Bromodichloromethane
1,4-Dioxane-d_8	1,4-Dioxane	
2-Butanone-d_5	Acetone	2-Butanone
2-Hexanon-d_5	4-Methyl-2-pentanone	2-Hexanone
Benzene-d_6	Benzene	
Chloroethane-d_5	Dichlorodifluoromethane Chloromethane Bromomethane	Chloroethane Carbon disulfide
Chloroform-d	1,1-Dichloroethane Bromochloromethane Chloroform	Dibromochloromethane Bromoform
Toluene-d_8	Trichloroethene Toluene Tetrachloroethene Ethylbenzene	o-Xylene m,p-Xylene Styrene Isopropylbenzene
trans-1,3-Dichloropropene-d_4	cis-1,3-Dichloropropene trans-1,3-Dichloropropene	1,1,2-Trichloroethane
Vinyl Chloride-d_3	Vinyl chloride	

Surrogates are similar to analytes of interest in chemical composition, extraction, and chromatography but are not typically found in environmental samples. Other DMCs or surrogates may be used by a laboratory based on their experience provided adequate chromatographic separations can be demonstrated. All samples (blanks, spiked samples, project samples, QC samples) should contain DMCs or surrogates. If a sample does not contain DMC or surrogates or the method does not require surrogates (WI GRO), professional judgment should be used to determine if the reported results are useable or not. Acceptable evaluation of the DMC or surrogate spikes may not be applicable if dilution of the sample was required. Percent recoveries are calculated for each DMC or surrogate and these are evaluated based on the criteria within the laboratory report or project specific requirements. If criteria are not reported, use guidance found in the NFG, if available. Percent recoveries are calculated using the equation provided under accuracy in 'Definitions' from Barr's "Compendium of Data Quality Assessment Documentation".

For the WI GRO analysis, surrogates are not required for GRO but are required for PVOC. The method minimum surrogate recovery is 80%; there is no method maximum recovery. Use professional judgment when evaluating surrogates for WI GRO samples.

Table 4 includes guidance to evaluate the surrogate recovery where a single surrogate is analyzed.

Table 4 – Guidelines for Single DMC or Surrogate

Criteria	**Recommended Action for Associated Data**	
	Detect	**Non-Detect**
%R > Upper Limit	Qualify with '*'	No qualification
%R < Lower Limit	Qualify with '*' or '**', use professional judgment	
%R within Limits	No qualification	

'*' = reported value is estimated and QA/QA criteria were not met
'**' = reported value is unusable and QA/QC criteria were not met

Table 5 includes guidance where multiple surrogates are analyzed per analytical fraction.

Table 5 – Guidelines for Multiple DMC or Surrogates

Criteria	**Recommended Action for Associated Data**	
	Detect	**Non-Detect**
One %R < Lower Limit	No qualification may be necessary, use professional judgment	
Two or more %R < Lower Limit	Qualify with '*' or '**', use professional judgment	
Two or more %R > Upper Limit	Qualify fraction with '*'	No qualification
One %R > Upper Limit	No qualification may be necessary, use professional judgment	No qualification
All %R within Limits	No qualification	

'*' = reported value is estimated and QA/QA criteria were not met
'**' = reported value is unusable and QA/QC criteria were not met

4.4 Laboratory Control Samples (LCS) and Laboratory Control Sample Duplicate Samples (LCSD)

The laboratory control sample is used to monitor the overall performance of each step during analysis, including sample preparation. The LCS should be analyzed:

- Once every preparation batch (typically 20 or less samples of the same matrix - WI GRO requires an additional LCSD analyzed at the end of 20 samples)
- Once for each matrix.

Laboratory control samples may contain all target compounds or a subset (see *Table 6* for guidance) and the percent recoveries are evaluated based on the criteria within the laboratory report or project specific requirements. If criteria are not available, use guidance found in the NFG. Percent recoveries are calculated for accuracy and the relative percent difference (RPD) is calculated for precision (when an LCSD was analyzed). Accuracy and precision equations can be found in 'Definitions' from Barr's "Compendium of Data Quality Assessment Documentation".

Table 6 – Number of Suggested Target Compounds - LCS/LCSD and MS/MSD

Number of Target Parameters	Number of Spiked Compounds
1-10 analytes	Spike all compounds
11-20 analytes	At least 10 compounds or 80% of all analytes, whichever is greater
More than 20 analytes	Spike at least 16 compounds

Table 7 – Guidelines for Laboratory Control Samples

Criteria	Recommended Action for Associated Data	
	Detect	Non-Detect
%R and RPD > Upper Limit	Qualify with '*'	No qualification
%R < Lower Limit	Qualify with '*' or '**', use professional judgment	
%R and RPD within Limits	No qualification	

* = Reported value is estimated and QA/QC criteria were not met
** = Reported value is unusable and QA/QC criteria were not met

4.5 Laboratory Duplicate Samples

Laboratory duplicate samples are separate aliquots of field samples analyzed to demonstrate acceptable method precision by the laboratory at the time of analysis. Field blanks and proficiency testing (PT) samples should not be used for duplicate analysis. The RPDs are calculated using the equation as provided in 'Definitions' from Barr's "Compendium of Data Quality Assessment Documentation" and are

not calculated where data are already qualified with b, U, <, or **. RPD results are dependent on the homogeneity of the samples.

Duplicates should be analyzed (whichever is more frequent):

- One from each matrix (soil or water)
- One from each SDG

The MS/MSD duplicate pairs may be substituted for laboratory duplicates.

Laboratory acceptance criteria or project specific requirement are used to evaluate RPDs. If criteria are not available, use guidance found in NFG or use professional judgment when considering qualification of associated results.

Higher RPDs are expected when results are at or near the reporting limits and are not always indicative of poor precision. RPDs are typically only evaluated for samples where both the native and duplicate sample concentrations are greater than five times (>5x) the RL. In cases where either of the samples (native or duplicate) is non-detect for a parameter and the other corresponding sample has detectable concentrations much greater than five times (>5x) the RL, professional judgment should be used to determine if qualification is appropriate.

Table 8 – Guidelines for Laboratory Duplicates

% RPD	Recommended Action for Associated Data
RPD < Upper Limit	No action is required
RPD > Upper Limit	Both results are ≤ 5x RL, no action is required
RPD > Upper Limit	Both results are > 5x RL, consider qualifying with '*'

* = Reported value is estimated and QA/QC criteria were not met

4.6 Field Duplicate Samples

Field duplicate samples (also known as "masked" or "blind" duplicate samples) are used to demonstrate acceptable precision and reproducibility of the field and laboratory procedures. Frequency of collection is project specific. The RPDs are calculated using the equation as provided under precision in 'Definitions' from Barr's "Compendium of Data Quality Assessment Documentation" and are not calculated where data is already qualified with b, U, <, or **. RPD results are dependent on the homogeneity of the samples.

Acceptance criteria for field duplicate samples are subject to the professional judgment of the Data Quality Specialist but typically RPDs ≤ 30% for aqueous samples and ≤ 40% for soil and sediment samples are considered acceptable unless other project specific requirements are defined.

Higher RPDs are expected when results are at or near the reporting limits and are not always indicative of poor precision. RPDs are typically only evaluated for samples where both the native and duplicate sample concentrations are greater than five times (>5x) the RL. In cases where either of the samples (native or field duplicate) is non-detect for a parameter and the other corresponding sample has detectable concentrations much greater than five times (>5x) the RL, professional judgment should be used to determine if qualification is appropriate.

4.7 Matrix Spikes (MS) and Matrix Spike Duplicate (MSD) Samples

Matrix spike samples may contain all target compounds or a subset (see *Table 6*) and provide information about the effect of each samples' matrix on the sample preparation procedures and analytical results. Matrix spikes are typically analyzed at the following frequencies:

- 1 (MS/MSD pair) in every 20 samples (does not apply to GRO in the WI method)
- 1 per preparation batch per matrix
- 1 per SDG

However, the frequency may be project specific and the documents outlining the needs of the project (SAP, QAPP, etc.) should be reviewed. In some cases, MS/MSD analysis is not required.

The percent recoveries are evaluated based on the criteria within the laboratory report or project specific requirements. If a matrix spike recovery does not meet acceptance criteria and is not associated with a project sample, no further action is required unless other systematic evidence warrants qualification.

If the native concentration of a spiked sample is significantly greater than the spike added (>4x), spike recovery cannot be accurately evaluated, therefore the criteria do not apply. Professional judgment should be used for percent recoveries nominally outside laboratory acceptance criteria prior to qualifying data.

If criteria are not available, use guidance found in the NFG. Percent recoveries of matrix spike (and matrix spike duplicate) samples should be calculated using the equation provided under accuracy in 'Definitions' from Barr's "Compendium of Data Quality Assessment Documentation".

Solid samples may have highly variable concentrations of target analytes and percent recoveries (%R) may be influenced by the sampling precision and inherent sample homogeneity. Professional judgment should be used for difficult matrices and the acceptance criteria adjusted accordingly.

Table 9 – Guidelines for Matrix Spikes

Criteria	**Recommended Action for Associated Data**	
	Detect	**Non-Detect**
%R and RPD > Upper Limit	Qualify with '*'	No qualification
%R < Lower Limit	Qualify with '*' or '**', use professional judgment	
%R and RPD within Limits	No qualification	

* = Reported value is estimated and QA/QC criteria were not met
** = Reported value is unusable and QA/QC criteria were not met

While matrix spike duplicates are not required by all methods, if results for MSD analyses are reported, evaluate the RPD for MS and MSD pairs using the equation as provided under precision in 'Definitions' from Barr's "Compendium of Data Quality Assessment Documentation".

4.8 Overall Assessment

The chain-of-custody should be reviewed to determine if the laboratory report matches the requested analyses and that project specific parameters were analyzed as requested. The narrative and other supporting documentation should be evaluated to ensure that sample condition was appropriately documented by the laboratory upon receipt. If available, historical data should be used to assist with data evaluation. Any additional anomalies should be documented and evaluated, if necessary.

5.0 Quality Control and Quality Assurance (QA/QC)

Depending on the project objectives, the data review may include the completion of a Routine Level Quality Control Report (see Barr's "Compendium of Data Quality Assessment Documentation") as part of the evaluation process. Within each QC data section, the reviewer should include references to whether the QC data met or exceeded the acceptance criteria. The qualifiers, added, removed, or retained, should be documented also. Where multiple qualifiers may be applicable to a sample/analyte result, professional judgment should be used to determine if all qualifiers are necessary or if one qualifier would be sufficient to represent the deviations. A statement as to whether the data are acceptable as reported or acceptable with qualification(s) should also be included. If revised reports are required and the revision affects the sample results, notification should be given to the appropriate data management personnel and/or project team members.

The Data Quality Specialist will verify that the qualifiers associated with data tables match the Routine Level Quality Control Report.

6.0 Records

The Routine Level Quality Control Report should be saved to the appropriate internal Barr file and the link uploaded to the tracking system. Periodically, Data Quality staff should check for missing Routine Level Quality Control Reports in the tracking system to help maintain the most current information.

Documentation specific to this SOP are listed below and are available in Barr's "Compendium of Data Quality Assessment Documentation".

- Definitions
- Barr Qualifiers/Footnotes
- Routine Level Quality Control Report

Additional records information can be found in Barr's "Records Management System Manual".

7.0 References

Environmental Protection Agency. *Title 40 of the Code of Federal Regulations, Part 136.3.*

Environmental Protection Agency, *National Functional Guidelines for Superfund Organic Methods Data Review.*

Analytical methods listed under the 'Scope and Applicability' section of this SOP.

Attachment 1

Revision History

Revision Number	Date of Revision	Section	Revision Made
3.1	02/2009	Document Wide	Edits to references, formatting; minor language additions and corrections
		IX	Added Table 10
		Attachments	Added Attachment 3
3.2	04/2011	Document Wide	Added analytical methods to applicability section.
		Attachments	Updated Attachment 1 and 2 to include current forms.
4.0	04/06/12	Document Wide	Major revision
5.0	06/17/13	Cover page	Added Calgary office
		I	Added waste rock and drill cores to examples of product sample
		III, IV, V, VI, VII	Added 'project specific requirements' as possible criteria source
		VI	Added 'field and laboratory procedures' to clarify that it's not only a laboratory item
		VI	Clarified field duplicate criteria as < one value and not a range
		IX	Added statement regarding multiple qualifiers
6.0	01/15/16	Document Wide	SOP restructuring, new format

Appendix D3

Quality Assurance/Quality Control Review
Landau 2013 Phase II Investigation

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Memorandum

To: Mary Monahan – Project Coordinator, Ecology and Chris Wend, Ecology
From: Al Gebhard and Dana Pasi – Barr Engineering
Subject: Quality Assurance / Quality Control Review – Landau 2013 Phase II Investigation
Date: November 3, 2017
Project: Yakima Mill Site

1.0 Introduction

A Phase II Environmental Site Assessment (Phase II) was completed at the Triangular and Plywood Plant Parcels at the Yakima Mill Site (Mill Site) by Landau Associates in 2013 (Landau, 2013). The results of the Phase II are summarized in the report titled Phase II Investigation; Yakima Mill Site; Triangular and Plywood Plant Parcels (Landau, 2013). Landau stated that the laboratory analytical data set was validated for quality assurance/quality control (QA/QC) purposes. However, Barr Engineering Co. (Barr) does not have any documentation of the QA/QC review procedures used by Landau for the data validation.

At Ecology's direction, because the Phase II was not prepared under Ecology oversight, Barr conducted an additional quality assurance/quality control (QA/QC) review of the Phase II data. The objective of this memorandum is to establish the usability of the Phase II data for the purposes of the Remedial Investigation (RI) Work Plan (Work Plan) that Barr and Fulcrum Environmental Consulting, Inc. (Fulcrum) are preparing for the Mill Site.

New data to be collected by Barr and Fulcrum under the RI Work Plan will be subject to QA/QA review to confirm usability as provided in the SAP/QAPP for the project.

This memorandum summarizes Barr's QA/QC review of the analytical data from the Landau Phase II investigation at the Mill Site. In addition, this memorandum presents a comparison of the practical quantitation limits (PQLs) associated with the 2013 Phase II data set to the standard cleanup levels potentially applicable to the Mill Site (i.e., Washington State Department of Ecology (Ecology) Model Toxics Control Act (MTCA) Method A and B). The PQL, as defined in MTCA Regulation and Statute (Ecology, Rev. 2013), is "the lowest concentration that can be reliably measured within specified limits of precision, accuracy, representativeness, completeness, and comparability during routine laboratory operating conditions, using department approved methods" (WAC 173-340-200). When establishing cleanup levels, the MTCA regulations further provide that "In some cases, cleanup levels calculated using the methods specified in this chapter are less than natural background levels or levels that can be reliably measured. In those situations, the cleanup level shall be established at a concentration equal to the practical quantitation limit or natural background concentration, whichever is higher" (WAC 173-340-700(6)(d)).

The objective of this memorandum is to establish the usability of the Phase II data for the purposes of the RI Work Plan Barr is preparing of the Mill Site. The remainder of this memorandum is organized as follows:

- Section 2 – A summary of Barr's QA/QC review of the 2013 Phase II analytical data (Landau, 2013).
- Section 3 – A comparison of the PQLs reported for the 2013 Phase II data set to the standard cleanup levels potentially applicable to the Mill Site (i.e., MTCA A and MTCA B).
- Section 4 – An evaluation of the data from the 2013 Phase II that can be relied upon to judge conformance with standard MTCA cleanup levels for the Mill Site, given the QA/QC review, PQL comparison and planned investigation activities that will be conducted under the RI Work Plan.

2.0 Data Review

The data set in the Phase II report includes 65 soil samples with a total of about 4400 individual analyte results and 38 groundwater samples with a total of about 3500 individual analyte results. Barr performed a QA/QC review of the 2013 Phase II analytical data set. Barr's QA/QC review was performed in accordance with Barr's Standard Operating Procedures (SOPs) for data evaluation, the most recent version of which is in Attachment A to this memo. Barr's QA/QC SOPS are based on the quality assurance elements in The National Functional Guidelines for Organic and Inorganic Data Review (NFG USEPA 2008 and 2010) and are consistent with a Level 2a review. Per USEPA (2009), a Level 2a review is a verification and validation based on completeness and compliance checks of sample receipt conditions and sample-related QC results.

The analyses of samples collected during the 2013 Phase II at the Site were performed by ALS laboratories. Most samples were analyzed at the ALS Global laboratory in Everett, Washington while wood debris samples were analyzed at the ALS Global laboratory in Kelso, Washington. Barr's QA/QC review was performed on all of the lab reports (ALS job numbers EV13060104, EV13060119, EV13060128, EV13080134, and K1308586).

The areas covered by the Barr QA/QC evaluation process were:

- USEPA-recommended holding times and preservation
- Blank sample analyses

- Accuracy data
- Precision data
- Overall assessment of data quality

Any data qualifiers assigned during the evaluation process are Barr-defined qualifiers. The Barr-defined qualifiers were compared to the qualifiers in the data tables included in the 2013 Phase II report (Landau, 2013). Barr and Landau qualified data are discussed below.

The USEPA-recommended holding times were met for all project analyses. The laboratory did not note the dates of extraction; however, the laboratory stated that all holding times were met, and the data were accepted by Barr as meeting the recommended holding times. In addition, a review of the data tables in the Phase II report (Landau, 2013) showed no additional qualifiers not discussed below, indicating that Landau also did not find any holding time exceedances.

Laboratory method blanks were analyzed for target analytes. Analytical results for the method blanks were provided in the reports associated with the data set. Analyte concentration detections in method blank samples were compared against project sample analyte concentrations. In general, any sample analyte concentration less than five times the concentration of that analyte reported in an associated blank sample was qualified as a potential false positive concentration, which is denoted by a "b" qualifier in Tables 1 and 2. This process is consistent with the EPA's NFGs (USEPA, 2008 and 2010). Other multipliers of the method blanks concentrations may be used based on professional judgment (e.g., for a common lab contaminant). Based on Barr's QA/QC review, the reported concentrations of bis(2-ethylhexyl)phthalate in samples FPP-MW-2, FPP-MW-3, and FPP-MW-1 collected in August 2013 are potential false positive values. Bis(2-ethylhexyl)phthalate is considered a common laboratory contaminant. Specifically, the Agency for Toxic Substances and Disease Registry (ATSDR) Toxicological Profile discusses this issue in the Analytical Methods section for this compound (ATSDR, 2002).

> Detection and quantification of very low levels of [bis(2-ethylhexyl)phthalate] DEHP are seriously limited by the presence of this compound as a contaminant in almost all laboratory equipment and reagents. Plastics, glassware, aluminum foil, cork, rubber, glass wool, Teflon sheets, and solvents have all been found to be contaminated (EPA 1988a; Giam et al. 1975; Williams 1973). While efforts have been made to reduce laboratory contamination (Giam et al. 1975; Thuren 1986), DEHP is still reported in laboratory blanks, even with thorough cleaning methods (EPA 1988a; Giam et al. 1975). Therefore, practical sample detection limits are often more than an order of magnitude higher than instrument or method detection limits. The EPA (1988a) reports that DEHP, along with other common phthalate and adipate esters, cannot generally be accurately or precisely measured at concentrations below about 2 ppb, due to blank contamination *(see ATSDR, 2002 for references in this paragraph)*.

As shown in the data tables in the Phase II report (Landau, 2013), Landau indicates the reported concentrations of bis(2-ethylhexyl)phthalate for these same samples that are above the PQL are potential false positives by applying a "U" qualifier in their data tables (Landau defines the "U" qualifier as "Indicates the compounds was not detected at the reported concentration.")

Trip blank samples were collected and analyzed for volatile organic compounds (VOCs) and total petroleum hydrocarbons (TPH) – gasoline during the 2013 sampling events. There were no detections of target compounds reported in the trip blanks.

The review of the accuracy and precision data involved evaluation of laboratory control sample (LCS), matrix spike (MS) samples, surrogate standards, and duplicate sample results. Accuracy was evaluated by comparing laboratory percent recoveries from LCS, MS samples, and surrogate standards to laboratory acceptance criteria. Precision was evaluated by calculating the relative percent difference (RPD) of duplicate sample pairs. The laboratory acceptance criteria were not included in the lab reports however, the laboratory noted any deviations from typical acceptance criteria. As applicable, the laboratory data were compared against the percent recoveries and RPD limits defined in the NFG (USEPA, 2008 and 2010).

LCSs were analyzed with each analytical sample batch as required by the analytical methods. The majority of the percent recoveries met the established laboratory acceptance criteria. The few laboratory deviations were noted. The LCSs analyzed for 4-chloro-3-methylphenol with the June 2013 samples had a percent recovery that was noted by the laboratory as being below the acceptance criteria and the associated sample data was qualified by Barr as "estimated concentration" (*). Similarly, Landau also qualified the same results in the Phase II data tables (Landau, 2013) as estimated with their qualifier (UJ), indicating the analyte was not detected in the sample and that the reported sample reporting limit is an estimate.

Laboratory precision was evaluated by the analysis of LCS duplicates (LCSDs). The precision is determined by the laboratory by calculating the RPDs for the data sample pairs. The RPD formula is as follows:

$$RPD = \frac{|S - D|}{(S + D)/2} \times 100$$

Where: RPD = relative percent difference

S = original sample result

D = duplicate sample result

The calculated RPD for 4-nitrophenol analyzed with the June 2013 samples was noted to be above the laboratory acceptance criteria, but since both the LCS and the LCSD had percent recoveries that displayed acceptable accuracy, the data were not qualified. Also, the calculated RPD (26%) was below the acceptance criteria (50%) included in the NFG Organic Data Review (USEPA, 2008).

MS and MS duplicate (MSD) samples were included with the August 2013 data set. Barr assumed that the previous data reports did not include site-specific MS/MSD data because non-project samples were used by the lab for the data sets. All analytical results for MS/MSD samples presented with the project data were acceptable with no deviations from criteria noted by the laboratory and therefore no qualification was necessary by Barr. In addition, there did not seem to be any qualification by Landau for the MS/MSD sample results based on the data tables in the Phase II (Landau, 2013).

Surrogates are similar to analytes of interest in terms of their chemical composition, extraction, and chromatography but are not typically found in environmental samples. All organic samples (blanks, spiked samples, project samples, QC samples) should contain surrogates. The surrogate recoveries were included with the organic analyses, as required by the method. Depending on the analysis, one or more surrogates are required. Surrogate standard recoveries were evaluated by comparing the percent recoveries to laboratory acceptance criteria with Barr's evaluation based on deviations noted by the laboratory. There were multiple surrogate recovery results that were not compared to acceptance criteria because the sample required a dilution that resulted in the surrogates being diluted outside the calibration range of the analytical instrument. Since dilution is a standard and necessary laboratory procedure, no data were qualified. Also, there were multiple samples that had one semi-volatile organic compound (SVOC) surrogate standard recovery that did not meet the laboratory acceptance criteria; however, no data were qualified by Barr because Method 8270 allows one surrogate per fraction to deviate from the criteria without qualification. Sample FPP-B05-S (15-16.5) had a surrogate recovery that was higher than the laboratory defined acceptable range for VOC (Method 8260) analysis. Both Barr and Landau qualified all sample detections as estimated concentrations (in Table 2, the Barr qualifier is * and the Landau qualifier is J) with a potential high bias. In addition, the surrogate analyzed for method NWTPH-DX had a recovery that was below the acceptance criteria for sample FPP-B31-S (15-16) and the associated TPH-diesel range and TPH-oil range results were qualified as estimated (Barr: *, Landau: UJ TPH-diesel range and J TPH-oil range) with a potential low bias. The remaining surrogate standard recoveries met laboratory acceptance criteria or had deviations that did not result in sample qualification.

Laboratory duplicate sample data were included with the August 2013 data. No deviations were noted when comparing the calculated RPDs to laboratory acceptance criteria.

The data tables included with the 2013 Phase II report (Landau, 2013) included qualification (J) of TPH-diesel range when the laboratory noted that the result may include overlap with TPH-oil range, indicating a potential high bias. Barr would not typically add a qualifier to the lab results because of such an occurrence. Therefore, Barr considers the TPH-diesel analytical results that include overlap with the oil range analytical results to be acceptable and this data will be relied on for the purposes of the RI

Provided below is a summary of the Barr qualified data described above and the impact on the usability of that data:

- There was a limited field QC sample set for the 2013 Phase II investigation (i.e., minimal project matrix spikes, field blanks, or field duplicates; only trip blanks). Additional field QC samples would have helped to ensure that the data quality objectives were met in the sampling process as well as in the laboratory but the absence of additional field QC samples does not diminish the usability of the data.

- The evaluation of the laboratory QC did not include comparison to defined laboratory acceptance criteria but instances where there were deviations were noted by the laboratory. Though many of the spike recoveries were low, they are acceptable when compared to NFG criteria (USEPA 2008, 2010) and were not noted as deviations by the laboratory in the majority of cases.

- Due to concentrations in the blank sample, the PQL for bis(2-ethylhexyl)phthalate in groundwater sample FPP-MW-1, FPP-MW-2, and FPP-MW-3 was raised and reported as a non-detect in the Phase II (Landau, 2013) data tables.

The QA/QC review indicates that the data are acceptable as qualified.

3.0 PQLs Compared to MTCA A and B Cleanup Levels

In addition to the data QA/QC evaluation discussed above, the soil and groundwater sample PQLs included in the Phase II report (Landau, 2013) from the Mill Site were compared against the standard MTCA cleanup levels potentially applicable for the Mill Site (i.e., Method A and Method B). PQLs for soil samples are shown in Table 1 and PQLs for groundwater samples are shown in Table 2. The following parameters had PQLs for some samples above the lowest applicable MTCA Method A and MTCA Method B standard cleanup levels. As noted above, under WAC 173-340-700(6)(d), this does not, in and of itself, mean that the data are not reliable or relevant to investigation and cleanup activities.

For soil:

- Metals (Method EPA 6020A) – Soil samples were analyzed by EPA method 6020 (Inductively Coupled Plasma –Mass Spectrometry [ICP-MS]).
    - The PQL for arsenic was greater than the standard cleanup levels for all samples. The MTCA Method B cancer cleanup level for arsenic of 0.667 mg/kg is less than the PQL of EPA method 6020 of approximately 1.0 mg/kg. However, the naturally occurring background concentrations of arsenic are typically higher than both the MTCA Method B cleanup level and the PQL. The 90th percentile of arsenic in soil in Yakima County is 5.13 mg/kg as reported in Natural Background Soil Metals Concentrations in Washington State, Toxics Cleanup Program, Department of Ecology (Ecology, 1994).
- SVOCs (Method EPA 8270D) –

  - The PQLs for 2,6-dinitrotoluene, 3,3`-dichlorobenzidine, bis(2-chloroethyl)ether, hexachlorobenzene, n-nitrosodimethylamine, n-nitrosodi-n-propylamine, and pentachlorophenol were above the lowest standard cleanup level for sample FPP-B04 (11-12 ft.), which was analyzed after a dilution due to the presence of petroleum constituents.
  - The PQL for n-nitrosodimethylamine (100 ug/Kg) was above the lowest standard cleanup level (19.6 ug/Kg) for all samples.
  - The PQL for n-nitrosodi-n-propylamine (200 ug/Kg for three samples and 1000 ug/Kg for one sample) was above the lowest standard cleanup level (143 ug/Kg) for four samples.

For groundwater:

- Metals (Method EPA 200.8) – Groundwater samples were analyzed by EPA method 200.8 (ICP-MS).

  - The PQL for arsenic (0.5 ug/L) was above the lowest MTCA B cleanup level (0.0583 ug/L) for all of the samples.
  - Typical background concentrations of arsenic (MTCA/SMS Advisory Group, 2010) are greater than both the MTCA B cleanup level and the PQL of method EPA 200.8.
  - Ecology indicates that the MTCA A cleanup level of 5 ug/L is routinely used for arsenic in groundwater.

- SVOCs (Method EPA 8270) –

  - The PQLs for azobenzene, benzo(b)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, bis(2-chloroethyl)ether, bis(2-ethylhexyl)phthalate, 4-chloroaniline, dibenzo(a,h)anthracene, 3,3`-dichlorobenzidine, 2,4-dinitrotoluene, 2,6-dinitrotoluene, hexachlorobenzene, hexachlorobutadiene, hexachloroethane, indeno(1,2,3-cd)pyrene, 1-methylnaphthalene, n-nitrosodimethylamine, n-nitrosodi-n-propylamine, 2,2-oxybis (1-chloropropane), 1,2,4-trichlorobenzene, and pentachlorophenol were above the lowest standard cleanup levels for all samples. With the exception of n-nitrosodimethylamine, all PQLs were about 1500 times higher than the lowest MTCA cleanup level.
  - The samples were analyzed using EPA method 8270. Selected ion monitoring (SIM) was used only for samples MW-09A and MW-12 collected on June 20, 2013.

- VOCs (Method 8260) –

  - The PQLs for 1,1,2,2-tetrachloroethane, 1,1,1,2-tetrachloroethane, 1,1,2-trichloroethane, 1,2,3-trichloropropane, 1,2,4-trichlorobenzene, 1,2-dibromo 3-chloropropane, 1,2-dichloroethane, 1,2-dichloropropane, cis-1,3-dichloropropene, trans- 1,3-dichloropropene, acrylonitrile, benzene, bromodichloromethane, carbon tetrachloride, chlorodibromomethane, chloroform, and hexachlorobutadiene were above the lowest

standard cleanup level for all of the samples. The majority of these compounds had PQLs less than 10 times higher than the lowest standard cleanup level.
    - The samples were analyzed using EPA method 8260 without SIM.

- PCBs (Method EPA 8082) –
    - The PQLs for aroclor 1254 and aroclor 1260 (0.10 ug/L) were greater than the lowest standard cleanup level (0.0438 ug/L) for samples collected from MW-09A and MW-12 on June 20, 2013.
    - PCBs were analyzed by EPA method 8082, which is the standard analytical method for PCB analyses.

- TPH (Method NWTPH-DX) –
    - The PQLs for TPH as diesel for sample FPP-B05 collected on June 19, 2013 and for TPH as diesel and motor oil for sample FPP-B27 collected on August 21, 2013 were greater than the lowest standard cleanup level. The laboratory PQLs were raised due to matrix interferences, as noted by the laboratory. Sample FPP-B05 had the diesel range and motor oil range PQLs raised due to motor oil range product overlap. Sample FPP-B27 had the diesel range PQL raised due to the chromatogram indicating that it is likely the sample contained an unidentified diesel range product and an unidentified oil range product. There was a detection of motor oil above the PQL in sample FPP-B27 collected on August 21, 2013, but diesel was not detected in the sample at a concentration above the elevated PQL.

All of the data is acceptable to judge conformance with MTCA cleanup levels with the exceptions noted above. This data will not be relied upon to judge conformance with MTCA cleanup levels but it does inform Mill Site conditions within the constraints of the analytical methods that were used.

4.0 Conclusions

Barr conducted a QA/QC review of the soil and groundwater analytical data presented in Landau's Phase II Investigation Report (Landau, 2013) to evaluate the usability of the data for the purposes of the RI Work Plan for the Site being prepared by Barr. In general, the QA/QC review showed that the data are considered acceptable as qualified.

With the following exceptions, all data from the Phase II report can be used for judging conformance with MTCA cleanup levels during investigation and cleanup activities based on the results of the QA/QC review and the PQL comparison to cleanup levels. To the extent that specific sample results are not suitable to judge conformance with MTCA cleanup levels, the data does provide useful information as specifically described below.

For soil:

- SVOCs (Method EPA 8270) - PQLs that were raised due to dilution in sample FPP-B04 (11-12 ft.) will not be relied upon for judging conformance with MTCA cleanup levels in preparing the RI Work Plan. The data are useful however in judging that the SVOC concentrations do not exceed the PQLs reported in the analysis. Analysis of soil samples for SVOCs in this area is planned for the RI. SVOC analysis for the Mill Site RI will be completed using Method EPA 8270 (SIM), which will have PQLs below the standard cleanup levels for all SVOCs.

For groundwater:

- SVOCs (Method EPA 8270) – the PQLs for the specific SVOCs listed in Section 3 were above the lowest MTCA cleanup levels. This data will not be relied upon for judging conformance with MTCA cleanup levels in development of the RI Work Plan. The data are useful however in judging that the SVOC concentrations do not exceed the PQLs reported in the analysis. Site-wide groundwater sampling with analysis for SVOCs will be included in the RI Work Plan. Groundwater samples will be analyzed by Method EPA 8270 (SIM) for assessment of SVOCs. The PQLs for SVOCs are all less than the lowest cleanup levels with analysis by Method EPA 8270 (SIM) as shown in the draft Quality Assurance Project Plan (QAPP) for the RI that Barr previously submitted to Ecology.

- VOCs (Method EPA 8260) – the PQLs for the specific VOCs listed in Section 3 were above the lowest MTCA cleanup levels. This data will not be relied upon for judging conformance with MTCA cleanup levels in development of the RI Work Plan. The data are useful however in judging that the VOC concentrations do not exceed the PQLs reported in the analysis. Site-wide groundwater sampling with analysis for VOCs will be included in the RI Work Plan. Groundwater samples will be analyzed by EPA method 8260 (SIM) for assessment of VOCs. As described in the previously submitted draft QAPP, the PQLs for all VOCs are less than the lowest standard MTCA cleanup level with analysis by EPA method 8260 (SIM), with the exception of 1,2,3-trichloropropane, 1,3-dichloropropene-cis, and 1,3,-dichloropropene-trans. No Ecology approved analytical methods are available with PQLs below the lowest MTCA cleanup levels for these three compounds.

- TPH (Method NWTPH-DX) – the PQLs for TPH as diesel for samples FPP-B04 collected on June 13, 2013 and FPP-B27 collected on August 21, 2013 were above the MTCA cleanup levels. TPH as diesel was not reported in these samples. This data will not be relied upon to judge conformance with MTCA cleanup levels in development of the RI Work Plan. The data are useful however in judging that the TPH concentrations do not exceed the PQLs reported in the analysis. Groundwater sampling with analysis for TPH will be conducted in this area as part of the RI using method NWTPH-Gx and NWTPH-Dx, which should have PQLs below the MTCA cleanup levels.

Samples not specifically discussed above will be considered useable to judge conformance with MTCA cleanup levels.

5.0 References

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6.0 Attachments

Table 1 – Historical Soil Data Review – 2013 Landau PQLs vs MTCA cleanup levels

Table 2 – Historical Groundwater Data Review – 2013 Landau PQLs vs MTCA cleanup levels

Attachment A – Barr Data Evaluation Standard Operating Procedures

Table 1
Historical Soil Data Review - 2013 Landau PQLs vs. MTCA Cleanup Levels
Yakima Mill Site

Location					FPP-B01		FPP-B01		FPP-B02		FPP-B02		FPP-B03		FPP-B03		FPP-B04		FPP-B04		FPP-B05		FPP-B05		FPP-B06	
Date					6/18/2013		6/18/2013		6/19/2013		6/19/2013		6/18/2013		6/18/2013		6/18/2013		6/18/2013		6/19/2013		6/19/2013		6/18/2013	
Depth					0.5 - 1.5 ft		12 - 13 ft		1 - 2 ft		14 - 15.5 ft		0.5 - 2 ft		13 - 14 ft		11 - 12 ft		21 - 22 ft		15 - 16.5 ft		22.5 - 24 ft		15 - 16 ft	
Sample Type					N		N		N		N		N		N		N		N		N		N		N	
Result Type					PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result
Data Status					SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource
Parameter	Analysis Location	Washington Method A Unrestricted Land Use	Washington Method B Cancer Direct Contact	Washington Method B Noncancer Direct Contact																						
Effective Date		07/01/2015	07/01/2015	07/01/2015																						
Exceedance Key		No Exceedances	Shade	No Exceedances																						
General Parameters																										
Carbon, total organic	%				--	--	--	--	--	--	0.10	ND	--	--	--	--	--	--	--	--	0.10	0.65	--	--	--	--
pH	pH units				--	--	--	--	--	--	1.0	8.58	--	--	--	--	--	--	--	--	1.0	7.11	--	--	--	--
Solids, percent	%				--	--	--	--	--	--	0	92.3	--	--	--	--	--	--	--	--	0	90.5	--	--	--	--
Metals																										
Arsenic	mg/kg	20	0.667	24	1.0	2.5	1.0	2.0	1.0	2.2	1.0	2.0	1.0	2.5	1.0	2.3	1.0	2.2	1.3	4.7	1.0	2.3	1.0	1.4	1.0	2.5
Cadmium	mg/kg	2		80	0.50	ND	0.50	ND	0.50	ND	0.50	ND	0.50	ND	0.50	ND	0.50	ND	0.50	ND	0.50	ND	0.50	ND	0.50	ND
Chromium	mg/kg				0.50	15	0.50	10	0.50	13	0.50	8.8	0.50	18	0.50	14	0.50	28	0.64	17	0.50	14	0.50	16	0.50	39
Chromium, hexavalent	mg/kg	19		240	--	--	--	--	--	--	5.0	ND	--	--	--	--	--	--	--	--	5.0	ND	--	--	--	--
Iron	mg/kg			56000	50	23000	50	20000	50	21000	50	21000	50	24000	50	23000	50	26000	58	20000	50	22000	50	22000	50	22000
Lead	mg/kg	250			0.50	14	0.50	2.7	0.50	15	0.50	3.2	0.50	8.5	0.50	2.8	0.50	3.5	0.50	14	0.50	4.8	0.50	2.4	0.50	4.0
Manganese	mg/kg			11200	0.50	360	0.50	370	0.50	350	0.50	360	0.50	350	0.50	350	0.50	300	0.50	250	0.50	300	0.50	250	0.50	280
Mercury	mg/kg	2			0.020	0.040	0.020	0.033	0.020	0.040	0.020	0.031	0.020	0.036	0.020	0.024	0.020	0.028	0.020	0.035	0.020	0.028	0.020	ND	0.020	0.037
SVOCs																										
1,2,4-Trichlorobenzene	ug/kg		34500	800000	100	ND	--	--	100	ND	100	ND	100	ND	--	--	1000	ND	--	--	200	ND	100	ND	--	--
1,2-Dichlorobenzene	ug/kg			7200000	100	ND	--	--	100	ND	100	ND	100	ND	--	--	1000	ND	--	--	200	ND	100	ND	--	--
1,3-Dichlorobenzene	ug/kg				100	ND	--	--	100	ND	100	ND	100	ND	--	--	1000	ND	--	--	200	ND	100	ND	--	--
1,4-Dichlorobenzene	ug/kg		185000	5600000	100	ND	--	--	100	ND	100	ND	100	ND	--	--	1000	ND	--	--	200	ND	100	ND	--	--
1-Methylnaphthalene	ug/kg		34500	5600000	10	19	--	--	10	16	10	ND	10	ND	--	--	100	ND	--	--	20	ND	10	ND	--	--
2,2'-oxybis (1-chloropropane)	ug/kg		14300	3200000	100	ND	--	--	100	ND	100	ND	100	ND	--	--	1000	ND	--	--	200	ND	100	ND	--	--
2,3,4,6-Tetrachlorophenol	ug/kg			2400000	250	ND	--	--	250	ND	250	ND	250	ND	--	--	2500	ND	--	--	500	ND	250	ND	--	--
2,4,5-Trichlorophenol	ug/kg			8000000	100	ND	--	--	100	ND	100	ND	100	ND	--	--	1000	ND	--	--	200	ND	100	ND	--	--
2,4,6-Trichlorophenol	ug/kg		90900	80000	100	ND	--	--	100	ND	100	ND	100	ND	--	--	1000	ND	--	--	200	ND	100	ND	--	--
2,4-Dichlorophenol	ug/kg			240000	100	ND	--	--	100	ND	100	ND	100	ND	--	--	1000	ND	--	--	200	ND	100	ND	--	--
2,4-Dimethylphenol	ug/kg			1600000	100	ND	--	--	100	ND	100	ND	100	ND	--	--	1000	ND	--	--	200	ND	100	ND	--	--
2,4-Dinitrophenol	ug/kg			160000	250	ND	--	--	250	ND	250	ND	250	ND	--	--	2500	ND	--	--	500	ND	250	ND	--	--
2,4-Dinitrotoluene	ug/kg		3230	160000	250	ND	--	--	250	ND	250	ND	250	ND	--	--	2500	ND	--	--	500	ND	250	ND	--	--
2,6-Dichlorophenol	ug/kg				100	ND	--	--	100	ND	100	ND	100	ND	--	--	1000	ND	--	--	200	ND	100	ND	--	--
2,6-Dinitrotoluene	ug/kg		667	24000	250	ND	--	--	250	ND	250	ND	250	ND	--	--	2500	ND	--	--	500	ND	250	ND	--	--
2-Chloronaphthalene	ug/kg			6400000	100	ND	--	--	100	ND	100	ND	100	ND	--	--	1000	ND	--	--	200	ND	100	ND	--	--
2-Chlorophenol	ug/kg			400000	100	ND	--	--	100	ND	100	ND	100	ND	--	--	1000	ND	--	--	200	ND	100	ND	--	--
2-Methyl-4,6-dinitrophenol	ug/kg				100	ND	--	--	100	ND	100	ND	100	ND	--	--	1000	ND	--	--	200	ND	100	ND	--	--
2-Methylnaphthalene	ug/kg			320000	10	28	--	--	10	25	10	ND	10	ND	--	--	100	ND	--	--	20	ND	10	ND	--	--
2-Methylphenol (o-cresol)	ug/kg			4000000	100	ND	--	--	100	ND	100	ND	100	ND	--	--	1000	ND	--	--	200	ND	100	ND	--	--
2-Nitroaniline	ug/kg			800000	250	ND	--	--	250	ND	250	ND	250	ND	--	--	2500	ND	--	--	500	ND	250	ND	--	--
2-Nitrophenol	ug/kg				250	ND	--	--	250	ND	250	ND	250	ND	--	--	2500	ND	--	--	500	ND	250	ND	--	--
3,3`-Dichlorobenzidine	ug/kg		2220		250	ND	--	--	250	ND	250	ND	250	ND	--	--	2500	ND	--	--	500	ND	250	ND	--	--
3,4-Methylphenol (m,p cresols)	ug/kg				100	ND	--	--	100	ND	100	ND	100	ND	--	--	1000	ND	--	--	200	ND	100	ND	--	--
3-Nitroaniline	ug/kg				250	ND	--	--	250	ND	250	ND	250	ND	--	--	2500	ND	--	--	500	ND	250	ND	--	--
4-Bromophenyl phenyl ether	ug/kg				100	ND	--	--	100	ND	100	ND	100	ND	--	--	1000	ND	--	--	200	ND	100	ND	--	--
4-Chloro-3-methylphenol	ug/kg				100	ND	--	--	100	ND	100	ND	100	ND	--	--	1000	ND	--	--	200	ND	100	ND	--	--
4-Chloroaniline	ug/kg		5000	320000	100	ND	--	--	100	ND	100	ND	100	ND	--	--	1000	ND	--	--	200	ND	100	ND	--	--
4-Chlorophenyl phenyl ether	ug/kg				100	ND	--	--	100	ND	100	ND	100	ND	--	--	1000	ND	--	--	200	ND	100	ND	--	--
4-Nitroaniline	ug/kg				250	ND	--	--	250	ND	250	ND	250	ND	--	--	2500	ND	--	--	500	ND	250	ND	--	--
4-Nitrophenol	ug/kg				500	ND	--	--	500	ND	500	ND	500	ND	--	--	5000	ND	--	--	1000	ND	500	ND	--	--
Acenaphthene	ug/kg			4800000	10	ND	--	--	10	ND	10	ND	10	ND	--	--	100	ND	--	--	20	ND	10	ND	--	--
Acenaphthylene	ug/kg				10	19	--	--	10	31	10	ND	10	ND	--	--	100	ND	--	--	20	ND	10	ND	--	--
Aniline	ug/kg		175000	560000	100	ND	--	--	100	ND	100	ND	100	ND	--	--	1000	ND	--	--	200	ND	100	ND	--	--
Anthracene	ug/kg			24000000	10	ND	--	--	10	18	10	ND	10	ND	--	--	100	ND	--	--	20	ND	10	ND	--	--
Azobenzene	ug/kg		9090		100	ND	--	--	100	ND	100	ND	100	ND	--	--	1000	ND	--	--	200	ND	100	ND	--	--
Benz(a)anthracene	ug/kg		1370		10	13	--	--	10	28	10	ND	10	ND	--	--	100	ND	--	--	20	ND	10	ND	--	--
Benzo(a)pyrene	ug/kg	100	137		10	14	--	--	10	30	10	ND	10	ND	--	--	100	ND	--	--	20	ND	10	ND	--	--
Benzo(b)fluoranthene	ug/kg		1370		10	19	--	--	10	29	10	ND	10	ND	--	--	100	ND	--	--	20	ND	10	ND	--	--
Benzo(g,h,i)perylene	ug/kg				10	19	--	--	10	29	10	ND	10	ND	--	--	100	ND	--	--	20	ND	10	ND	--	--
Benzo(k)fluoranthene	ug/kg		13700		10	11	--	--	10	19	10	ND	10	ND	--	--	100	ND	--	--	20	ND	10	ND	--	--
Benzoic acid	ug/kg			320000000	1000	ND	--	--	1000	ND	1000	ND	1000	ND	--	--	10000	ND	--	--	2000	ND	1000	ND	--	--
Benzyl alcohol	ug/kg			8000000	100	ND	--	--	100	ND	100	ND	100	ND	--	--	1000	ND	--	--	200	ND	100	ND	--	--
Bis(2-chloroethoxy)methane	ug/kg				100	ND	--	--	100	ND	100	ND	100	ND	--	--	1000	ND	--	--	200	ND	100	ND	--	--
Bis(2-chloroethyl)ether	ug/kg		909		100	ND	--	--	100	ND	100	ND	100	ND	--	--	1000	ND	--	--	200	ND	100	ND	--	--
Bis(2-ethylhexyl)phthalate	ug/kg		71400	1600000	130	ND	--	--	130	ND	130	ND	130	ND	--	--	1300	ND	--	--	260	ND	130	ND	--	--

Table 1
Historical Soil Data Review - 2013 Landau PQLs vs. MTCA Cleanup Levels
Yakima Mill Site

				Location	FPP-B01		FPP-B01		FPP-B02		FPP-B02		FPP-B03		FPP-B03		FPP-B04		FPP-B04		FPP-B05		FPP-B05		FPP-B06	
				Date	6/18/2013		6/18/2013		6/19/2013		6/19/2013		6/18/2013		6/18/2013		6/18/2013		6/18/2013		6/19/2013		6/19/2013		6/18/2013	
				Depth	0.5 - 1.5 ft		12 - 13 ft		1 - 2 ft		14 - 15.5 ft		0.5 - 2 ft		13 - 14 ft		11 - 12 ft		21 - 22 ft		15 - 16.5 ft		22.5 - 24 ft		15 - 16 ft	
				Sample Type	N		N		N		N		N		N		N		N		N		N		N	
				Result Type	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result
				Data Status	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource
Parameter	Analysis Location	Washington Method A Unrestricted Land Use	Washington Method B Cancer Direct Contact	Washington Method B Noncancer Direct Contact																						
Effective Date		07/01/2015	07/01/2015	07/01/2015																						
Exceedance Key		No Exceedances	Shade	No Exceedances																						
Butyl benzyl phthalate	ug/kg		526000	16000000	100	ND	--	--	100	ND	100	ND	100	ND	--	--	1000	ND	--	--	200	ND	100	ND	--	--
Carbazole	ug/kg				100	ND	--	--	100	ND	100	ND	100	ND	--	--	1000	ND	--	--	200	ND	100	ND	--	--
Chrysene	ug/kg		137000		10	21	--	--	10	33	10	ND	10	ND	--	--	100	ND	--	--	20	ND	10	ND	--	--
Dibenz(a,h)anthracene	ug/kg		137		10	ND	--	--	10	ND	10	ND	10	ND	--	--	100	ND	--	--	20	ND	10	ND	--	--
Dibenzofuran	ug/kg			80000	100	ND	--	--	100	ND	100	ND	100	ND	--	--	1000	ND	--	--	200	ND	100	ND	--	--
Diethyl phthalate	ug/kg			64000000	100	ND	--	--	100	ND	100	ND	100	ND	--	--	1000	ND	--	--	200	ND	100	ND	--	--
Dimethyl phthalate	ug/kg				100	ND	--	--	100	ND	100	ND	100	ND	--	--	1000	ND	--	--	200	ND	100	ND	--	--
Di-n-butyl phthalate	ug/kg			8000000	130	ND	--	--	130	ND	130	ND	130	ND	--	--	1300	ND	--	--	260	ND	130	ND	--	--
Di-n-octyl phthalate	ug/kg			800000	100	ND	--	--	100	ND	100	ND	100	ND	--	--	1000	ND	--	--	200	ND	100	ND	--	--
Fluoranthene	ug/kg			3200000	10	49	--	--	10	92	10	ND	10	10	--	--	100	ND	--	--	20	ND	10	ND	--	--
Fluorene	ug/kg			3200000	10	ND	--	--	10	12	10	ND	10	ND	--	--	100	ND	--	--	20	ND	10	ND	--	--
Hexachlorobenzene	ug/kg		625	64000	100	ND	--	--	100	ND	100	ND	100	ND	--	--	1000	ND	--	--	200	ND	100	ND	--	--
Hexachlorobutadiene	ug/kg		12800	80000	100	ND	--	--	100	ND	100	ND	100	ND	--	--	1000	ND	--	--	200	ND	100	ND	--	--
Hexachlorocyclopentadiene	ug/kg			480000	500	ND	--	--	500	ND	500	ND	500	ND	--	--	5000	ND	--	--	1000	ND	500	ND	--	--
Hexachloroethane	ug/kg		25000	56000	100	ND	--	--	100	ND	100	ND	100	ND	--	--	1000	ND	--	--	200	ND	100	ND	--	--
Indeno(1,2,3-cd)pyrene	ug/kg		1370		10	12	--	--	10	18	10	ND	10	ND	--	--	100	ND	--	--	20	ND	10	ND	--	--
Isophorone	ug/kg		1053000	16000000	100	ND	--	--	100	ND	100	ND	100	ND	--	--	1000	ND	--	--	200	ND	100	ND	--	--
Naphthalene	ug/kg	5000		1600000	10	52	--	--	10	67	10	ND	10	ND	--	--	100	ND	--	--	20	ND	10	ND	--	--
Nitrobenzene	ug/kg			160000	100	ND	--	--	100	ND	100	ND	100	ND	--	--	1000	ND	--	--	200	ND	100	ND	--	--
n-Nitrosodimethylamine	ug/kg		19.6	640	100	ND	--	--	100	ND	100	ND	100	ND	--	--	1000	ND	--	--	200	ND	100	ND	--	--
n-Nitrosodi-n-propylamine	ug/kg		143		100	ND	--	--	100	ND	100	ND	100	ND	--	--	1000	ND	--	--	200	ND	100	ND	--	--
n-Nitrosodiphenylamine	ug/kg		204000		100	ND	--	--	100	ND	100	ND	100	ND	--	--	1000	ND	--	--	200	ND	100	ND	--	--
Pentachlorophenol	ug/kg		2500	400000	500	ND	--	--	500	ND	500	ND	500	ND	--	--	5000	ND	--	--	1000	ND	500	ND	--	--
Phenanthrene	ug/kg				10	51	--	--	10	89	10	ND	10	ND	--	--	100	ND	--	--	20	ND	10	ND	--	--
Phenol	ug/kg			24000000	100	ND	--	--	100	ND	100	ND	100	ND	--	--	1000	ND	--	--	200	ND	100	ND	--	--
Pyrene	ug/kg			2400000	10	53	--	--	10	110	10	ND	10	ND	--	--	100	ND	--	--	20	ND	10	ND	--	--
Pyridine	ug/kg			80000	200	ND	--	--	200	ND	200	ND	200	ND	--	--	2000	ND	--	--	400	ND	200	ND	--	--
VOCs																										
1,1,1,2-Tetrachloroethane	ug/kg		38500	2400000	10	ND	--	--	10	ND	10	ND	10	ND	--	--	10	ND	--	--	10	ND	10	ND	--	--
1,1,1-Trichloroethane	ug/kg	2000		160000000	10	ND	--	--	10	ND	10	ND	10	ND	--	--	10	ND	--	--	10	ND	10	ND	--	--
1,1,2,2-Tetrachloroethane	ug/kg		5000	1600000	10	ND	--	--	10	ND	10	ND	10	ND	--	--	10	ND	--	--	10	ND	10	ND	--	--
1,1,2-Trichloroethane	ug/kg		17500	320000	10	ND	--	--	10	ND	10	ND	10	ND	--	--	10	ND	--	--	10	ND	10	ND	--	--
1,1-Dichloroethane	ug/kg		175000	16000000	10	ND	--	--	10	ND	10	ND	10	ND	--	--	10	ND	--	--	10	ND	10	ND	--	--
1,1-Dichloroethylene	ug/kg			4000000	10	ND	--	--	10	ND	10	ND	10	ND	--	--	10	ND	--	--	10	ND	10	ND	--	--
1,1-Dichloropropene	ug/kg				10	ND	--	--	10	ND	10	ND	10	ND	--	--	10	ND	--	--	10	ND	10	ND	--	--
1,2,3-Trichlorobenzene	ug/kg				10	ND	--	--	10	ND	10	ND	10	ND	--	--	10	ND	--	--	10	ND	10	ND	--	--
1,2,3-Trichloropropane	ug/kg		33.3	320000	10	ND	--	--	10	ND	10	ND	10	ND	--	--	10	ND	--	--	10	ND	10	ND	--	--
1,2,4-Trichlorobenzene	ug/kg		34500	800000	10	ND	--	--	10	ND	10	ND	10	ND	--	--	10	ND	--	--	10	ND	10	ND	--	--
1,2,4-Trimethylbenzene	ug/kg				10	ND	--	--	10	ND	10	ND	10	ND	--	--	10	ND	--	--	10	41 J*	10	ND	--	--
1,2-Dibromo-3-chloropropane (DBCP)	ug/kg		1250	16000	50	ND	--	--	50	ND	50	ND	50	ND	--	--	50	ND	--	--	50	ND	50	ND	--	--
1,2-Dibromoethane (EDB)	ug/kg	5.00	500	720000	5.0	ND	--	--	5.0	ND	5.0	ND	5.0	ND	--	--	5.0	ND	--	--	5.0	ND	5.0	ND	--	--
1,2-Dichlorobenzene	ug/kg			7200000	10	ND	--	--	10	ND	10	ND	10	ND	--	--	10	ND	--	--	10	ND	10	ND	--	--
1,2-Dichloroethane	ug/kg		11000	480000	10	ND	--	--	10	ND	10	ND	10	ND	--	--	10	ND	--	--	10	ND	10	ND	--	--
1,2-Dichloroethylene, cis	ug/kg			160000	10	ND	--	--	10	ND	10	ND	10	ND	--	--	10	ND	--	--	10	ND	10	ND	--	--
1,2-Dichloroethylene, trans	ug/kg			1600000	10	ND	--	--	10	ND	10	ND	10	ND	--	--	10	ND	--	--	10	ND	10	ND	--	--
1,2-Dichloropropane	ug/kg		27800	7200000	10	ND	--	--	10	ND	10	ND	10	ND	--	--	10	ND	--	--	10	ND	10	ND	--	--
1,3,5-Trimethylbenzene	ug/kg			800000	10	ND	--	--	10	ND	10	ND	10	ND	--	--	10	ND	--	--	10	22 J*	10	ND	--	--
1,3-Dichlorobenzene	ug/kg				10	ND	--	--	10	ND	10	ND	10	ND	--	--	10	ND	--	--	10	ND	10	ND	--	--
1,3-Dichloropropane	ug/kg				10	ND	--	--	10	ND	10	ND	10	ND	--	--	10	ND	--	--	10	ND	10	ND	--	--
1,3-Dichloropropene, cis	ug/kg		10000	2400000	10	ND	--	--	10	ND	10	ND	10	ND	--	--	10	ND	--	--	10	ND	10	ND	--	--
1,3-Dichloropropene, trans	ug/kg		10000	2400000	10	ND	--	--	10	ND	10	ND	10	ND	--	--	10	ND	--	--	10	ND	10	ND	--	--
1,4-Dichlorobenzene	ug/kg		185000	5600000	10	ND	--	--	10	ND	10	ND	10	ND	--	--	10	ND	--	--	10	ND	10	ND	--	--
2,2-Dichloropropane	ug/kg				10	ND	--	--	10	ND	10	ND	10	ND	--	--	10	ND	--	--	10	ND	10	ND	--	--
2-Hexanone	ug/kg				50	ND	--	--	50	ND	50	ND	50	ND	--	--	50	ND	--	--	50	ND	50	ND	--	--
Acetone	ug/kg			72000000	50	ND	--	--	50	ND	50	ND	50	ND	--	--	50	ND	--	--	50	ND	50	ND	--	--
Acrylonitrile	ug/kg		1850	3200000	50	ND	--	--	50	ND	50	ND	50	ND	--	--	50	ND	--	--	50	ND	50	ND	--	--
Benzene	ug/kg	30.0	18200	320000	5.0	ND	--	--	5.0	ND	5.0	ND	5.0	ND	--	--	5.0	ND	--	--	5.0	ND	5.0	ND	--	--
Bromobenzene	ug/kg				10	ND	--	--	10	ND	10	ND	10	ND	--	--	10	ND	--	--	10	ND	10	ND	--	--
Bromochloromethane	ug/kg				10	ND	--	--	10	ND	10	ND	10	ND	--	--	10	ND	--	--	10	ND	10	ND	--	--
Bromodichloromethane	ug/kg		16100	1600000	10	ND	--	--	10	ND	10	ND	10	ND	--	--	10	ND	--	--	10	ND	10	ND	--	--

Table 1
Historical Soil Data Review - 2013 Landau PQLs vs. MTCA Cleanup Levels
Yakima Mill Site

				Location	FPP-B01		FPP-B01		FPP-B02		FPP-B02		FPP-B03		FPP-B03		FPP-B04		FPP-B04		FPP-B05		FPP-B05		FPP-B06	
				Date	6/18/2013		6/18/2013		6/19/2013		6/19/2013		6/18/2013		6/18/2013		6/18/2013		6/18/2013		6/19/2013		6/19/2013		6/18/2013	
				Depth	0.5 - 1.5 ft		12 - 13 ft		1 - 2 ft		14 - 15.5 ft		0.5 - 2 ft		13 - 14 ft		11 - 12 ft		21 - 22 ft		15 - 16.5 ft		22.5 - 24 ft		15 - 16 ft	
				Sample Type	N		N		N		N		N		N		N		N		N		N		N	
				Result Type	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result
				Data Status	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource
Parameter	Analysis Location	Washington Method A Unrestricted Land Use	Washington Method B Cancer Direct Contact	Washington Method B Noncancer Direct Contact																						
Effective Date		07/01/2015	07/01/2015	07/01/2015																						
Exceedance Key		No Exceedances	Shade	No Exceedances																						
Bromoform	ug/kg		127000	1600000	10	ND	--	--	10	ND	10	ND	10	ND	--	--	10	ND	--	--	10	ND	10	ND	--	--
Bromomethane	ug/kg			112000	10	ND	--	--	10	ND	10	ND	10	ND	--	--	10	ND	--	--	10	ND	10	ND	--	--
Butylbenzene	ug/kg			4000000	10	ND	--	--	10	ND	10	ND	10	ND	--	--	10	ND	--	--	10	12 J*	10	ND	--	--
Butylbenzene, sec	ug/kg			8000000	10	ND	--	--	10	ND	10	ND	10	ND	--	--	10	ND	--	--	10	ND	10	ND	--	--
Butylbenzene, tert	ug/kg			8000000	10	ND	--	--	10	ND	10	ND	10	ND	--	--	10	ND	--	--	10	ND	10	ND	--	--
Carbon disulfide	ug/kg			8000000	10	ND	--	--	10	ND	10	ND	10	ND	--	--	10	ND	--	--	10	ND	10	ND	--	--
Carbon tetrachloride	ug/kg		14300	320000	10	ND	--	--	10	ND	10	ND	10	ND	--	--	10	ND	--	--	10	ND	10	ND	--	--
Chlorobenzene	ug/kg			1600000	10	ND	--	--	10	ND	10	ND	10	ND	--	--	10	ND	--	--	10	ND	10	ND	--	--
Chlorodibromomethane	ug/kg		11900	1600000	10	ND	--	--	10	ND	10	ND	10	ND	--	--	10	ND	--	--	10	ND	10	ND	--	--
Chloroethane	ug/kg				10	ND	--	--	10	ND	10	ND	10	ND	--	--	10	ND	--	--	10	ND	10	ND	--	--
Chloroform	ug/kg		32300	800000	10	ND	--	--	10	ND	10	ND	10	ND	--	--	10	ND	--	--	10	ND	10	ND	--	--
Chloromethane	ug/kg				10	ND	--	--	10	ND	10	ND	10	ND	--	--	10	ND	--	--	10	ND	10	ND	--	--
Chlorotoluene, o	ug/kg			1600000	10	ND	--	--	10	ND	10	ND	10	ND	--	--	10	ND	--	--	10	ND	10	ND	--	--
Chlorotoluene, p	ug/kg				10	ND	--	--	10	ND	10	ND	10	ND	--	--	10	ND	--	--	10	ND	10	ND	--	--
Cumene (isopropyl benzene)	ug/kg			8000000	10	ND	--	--	10	ND	10	ND	10	ND	--	--	10	ND	--	--	10	ND	10	ND	--	--
Cymene p- (toluene isopropyl p-)	ug/kg				10	ND	--	--	10	ND	10	ND	10	ND	--	--	10	ND	--	--	10	11 J*	10	ND	--	--
Dibromomethane (methylene bromide)	ug/kg			800000	10	ND	--	--	10	ND	10	ND	10	ND	--	--	10	ND	--	--	10	ND	10	ND	--	--
Dichlorodifluoromethane (Freon-12)	ug/kg			16000000	10	ND	--	--	10	ND	10	ND	10	ND	--	--	10	ND	--	--	10	ND	10	ND	--	--
Ethyl benzene	ug/kg	6000		8000000	10	ND	--	--	10	ND	10	ND	10	ND	--	--	10	ND	--	--	10	ND	10	ND	--	--
Hexachlorobutadiene	ug/kg		12800	80000	10	ND	--	--	10	ND	10	ND	10	ND	--	--	10	ND	--	--	10	ND	10	ND	--	--
Methyl ethyl ketone (2-butanone)	ug/kg			48000000	50	ND	--	--	50	ND	50	ND	50	ND	--	--	50	ND	--	--	50	ND	50	ND	--	--
Methyl isobutyl ketone (MIBK)	ug/kg			6400000	50	ND	--	--	50	ND	50	ND	50	ND	--	--	50	ND	--	--	50	ND	50	ND	--	--
Methyl tertiary butyl ether (MTBE)	ug/kg	100	556000		10	ND	--	--	10	ND	10	ND	10	ND	--	--	10	ND	--	--	10	ND	10	ND	--	--
Methylene chloride	ug/kg	20.0	500000	480000	20	ND	--	--	20	ND	20	ND	20	ND	--	--	20	ND	--	--	20	ND	20	ND	--	--
Naphthalene	ug/kg	5000		1600000	10	ND	--	--	10	ND	10	ND	10	ND	--	--	10	ND	--	--	10	ND	10	ND	--	--
Propylbenzene	ug/kg			8000000	10	ND	--	--	10	ND	10	ND	10	ND	--	--	10	ND	--	--	10	ND	10	ND	--	--
Styrene	ug/kg			16000000	10	ND	--	--	10	ND	10	ND	10	ND	--	--	10	ND	--	--	10	ND	10	ND	--	--
Tetrachloroethylene	ug/kg	50.0	476000	480000	10	ND	--	--	10	ND	10	ND	10	ND	--	--	10	ND	--	--	10	ND	10	ND	--	--
Toluene	ug/kg	7000		6400000	10	ND	--	--	10	ND	10	ND	10	ND	--	--	10	ND	--	--	10	ND	10	ND	--	--
Trichloroethylene (TCE)	ug/kg	30.0	12000	40000	10	ND	--	--	10	ND	10	ND	10	ND	--	--	10	ND	--	--	10	ND	10	ND	--	--
Trichlorofluoromethane (Freon-11)	ug/kg			24000000	10	ND	--	--	10	ND	10	ND	10	ND	--	--	10	ND	--	--	10	ND	10	ND	--	--
Vinyl chloride	ug/kg			240000	10	ND	--	--	10	ND	10	ND	10	ND	--	--	10	ND	--	--	10	ND	10	ND	--	--
Xylene, m & p	ug/kg			16000000	20	ND	--	--	20	ND	20	ND	20	ND	--	--	20	ND	--	--	20	ND	20	ND	--	--
Xylene, o	ug/kg			16000000	10	ND	--	--	10	ND	10	ND	10	ND	--	--	10	ND	--	--	10	ND	10	ND	--	--
PCBs																										
Aroclor 1016	mg/kg		14.3	5.6	0.10	ND	--	--	--	--	0.10	ND	0.10	ND	--	--	0.10	ND	--	--	0.10	ND	0.10	ND	--	--
Aroclor 1221	mg/kg				0.10	ND	--	--	--	--	0.10	ND	0.10	ND	--	--	0.10	ND	--	--	0.10	ND	0.10	ND	--	--
Aroclor 1232	mg/kg				0.10	ND	--	--	--	--	0.10	ND	0.10	ND	--	--	0.10	ND	--	--	0.10	ND	0.10	ND	--	--
Aroclor 1242	mg/kg				0.10	ND	--	--	--	--	0.10	ND	0.10	ND	--	--	0.10	ND	--	--	0.10	ND	0.10	ND	--	--
Aroclor 1248	mg/kg				0.10	ND	--	--	--	--	0.10	ND	0.10	ND	--	--	0.10	ND	--	--	0.10	ND	0.10	ND	--	--
Aroclor 1254	mg/kg		0.5	1.6	0.10	ND	--	--	--	--	0.10	ND	0.10	ND	--	--	0.10	ND	--	--	0.10	ND	0.10	ND	--	--
Aroclor 1260	mg/kg		0.5		0.10	ND	--	--	--	--	0.10	ND	0.10	ND	--	--	0.10	ND	--	--	0.10	ND	0.10	ND	--	--
Aroclor 1268	mg/kg				0.10	ND	--	--	--	--	0.10	ND	0.10	ND	--	--	0.10	ND	--	--	0.10	ND	0.10	ND	--	--
Total Petroleum Hydrocarbons																										
Total Petroleum Hydrocarbons (as diesel)	mg/kg	2000			25	ND	25	ND	25	ND	25	ND	25	ND	25	ND	250	ND	25	ND	100	ND	25	ND	50	ND
Total Petroleum Hydrocarbons (as gasoline)	mg/kg	30.0			3.0	ND	3.0	ND	3.0	6.2	3.0	ND	--	--	--	--	3.0	ND	3.0	ND	3.0	24	3.0	ND	--	--
Total Petroleum Hydrocarbons (as motor oil)	mg/kg	2000			50	130	50	ND	50	190	50	ND	50	ND	50	ND	500	9400	50	710	200	4500	50	500	100	2100

Barr qualifier - *: Estimated value, QA/QC criteria not met.
Landau qualifier - J: Indicates the analyte was positively identified; the associated numerical value is the approximate concentration of the analyte in the sample.
N: Normal Sample.
FD: Field Duplicate Sample.
ND: Not detected.
PQL: Practical Quantitation Limit.
SSource: Laboratory and/or field data obtained from a secondary source external to Barr. Second source QA/QC evaluation procedures may or may not have been performed beyond the original data generator.

11-06-2017

Table 1
Historical Soil Data Review - 2013 Landau PQLs vs. MTCA Cleanup Levels
Yakima Mill Site

				Location	FPP-B07		FPP-B07		FPP-B08		FPP-B09		FPP-B09		FPP-B10		FPP-B10		FPP-B11		FPP-B11		FPP-B12		FPP-B13	
				Date	6/19/2013		6/19/2013		6/18/2013		6/19/2013		6/19/2013		6/18/2013		6/18/2013		6/18/2013		6/18/2013		6/17/2013		6/17/2013	
				Depth	0.5 - 1 ft		15 - 16 ft		5 - 6.5 ft		12 - 13 ft		15 - 16.5 ft		10 - 11 ft		15 - 16 ft		18 - 19 ft		22 - 23 ft		6 - 7 ft		12 - 14.5 ft	
				Sample Type	N		N		N		N		N		N		N		N		N		N		N	
				Result Type	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result
				Data Status	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource
Parameter	Analysis Location	Washington Method A Unrestricted Land Use	Washington Method B Cancer Direct Contact	Washington Method B Noncancer Direct Contact																						
Effective Date		07/01/2015	07/01/2015	07/01/2015																						
Exceedance Key		No Exceedances	Shade	No Exceedances																						
General Parameters																										
Carbon, total organic	%				--	--	0.10	0.15	0.10	1.5	--	--	0.10	3.3	--	--	--	--	--	--	--	--	--	--	0.10	0.11
pH	pH units				--	--	1.0	7.80	1.0	8.22	--	--	1.0	6.39	--	--	--	--	--	--	--	--	--	--	1.0	8.86
Solids, percent	%				--	--	0	84.0	0	85.4	--	--	0	73.6	--	--	--	--	--	--	--	--	--	--	--	--
Metals																										
Arsenic	mg/kg	20	0.667	24	1.0	2.1	1.0	2.6	1.0	3.2	1.0	2.1	1.0	2.9	1.0	2.1	1.0	2.4	1.0	2.4	1.0	1.4	1.0	1.6	1.0	1.6
Cadmium	mg/kg	2		80	0.50	ND	0.50	ND	0.50	ND	0.50	ND	0.50	ND	0.50	ND	0.50	ND	0.50	ND	0.50	ND	0.50	ND	0.50	ND
Chromium	mg/kg				0.50	15	0.50	26	0.50	17	0.50	17	0.50	13	0.50	16	0.50	21	0.50	14	0.50	11	0.50	14	0.50	16
Chromium, hexavalent	mg/kg	19		240	--	--	--	--	--	--	--	--	5.0	ND	--	--	--	--	--	--	--	--	--	--	5.0	ND
Iron	mg/kg			56000	50	37000	50	25000	50	23000	50	25000	50	21000	50	22000	50	22000	50	21000	50	20000	50	18000	50	25000
Lead	mg/kg	250			0.50	4.2	0.50	3.7	0.50	15	0.50	3.5	0.50	7.8	0.50	4.4	0.50	3.6	0.50	7.6	0.50	2.9	0.50	2.1	0.50	2.9
Manganese	mg/kg			11200	0.50	470	0.50	270	0.50	360	0.50	290	0.50	260	0.50	260	0.50	200	0.50	230	0.50	220	0.50	240	0.50	290
Mercury	mg/kg	2			0.020	ND	0.020	0.034	0.020	0.052	0.020	0.025	0.020	0.025	0.020	0.061	0.020	0.027	0.020	0.032	0.020	0.040	0.020	ND	0.020	0.022
SVOCs																										
1,2,4-Trichlorobenzene	ug/kg		34500	800000	200	ND	100	ND	200	ND	--	--	100	ND	100	ND	--	--	100	ND	--	--	100	ND	100	ND
1,2-Dichlorobenzene	ug/kg			7200000	200	ND	100	ND	200	ND	--	--	100	ND	100	ND	--	--	100	ND	--	--	100	ND	100	ND
1,3-Dichlorobenzene	ug/kg				200	ND	100	ND	200	ND	--	--	100	ND	100	ND	--	--	100	ND	--	--	100	ND	100	ND
1,4-Dichlorobenzene	ug/kg		185000	5600000	200	ND	100	ND	200	ND	--	--	100	ND	100	ND	--	--	100	ND	--	--	100	ND	100	ND
1-Methylnaphthalene	ug/kg		34500	5600000	20	ND	10	ND	20	ND	--	--	10	ND	10	ND	--	--	10	ND	--	--	10	ND	10	ND
2,2'-oxybis (1-chloropropane)	ug/kg		14300	3200000	200	ND	100	ND	200	ND	--	--	100	ND	100	ND	--	--	100	ND	--	--	100	ND	100	ND
2,3,4,6-Tetrachlorophenol	ug/kg			2400000	500	ND	250	ND	500	ND	--	--	250	ND	250	ND	--	--	250	ND	--	--	250	ND	250	ND
2,4,5-Trichlorophenol	ug/kg			8000000	200	ND	100	ND	200	ND	--	--	100	ND	100	ND	--	--	100	ND	--	--	100	ND	100	ND
2,4,6-Trichlorophenol	ug/kg		90900	80000	200	ND	100	ND	200	ND	--	--	100	ND	100	ND	--	--	100	ND	--	--	100	ND	100	ND
2,4-Dichlorophenol	ug/kg			240000	200	ND	100	ND	200	ND	--	--	100	ND	100	ND	--	--	100	ND	--	--	100	ND	100	ND
2,4-Dimethylphenol	ug/kg			1600000	200	ND	100	ND	200	ND	--	--	100	ND	100	ND	--	--	100	ND	--	--	100	ND	100	ND
2,4-Dinitrophenol	ug/kg			160000	500	ND	250	ND	500	ND	--	--	250	ND	250	ND	--	--	250	ND	--	--	250	ND	250	ND
2,4-Dinitrotoluene	ug/kg		3230	160000	500	ND	250	ND	500	ND	--	--	250	ND	250	ND	--	--	250	ND	--	--	250	ND	250	ND
2,6-Dichlorophenol	ug/kg				200	ND	100	ND	200	ND	--	--	100	ND	100	ND	--	--	100	ND	--	--	100	ND	100	ND
2,6-Dinitrotoluene	ug/kg		667	24000	500	ND	250	ND	500	ND	--	--	250	ND	250	ND	--	--	250	ND	--	--	250	ND	250	ND
2-Chloronaphthalene	ug/kg			6400000	200	ND	100	ND	200	ND	--	--	100	ND	100	ND	--	--	100	ND	--	--	100	ND	100	ND
2-Chlorophenol	ug/kg			400000	200	ND	100	ND	200	ND	--	--	100	ND	100	ND	--	--	100	ND	--	--	100	ND	100	ND
2-Methyl-4,6-dinitrophenol	ug/kg				200	ND	100	ND	200	ND	--	--	100	ND	100	ND	--	--	100	ND	--	--	100	ND	100	ND
2-Methylnaphthalene	ug/kg			320000	20	ND	10	ND	20	ND	--	--	10	13	10	ND	--	--	10	12	--	--	10	ND	10	ND
2-Methylphenol (o-cresol)	ug/kg			4000000	200	ND	100	ND	200	ND	--	--	100	ND	100	ND	--	--	100	ND	--	--	100	ND	100	ND
2-Nitroaniline	ug/kg			800000	500	ND	250	ND	500	ND	--	--	250	ND	250	ND	--	--	250	ND	--	--	250	ND	250	ND
2-Nitrophenol	ug/kg				500	ND	250	ND	500	ND	--	--	250	ND	250	ND	--	--	250	ND	--	--	250	ND	250	ND
3,3`-Dichlorobenzidine	ug/kg		2220		500	ND	250	ND	500	ND	--	--	250	ND	250	ND	--	--	250	ND	--	--	250	ND	250	ND
3,4-Methylphenol (m,p cresols)	ug/kg				200	ND	100	ND	200	ND	--	--	100	ND	100	ND	--	--	100	ND	--	--	100	ND	100	ND
3-Nitroaniline	ug/kg				500	ND	250	ND	500	ND	--	--	250	ND	250	ND	--	--	250	ND	--	--	250	ND	250	ND
4-Bromophenyl phenyl ether	ug/kg				200	ND	100	ND	200	ND	--	--	100	ND	100	ND	--	--	100	ND	--	--	100	ND	100	ND
4-Chloro-3-methylphenol	ug/kg				200	ND	100	ND	200	ND	--	--	100	ND	100	ND	--	--	100	ND	--	--	100	ND	100	ND
4-Chloroaniline	ug/kg		5000	320000	200	ND	100	ND	200	ND	--	--	100	ND	100	ND	--	--	100	ND	--	--	100	ND	100	ND
4-Chlorophenyl phenyl ether	ug/kg				200	ND	100	ND	200	ND	--	--	100	ND	100	ND	--	--	100	ND	--	--	100	ND	100	ND
4-Nitroaniline	ug/kg				500	ND	250	ND	500	ND	--	--	250	ND	250	ND	--	--	250	ND	--	--	250	ND	250	ND
4-Nitrophenol	ug/kg				1000	ND	500	ND	1000	ND	--	--	500	ND	500	ND	--	--	500	ND	--	--	500	ND	500	ND
Acenaphthene	ug/kg			4800000	20	ND	10	ND	20	ND	--	--	10	ND	10	ND	--	--	10	13	--	--	10	ND	10	ND
Acenaphthylene	ug/kg				20	ND	10	ND	20	ND	--	--	10	29	10	ND	--	--	10	54	--	--	10	ND	10	ND
Aniline	ug/kg		175000	560000	200	ND	100	ND	200	ND	--	--	100	ND	100	ND	--	--	100	ND	--	--	100	ND	100	ND
Anthracene	ug/kg			24000000	20	ND	10	ND	20	ND	--	--	10	ND	10	ND	--	--	10	14	--	--	10	ND	10	ND
Azobenzene	ug/kg		9090		200	ND	100	ND	200	ND	--	--	100	ND	100	ND	--	--	100	ND	--	--	100	ND	100	ND
Benz(a)anthracene	ug/kg		1370		20	44	10	ND	20	ND	--	--	10	ND	10	ND	--	--	10	11	--	--	10	ND	10	ND
Benzo(a)pyrene	ug/kg	100	137		20	46	10	ND	20	ND	--	--	10	ND	10	ND	--	--	10	12	--	--	10	ND	10	ND
Benzo(b)fluoranthene	ug/kg		1370		20	53	10	ND	20	25	--	--	10	ND	10	ND	--	--	10	11	--	--	10	ND	10	ND
Benzo(g,h,i)perylene	ug/kg				20	37	10	ND	20	21	--	--	10	ND	10	ND	--	--	10	15	--	--	10	ND	10	ND
Benzo(k)fluoranthene	ug/kg		13700		20	37	10	ND	20	ND	--	--	10	ND	10	ND	--	--	10	ND	--	--	10	ND	10	ND
Benzoic acid	ug/kg			320000000	2000	ND	1000	ND	2000	ND	--	--	1000	ND	1000	ND	--	--	1000	ND	--	--	1000	ND	1000	ND
Benzyl alcohol	ug/kg			8000000	200	ND	100	ND	200	ND	--	--	100	ND	100	ND	--	--	100	ND	--	--	100	ND	100	ND
Bis(2-chloroethoxy)methane	ug/kg				200	ND	100	ND	200	ND	--	--	100	ND	100	ND	--	--	100	ND	--	--	100	ND	100	ND
Bis(2-chloroethyl)ether	ug/kg		909		200	ND	100	ND	200	ND	--	--	100	ND	100	ND	--	--	100	ND	--	--	100	ND	100	ND
Bis(2-ethylhexyl)phthalate	ug/kg		71400	1600000	260	ND	130	ND	260	ND	--	--	130	ND	130	ND	--	--	130	ND	--	--	130	ND	130	ND

Table 1
Historical Soil Data Review - 2013 Landau PQLs vs. MTCA Cleanup Levels
Yakima Mill Site

Location					FPP-B07		FPP-B07		FPP-B08		FPP-B09		FPP-B09		FPP-B10		FPP-B10		FPP-B11		FPP-B11		FPP-B12		FPP-B13	
Date					6/19/2013		6/19/2013		6/18/2013		6/19/2013		6/19/2013		6/18/2013		6/18/2013		6/18/2013		6/18/2013		6/17/2013		6/17/2013	
Depth					0.5 - 1 ft		15 - 16 ft		5 - 6.5 ft		12 - 13 ft		15 - 16.5 ft		10 - 11 ft		15 - 16 ft		18 - 19 ft		22 - 23 ft		6 - 7 ft		12 - 14.5 ft	
Sample Type					N		N		N		N		N		N		N		N		N		N		N	
Result Type					PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result
Data Status					SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource
Parameter	Analysis Location	Washington Method A Unrestricted Land Use	Washington Method B Cancer Direct Contact	Washington Method B Noncancer Direct Contact																						
Effective Date		07/01/2015	07/01/2015	07/01/2015																						
Exceedance Key		No Exceedances	Shade	No Exceedances																						
Butyl benzyl phthalate	ug/kg		526000	16000000	200	ND	100	ND	200	ND	--	--	100	ND	100	ND	--	--	100	ND	--	--	100	ND	100	ND
Carbazole	ug/kg				200	ND	100	ND	200	ND	--	--	100	ND	100	ND	--	--	100	ND	--	--	100	ND	100	ND
Chrysene	ug/kg		137000		20	98	10	ND	20	42	--	--	10	ND	10	ND	--	--	10	12	--	--	10	ND	10	ND
Dibenz(a,h)anthracene	ug/kg		137		20	ND	10	ND	20	ND	--	--	10	ND	10	ND	--	--	10	ND	--	--	10	ND	10	ND
Dibenzofuran	ug/kg			80000	200	ND	100	ND	200	ND	--	--	100	ND	100	ND	--	--	100	ND	--	--	100	ND	100	ND
Diethyl phthalate	ug/kg			64000000	200	ND	100	ND	200	ND	--	--	100	ND	100	ND	--	--	100	ND	--	--	100	ND	100	ND
Dimethyl phthalate	ug/kg				200	ND	100	ND	200	ND	--	--	100	ND	100	ND	--	--	100	ND	--	--	100	ND	100	ND
Di-n-butyl phthalate	ug/kg			8000000	260	ND	130	ND	260	ND	--	--	130	ND	130	ND	--	--	130	ND	--	--	130	ND	130	ND
Di-n-octyl phthalate	ug/kg			800000	200	ND	100	ND	200	ND	--	--	100	ND	100	ND	--	--	100	ND	--	--	100	ND	100	ND
Fluoranthene	ug/kg			3200000	20	68	10	ND	20	23	--	--	10	38	10	ND	--	--	10	69	--	--	10	ND	10	ND
Fluorene	ug/kg			3200000	20	ND	10	ND	20	ND	--	--	10	ND	10	ND	--	--	10	ND	--	--	10	ND	10	ND
Hexachlorobenzene	ug/kg		625	64000	200	ND	100	ND	200	ND	--	--	100	ND	100	ND	--	--	100	ND	--	--	100	ND	100	ND
Hexachlorobutadiene	ug/kg		12800	80000	200	ND	100	ND	200	ND	--	--	100	ND	100	ND	--	--	100	ND	--	--	100	ND	100	ND
Hexachlorocyclopentadiene	ug/kg			480000	1000	ND	500	ND	1000	ND	--	--	500	ND	500	ND	--	--	500	ND	--	--	500	ND	500	ND
Hexachloroethane	ug/kg		25000	56000	200	ND	100	ND	200	ND	--	--	100	ND	100	ND	--	--	100	ND	--	--	100	ND	100	ND
Indeno(1,2,3-cd)pyrene	ug/kg		1370		20	27	10	ND	20	ND	--	--	10	ND	10	ND	--	--	10	ND	--	--	10	ND	10	ND
Isophorone	ug/kg		1053000	16000000	200	ND	100	ND	200	ND	--	--	100	ND	100	ND	--	--	100	ND	--	--	100	ND	100	ND
Naphthalene	ug/kg	5000		1600000	20	ND	10	ND	20	ND	--	--	10	74	10	12	--	--	10	--	--	--	10	ND	10	ND
Nitrobenzene	ug/kg			160000	200	ND	100	ND	200	ND	--	--	100	ND	100	ND	--	--	10	140	--	--	100	ND	100	ND
n-Nitrosodimethylamine	ug/kg		19.6	640	200	ND	100	ND	200	ND	--	--	100	ND	100	ND	--	--	100	ND	--	--	100	ND	100	ND
n-Nitrosodi-n-propylamine	ug/kg		143		200	ND	100	ND	200	ND	--	--	100	ND	100	ND	--	--	100	ND	--	--	100	ND	100	ND
n-Nitrosodiphenylamine	ug/kg		204000		200	ND	100	ND	200	ND	--	--	100	ND	100	ND	--	--	100	ND	--	--	100	ND	100	ND
Pentachlorophenol	ug/kg		2500	400000	1000	ND	500	ND	1000	ND	--	--	500	ND	500	ND	--	--	500	ND	--	--	500	ND	500	ND
Phenanthrene	ug/kg				20	48	10	ND	20	38	--	--	10	40	10	ND	--	--	10	75	--	--	10	ND	10	ND
Phenol	ug/kg			24000000	200	ND	100	ND	200	ND	--	--	100	ND	100	ND	--	--	100	ND	--	--	100	ND	100	ND
Pyrene	ug/kg			2400000	20	120	10	ND	20	45	--	--	10	46	10	ND	--	--	10	81	--	--	10	ND	10	ND
Pyridine	ug/kg			80000	400	ND	200	ND	400	ND	--	--	200	ND	200	ND	--	--	200	ND	--	--	200	ND	200	ND
VOCs																										
1,1,1,2-Tetrachloroethane	ug/kg		38500	2400000	--	--	10	ND	10	ND	--	--	10	ND	10	ND	--	--	10	ND	--	--	10	ND	10	ND
1,1,1-Trichloroethane	ug/kg	2000		160000000	--	--	10	ND	10	ND	--	--	10	ND	10	ND	--	--	10	ND	--	--	10	ND	10	ND
1,1,2,2-Tetrachloroethane	ug/kg		5000	1600000	--	--	10	ND	10	ND	--	--	10	ND	10	ND	--	--	10	ND	--	--	10	ND	10	ND
1,1,2-Trichloroethane	ug/kg		17500	320000	--	--	10	ND	10	ND	--	--	10	ND	10	ND	--	--	10	ND	--	--	10	ND	10	ND
1,1-Dichloroethane	ug/kg		175000	16000000	--	--	10	ND	10	ND	--	--	10	ND	10	ND	--	--	10	ND	--	--	10	ND	10	ND
1,1-Dichloroethylene	ug/kg			4000000	--	--	10	ND	10	ND	--	--	10	ND	10	ND	--	--	10	ND	--	--	10	ND	10	ND
1,1-Dichloropropene	ug/kg				--	--	10	ND	10	ND	--	--	10	ND	10	ND	--	--	10	ND	--	--	10	ND	10	ND
1,2,3-Trichlorobenzene	ug/kg				--	--	10	ND	10	ND	--	--	10	ND	10	ND	--	--	10	ND	--	--	10	ND	10	ND
1,2,3-Trichloropropane	ug/kg		33.3	320000	--	--	10	ND	10	ND	--	--	10	ND	10	ND	--	--	10	ND	--	--	10	ND	10	ND
1,2,4-Trichlorobenzene	ug/kg		34500	800000	--	--	10	ND	10	ND	--	--	10	ND	10	ND	--	--	10	ND	--	--	10	ND	10	ND
1,2,4-Trimethylbenzene	ug/kg				--	--	10	ND	10	ND	--	--	10	ND	10	ND	--	--	10	ND	--	--	10	ND	10	ND
1,2-Dibromo-3-chloropropane (DBCP)	ug/kg		1250	16000	--	--	50	ND	50	ND	--	--	50	ND	50	ND	--	--	50	ND	--	--	50	ND	50	ND
1,2-Dibromoethane (EDB)	ug/kg	5.00	500	720000	--	--	5.0	ND	5.0	ND	--	--	5.0	ND	5.0	ND	--	--	5.0	ND	--	--	5.0	ND	5.0	ND
1,2-Dichlorobenzene	ug/kg			7200000	--	--	10	ND	10	ND	--	--	10	ND	10	ND	--	--	10	ND	--	--	10	ND	10	ND
1,2-Dichloroethane	ug/kg		11000	480000	--	--	10	ND	10	ND	--	--	10	ND	10	ND	--	--	10	ND	--	--	10	ND	10	ND
1,2-Dichloroethylene, cis	ug/kg			160000	--	--	10	ND	10	ND	--	--	10	ND	10	ND	--	--	10	ND	--	--	10	ND	10	ND
1,2-Dichloroethylene, trans	ug/kg			1600000	--	--	10	ND	10	ND	--	--	10	ND	10	ND	--	--	10	ND	--	--	10	ND	10	ND
1,2-Dichloropropane	ug/kg		27800	7200000	--	--	10	ND	10	ND	--	--	10	ND	10	ND	--	--	10	ND	--	--	10	ND	10	ND
1,3,5-Trimethylbenzene	ug/kg			800000	--	--	10	ND	10	ND	--	--	10	ND	10	ND	--	--	10	ND	--	--	10	ND	10	ND
1,3-Dichlorobenzene	ug/kg				--	--	10	ND	10	ND	--	--	10	ND	10	ND	--	--	10	ND	--	--	10	ND	10	ND
1,3-Dichloropropane	ug/kg				--	--	10	ND	10	ND	--	--	10	ND	10	ND	--	--	10	ND	--	--	10	ND	10	ND
1,3-Dichloropropene, cis	ug/kg		10000	2400000	--	--	10	ND	10	ND	--	--	10	ND	10	ND	--	--	10	ND	--	--	10	ND	10	ND
1,3-Dichloropropene, trans	ug/kg		10000	2400000	--	--	10	ND	10	ND	--	--	10	ND	10	ND	--	--	10	ND	--	--	10	ND	10	ND
1,4-Dichlorobenzene	ug/kg		185000	5600000	--	--	10	ND	10	ND	--	--	10	ND	10	ND	--	--	10	ND	--	--	10	ND	10	ND
2,2-Dichloropropane	ug/kg				--	--	10	ND	10	ND	--	--	10	ND	10	ND	--	--	10	ND	--	--	10	ND	10	ND
2-Hexanone	ug/kg				--	--	50	ND	50	ND	--	--	50	ND	50	ND	--	--	50	ND	--	--	50	ND	50	ND
Acetone	ug/kg			72000000	--	--	50	ND	50	ND	--	--	50	ND	50	ND	--	--	50	ND	--	--	50	ND	50	ND
Acrylonitrile	ug/kg		1850	3200000	--	--	50	ND	50	ND	--	--	50	ND	50	ND	--	--	50	ND	--	--	50	ND	50	ND
Benzene	ug/kg	30.0	18200	320000	--	--	5.0	ND	5.0	ND	--	--	5.0	ND	5.0	ND	--	--	5.0	ND	--	--	5.0	ND	5.0	ND
Bromobenzene	ug/kg				--	--	10	ND	10	ND	--	--	10	ND	10	ND	--	--	10	ND	--	--	10	ND	10	ND
Bromochloromethane	ug/kg				--	--	10	ND	10	ND	--	--	10	ND	10	ND	--	--	10	ND	--	--	10	ND	10	ND
Bromodichloromethane	ug/kg		16100	1600000	--	--	10	ND	10	ND	--	--	10	ND	10	ND	--	--	10	ND	--	--	10	ND	10	ND

Table 1
Historical Soil Data Review - 2013 Landau PQLs vs. MTCA Cleanup Levels
Yakima Mill Site

				Location	FPP-B07		FPP-B07		FPP-B08		FPP-B09		FPP-B09		FPP-B10		FPP-B10		FPP-B11		FPP-B11		FPP-B12		FPP-B13	
				Date	6/19/2013		6/19/2013		6/18/2013		6/19/2013		6/19/2013		6/18/2013		6/18/2013		6/18/2013		6/18/2013		6/17/2013		6/17/2013	
				Depth	0.5 - 1 ft		15 - 16 ft		5 - 6.5 ft		12 - 13 ft		15 - 16.5 ft		10 - 11 ft		15 - 16 ft		18 - 19 ft		22 - 23 ft		6 - 7 ft		12 - 14.5 ft	
				Sample Type	N		N		N		N		N		N		N		N		N		N		N	
				Result Type	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result
				Data Status	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource
Parameter	Analysis Location	Washington Method A Unrestricted Land Use	Washington Method B Cancer Direct Contact	Washington Method B Noncancer Direct Contact																						
Effective Date		07/01/2015	07/01/2015	07/01/2015																						
Exceedance Key		No Exceedances	Shade	No Exceedances																						
Bromoform	ug/kg		127000	1600000	--	--	10	ND	10	ND	--	--	10	ND	10	ND	--	--	10	ND	--	--	10	ND	10	ND
Bromomethane	ug/kg			112000	--	--	10	ND	10	ND	--	--	10	ND	10	ND	--	--	10	ND	--	--	10	ND	10	ND
Butylbenzene	ug/kg			4000000	--	--	10	ND	10	ND	--	--	10	ND	10	ND	--	--	10	ND	--	--	10	ND	10	ND
Butylbenzene, sec	ug/kg			8000000	--	--	10	ND	10	ND	--	--	10	ND	10	ND	--	--	10	ND	--	--	10	ND	10	ND
Butylbenzene, tert	ug/kg			8000000	--	--	10	ND	10	ND	--	--	10	ND	10	ND	--	--	10	ND	--	--	10	ND	10	ND
Carbon disulfide	ug/kg			8000000	--	--	10	ND	10	ND	--	--	10	ND	10	ND	--	--	10	ND	--	--	10	ND	10	ND
Carbon tetrachloride	ug/kg		14300	320000	--	--	10	ND	10	ND	--	--	10	ND	10	ND	--	--	10	ND	--	--	10	ND	10	ND
Chlorobenzene	ug/kg			1600000	--	--	10	ND	10	ND	--	--	10	ND	10	ND	--	--	10	ND	--	--	10	ND	10	ND
Chlorodibromomethane	ug/kg		11900	1600000	--	--	10	ND	10	ND	--	--	10	ND	10	ND	--	--	10	ND	--	--	10	ND	10	ND
Chloroethane	ug/kg				--	--	10	ND	10	ND	--	--	10	ND	10	ND	--	--	10	ND	--	--	10	ND	10	ND
Chloroform	ug/kg		32300	800000	--	--	10	ND	10	ND	--	--	10	ND	10	ND	--	--	10	ND	--	--	10	ND	10	ND
Chloromethane	ug/kg				--	--	10	ND	10	ND	--	--	10	ND	10	ND	--	--	10	ND	--	--	10	ND	10	ND
Chlorotoluene, o	ug/kg			1600000	--	--	10	ND	10	ND	--	--	10	ND	10	ND	--	--	10	ND	--	--	10	ND	10	ND
Chlorotoluene, p	ug/kg				--	--	10	ND	10	ND	--	--	10	ND	10	ND	--	--	10	ND	--	--	10	ND	10	ND
Cumene (isopropyl benzene)	ug/kg			8000000	--	--	10	ND	10	ND	--	--	10	ND	10	ND	--	--	10	ND	--	--	10	ND	10	ND
Cymene p- (toluene isopropyl p-)	ug/kg				--	--	10	ND	10	ND	--	--	10	ND	10	ND	--	--	10	ND	--	--	10	ND	10	ND
Dibromomethane (methylene bromide)	ug/kg			800000	--	--	10	ND	10	ND	--	--	10	ND	10	ND	--	--	10	ND	--	--	10	ND	10	ND
Dichlorodifluoromethane (Freon-12)	ug/kg			16000000	--	--	10	ND	10	ND	--	--	10	ND	10	ND	--	--	10	ND	--	--	10	ND	10	ND
Ethyl benzene	ug/kg	6000		8000000	--	--	10	ND	10	ND	--	--	10	ND	10	ND	--	--	10	ND	--	--	10	ND	10	ND
Hexachlorobutadiene	ug/kg		12800	80000	--	--	10	ND	10	ND	--	--	10	ND	10	ND	--	--	10	ND	--	--	10	ND	10	ND
Methyl ethyl ketone (2-butanone)	ug/kg			48000000	--	--	50	ND	50	ND	--	--	50	ND	50	ND	--	--	50	ND	--	--	50	ND	50	ND
Methyl isobutyl ketone (MIBK)	ug/kg			6400000	--	--	50	ND	50	ND	--	--	50	ND	50	ND	--	--	50	ND	--	--	50	ND	50	ND
Methyl tertiary butyl ether (MTBE)	ug/kg	100	556000		--	--	10	ND	10	ND	--	--	10	ND	10	ND	--	--	10	ND	--	--	10	ND	10	ND
Methylene chloride	ug/kg	20.0	500000	480000	--	--	20	ND	20	ND	--	--	20	ND	20	ND	--	--	20	ND	--	--	20	ND	20	ND
Naphthalene	ug/kg	5000		1600000	--	--	10	ND	10	ND	--	--	10	ND	10	ND	--	--	10	ND	--	--	10	ND	10	ND
Propylbenzene	ug/kg			8000000	--	--	10	ND	10	ND	--	--	10	ND	10	ND	--	--	10	ND	--	--	10	ND	10	ND
Styrene	ug/kg			16000000	--	--	10	ND	10	ND	--	--	10	ND	10	ND	--	--	10	ND	--	--	10	ND	10	ND
Tetrachloroethylene	ug/kg	50.0	476000	480000	--	--	10	ND	10	ND	--	--	10	ND	10	ND	--	--	10	ND	--	--	10	ND	10	ND
Toluene	ug/kg	7000		6400000	--	--	10	ND	10	ND	--	--	10	ND	10	ND	--	--	10	ND	--	--	10	ND	10	ND
Trichloroethylene (TCE)	ug/kg	30.0	12000	40000	--	--	10	ND	10	ND	--	--	10	ND	10	ND	--	--	10	ND	--	--	10	ND	10	ND
Trichlorofluoromethane (Freon-11)	ug/kg			24000000	--	--	10	ND	10	ND	--	--	10	ND	10	ND	--	--	10	ND	--	--	10	ND	10	ND
Vinyl chloride	ug/kg			240000	--	--	10	ND	10	ND	--	--	10	ND	10	ND	--	--	10	ND	--	--	10	ND	10	ND
Xylene, m & p	ug/kg			16000000	--	--	20	ND	20	ND	--	--	20	ND	20	ND	--	--	20	ND	--	--	20	ND	20	ND
Xylene, o	ug/kg			16000000	--	--	10	ND	10	ND	--	--	10	ND	10	ND	--	--	10	ND	--	--	10	ND	10	ND
PCBs																										
Aroclor 1016	mg/kg		14.3	5.6	--	--	--	--	--	--	--	--	0.10	ND	0.10	ND	--	--	0.10	ND	--	--	0.10	ND	0.10	ND
Aroclor 1221	mg/kg				--	--	--	--	--	--	--	--	0.10	ND	0.10	ND	--	--	0.10	ND	--	--	0.10	ND	0.10	ND
Aroclor 1232	mg/kg				--	--	--	--	--	--	--	--	0.10	ND	0.10	ND	--	--	0.10	ND	--	--	0.10	ND	0.10	ND
Aroclor 1242	mg/kg				--	--	--	--	--	--	--	--	0.10	ND	0.10	ND	--	--	0.10	ND	--	--	0.10	ND	0.10	ND
Aroclor 1248	mg/kg				--	--	--	--	--	--	--	--	0.10	ND	0.10	ND	--	--	0.10	ND	--	--	0.10	ND	0.10	ND
Aroclor 1254	mg/kg		0.5	1.6	--	--	--	--	--	--	--	--	0.10	ND	0.10	ND	--	--	0.10	ND	--	--	0.10	ND	0.10	ND
Aroclor 1260	mg/kg		0.5		--	--	--	--	--	--	--	--	0.10	ND	0.10	ND	--	--	0.10	ND	--	--	0.10	ND	0.10	ND
Aroclor 1268	mg/kg				--	--	--	--	--	--	--	--	0.10	ND	0.10	ND	--	--	0.10	ND	--	--	0.10	ND	0.10	ND
Total Petroleum Hydrocarbons																										
Total Petroleum Hydrocarbons (as diesel)	mg/kg	2000			120	ND	25	ND	25	220 J	25	ND	25	560 J	25	ND	25	ND	25	ND	25	ND	25	ND	25	ND
Total Petroleum Hydrocarbons (as gasoline)	mg/kg	30.0			--	--	3.0	ND	3.0	ND	--	--	3.0	ND	3.0	ND	--	--	3.0	ND	--	--	3.0	ND	3.0	ND
Total Petroleum Hydrocarbons (as motor oil)	mg/kg	2000			250	1500	50	120	50	520	50	ND	50	180	50	ND	50	79	50	170	50	ND	50	ND	50	ND

Barr qualifier - *: Estimated value, QA/QC criteria not met.
Landau qualifier - J: Indicates the analyte was positively identified; the associated numerical value is the approximate concentration of the analyte in the sample.
N: Normal Sample.
FD: Field Duplicate Sample.
ND: Not detected.
PQL: Practical Quantitation Limit.
SSource: Laboratory and/or field data obtained from a secondary source external to Barr. Second source QA/QC evaluation procedures may or may not have been performed beyond the original data generator.

11-06-2017

Table 1
Historical Soil Data Review - 2013 Landau PQLs vs. MTCA Cleanup Levels
Yakima Mill Site

Location					FPP-B13		FPP-B14		FPP-B14		FPP-B15		FPP-B16		FPP-B17		FPP-B17		FPP-B18		FPP-B19		FPP-B20		FPP-B21	
Date					6/17/2013		6/17/2013		6/17/2013		6/17/2013		6/17/2013		6/21/2013		6/21/2013		6/19/2013		6/19/2013		6/20/2013		6/20/2013	
Depth					5.5 - 6.5 ft		14 - 15 ft		18.5 - 19.5 ft		13.5 - 14.5 ft		11.7 - 12.7 ft		0.5 - 1.5 ft		16 - 17 ft		16.5 - 17.5 ft		11 - 12 ft		10 - 11 ft		13 - 14 ft	
Sample Type					N		N		N		N		N		N		N		N		N		N		N	
Result Type					PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result
Data Status					SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource
Parameter	Analysis Location	Washington Method A Unrestricted Land Use	Washington Method B Cancer Direct Contact	Washington Method B Noncancer Direct Contact																						
Effective Date		07/01/2015	07/01/2015	07/01/2015																						
Exceedance Key		No Exceedances	Shade	No Exceedances																						
General Parameters																										
Carbon, total organic	%				--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
pH	pH units				--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	1.0	7.89	--	--
Solids, percent	%				--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Metals																										
Arsenic	mg/kg	20	0.667	24	1.0	1.6	1.0	1.8	1.3	8.4	1.0	1.2	1.0	2.3	1.0	2.5	1.0	2.1	1.0	1.9	--	--	1.0	2.4	1.0	2.1
Cadmium	mg/kg	2		80	0.50	ND	0.50	ND	0.50	ND	0.50	ND	0.50	ND	0.50	ND	0.50	ND	0.50	ND	--	--	0.50	ND	0.50	ND
Chromium	mg/kg				0.50	19	0.50	16	0.66	14	0.50	17	0.52	15	0.50	21	0.50	19	0.50	28	--	--	0.50	9.3	0.50	11
Chromium, hexavalent	mg/kg	19		240	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Iron	mg/kg			56000	50	23000	50	23000	60	20000	50	26000	50	22000	50	27000	50	23000	50	23000	--	--	50	31000	50	22000
Lead	mg/kg	250			0.50	3.3	0.50	3.0	0.50	67	0.50	1.7	0.50	13	0.50	10	0.50	5.0	0.50	6.3	--	--	0.50	30	0.50	3.0
Manganese	mg/kg			11200	0.50	370	0.50	300	0.52	240	0.50	250	0.50	230	0.50	320	0.50	240	0.50	290	--	--	0.50	560	0.50	340
Mercury	mg/kg	2			0.020	ND	0.020	ND	0.020	0.075	0.020	ND	0.020	0.032	0.020	0.055	0.020	0.047	0.020	0.027	--	--	0.020	0.079	0.020	0.025
SVOCs																										
1,2,4-Trichlorobenzene	ug/kg		34500	800000	--	--	--	--	--	--	--	--	--	--	--	--	100	ND	--	--	--	--	100	ND	--	--
1,2-Dichlorobenzene	ug/kg			7200000	--	--	--	--	--	--	--	--	--	--	--	--	100	ND	--	--	--	--	100	ND	--	--
1,3-Dichlorobenzene	ug/kg				--	--	--	--	--	--	--	--	--	--	--	--	100	ND	--	--	--	--	100	ND	--	--
1,4-Dichlorobenzene	ug/kg		185000	5600000	--	--	--	--	--	--	--	--	--	--	--	--	100	ND	--	--	--	--	100	ND	--	--
1-Methylnaphthalene	ug/kg		34500	5600000	--	--	--	--	--	--	--	--	--	--	--	--	10	ND	--	--	--	--	10	ND	--	--
2,2'-oxybis (1-chloropropane)	ug/kg		14300	3200000	--	--	--	--	--	--	--	--	--	--	--	--	100	ND	--	--	--	--	100	ND	--	--
2,3,4,6-Tetrachlorophenol	ug/kg			2400000	--	--	--	--	--	--	--	--	--	--	--	--	250	ND	--	--	--	--	250	ND	--	--
2,4,5-Trichlorophenol	ug/kg			8000000	--	--	--	--	--	--	--	--	--	--	--	--	100	ND	--	--	--	--	100	ND	--	--
2,4,6-Trichlorophenol	ug/kg		90900	80000	--	--	--	--	--	--	--	--	--	--	--	--	100	ND	--	--	--	--	100	ND	--	--
2,4-Dichlorophenol	ug/kg			240000	--	--	--	--	--	--	--	--	--	--	--	--	100	ND	--	--	--	--	100	ND	--	--
2,4-Dimethylphenol	ug/kg			1600000	--	--	--	--	--	--	--	--	--	--	--	--	100	ND	--	--	--	--	100	ND	--	--
2,4-Dinitrophenol	ug/kg			160000	--	--	--	--	--	--	--	--	--	--	--	--	250	ND	--	--	--	--	250	ND	--	--
2,4-Dinitrotoluene	ug/kg		3230	160000	--	--	--	--	--	--	--	--	--	--	--	--	250	ND	--	--	--	--	250	ND	--	--
2,6-Dichlorophenol	ug/kg				--	--	--	--	--	--	--	--	--	--	--	--	100	ND	--	--	--	--	100	ND	--	--
2,6-Dinitrotoluene	ug/kg		667	24000	--	--	--	--	--	--	--	--	--	--	--	--	250	ND	--	--	--	--	250	ND	--	--
2-Chloronaphthalene	ug/kg			6400000	--	--	--	--	--	--	--	--	--	--	--	--	100	ND	--	--	--	--	100	ND	--	--
2-Chlorophenol	ug/kg			400000	--	--	--	--	--	--	--	--	--	--	--	--	100	ND	--	--	--	--	100	ND	--	--
2-Methyl-4,6-dinitrophenol	ug/kg				--	--	--	--	--	--	--	--	--	--	--	--	100	ND	--	--	--	--	100	ND	--	--
2-Methylnaphthalene	ug/kg			320000	--	--	--	--	--	--	--	--	--	--	--	--	10	ND	--	--	--	--	10	ND	--	--
2-Methylphenol (o-cresol)	ug/kg			4000000	--	--	--	--	--	--	--	--	--	--	--	--	100	ND	--	--	--	--	100	ND	--	--
2-Nitroaniline	ug/kg			800000	--	--	--	--	--	--	--	--	--	--	--	--	250	ND	--	--	--	--	250	ND	--	--
2-Nitrophenol	ug/kg				--	--	--	--	--	--	--	--	--	--	--	--	250	ND	--	--	--	--	250	ND	--	--
3,3`-Dichlorobenzidine	ug/kg		2220		--	--	--	--	--	--	--	--	--	--	--	--	250	ND	--	--	--	--	250	ND	--	--
3,4-Methylphenol (m,p cresols)	ug/kg				--	--	--	--	--	--	--	--	--	--	--	--	100	ND	--	--	--	--	100	ND	--	--
3-Nitroaniline	ug/kg				--	--	--	--	--	--	--	--	--	--	--	--	250	ND	--	--	--	--	250	ND	--	--
4-Bromophenyl phenyl ether	ug/kg				--	--	--	--	--	--	--	--	--	--	--	--	100	ND	--	--	--	--	100	ND	--	--
4-Chloro-3-methylphenol	ug/kg				--	--	--	--	--	--	--	--	--	--	--	--	100	ND	--	--	--	--	100	ND	--	--
4-Chloroaniline	ug/kg		5000	320000	--	--	--	--	--	--	--	--	--	--	--	--	100	ND	--	--	--	--	100	ND	--	--
4-Chlorophenyl phenyl ether	ug/kg				--	--	--	--	--	--	--	--	--	--	--	--	100	ND	--	--	--	--	100	ND	--	--
4-Nitroaniline	ug/kg				--	--	--	--	--	--	--	--	--	--	--	--	250	ND	--	--	--	--	250	ND	--	--
4-Nitrophenol	ug/kg				--	--	--	--	--	--	--	--	--	--	--	--	500	ND	--	--	--	--	500	ND	--	--
Acenaphthene	ug/kg			4800000	--	--	--	--	--	--	--	--	--	--	--	--	10	ND	--	--	--	--	10	ND	--	--
Acenaphthylene	ug/kg				--	--	--	--	--	--	--	--	--	--	--	--	10	11	--	--	--	--	10	ND	--	--
Aniline	ug/kg		175000	560000	--	--	--	--	--	--	--	--	--	--	--	--	100	ND	--	--	--	--	100	ND	--	--
Anthracene	ug/kg			24000000	--	--	--	--	--	--	--	--	--	--	--	--	10	ND	--	--	--	--	10	ND	--	--
Azobenzene	ug/kg		9090		--	--	--	--	--	--	--	--	--	--	--	--	100	ND	--	--	--	--	100	ND	--	--
Benz(a)anthracene	ug/kg		1370		--	--	--	--	--	--	--	--	--	--	--	--	10	ND	--	--	--	--	10	ND	--	--
Benzo(a)pyrene	ug/kg	100	137		--	--	--	--	--	--	--	--	--	--	--	--	10	ND	--	--	--	--	10	ND	--	--
Benzo(b)fluoranthene	ug/kg		1370		--	--	--	--	--	--	--	--	--	--	--	--	10	ND	--	--	--	--	10	ND	--	--
Benzo(g,h,i)perylene	ug/kg				--	--	--	--	--	--	--	--	--	--	--	--	10	ND	--	--	--	--	10	ND	--	--
Benzo(k)fluoranthene	ug/kg		13700		--	--	--	--	--	--	--	--	--	--	--	--	10	ND	--	--	--	--	10	ND	--	--
Benzoic acid	ug/kg			320000000	--	--	--	--	--	--	--	--	--	--	--	--	1000	ND	--	--	--	--	1000	ND	--	--
Benzyl alcohol	ug/kg			8000000	--	--	--	--	--	--	--	--	--	--	--	--	100	ND	--	--	--	--	100	ND	--	--
Bis(2-chloroethoxy)methane	ug/kg				--	--	--	--	--	--	--	--	--	--	--	--	100	ND	--	--	--	--	100	ND	--	--
Bis(2-chloroethyl)ether	ug/kg		909		--	--	--	--	--	--	--	--	--	--	--	--	100	ND	--	--	--	--	100	ND	--	--
Bis(2-ethylhexyl)phthalate	ug/kg		71400	1600000	--	--	--	--	--	--	--	--	--	--	--	--	130	ND	--	--	--	--	130	150	--	--

Table 1
Historical Soil Data Review - 2013 Landau PQLs vs. MTCA Cleanup Levels
Yakima Mill Site

				Location	FPP-B13		FPP-B14		FPP-B14		FPP-B15		FPP-B16		FPP-B17		FPP-B17		FPP-B18		FPP-B19		FPP-B20		FPP-B21	
				Date	6/17/2013		6/17/2013		6/17/2013		6/17/2013		6/17/2013		6/21/2013		6/21/2013		6/19/2013		6/19/2013		6/20/2013		6/20/2013	
				Depth	5.5 - 6.5 ft		14 - 15 ft		18.5 - 19.5 ft		13.5 - 14.5 ft		11.7 - 12.7 ft		0.5 - 1.5 ft		16 - 17 ft		16.5 - 17.5 ft		11 - 12 ft		10 - 11 ft		13 - 14 ft	
				Sample Type	N		N		N		N		N		N		N		N		N		N		N	
				Result Type	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result
				Data Status	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource
Parameter	Analysis Location	Washington Method A Unrestricted Land Use	Washington Method B Cancer Direct Contact	Washington Method B Noncancer Direct Contact																						
Effective Date		07/01/2015	07/01/2015	07/01/2015																						
Exceedance Key		No Exceedances	Shade	No Exceedances																						
Butyl benzyl phthalate	ug/kg		526000	16000000	--	--	--	--	--	--	--	--	--	--	--	--	100	ND	--	--	--	--	100	ND	--	--
Carbazole	ug/kg				--	--	--	--	--	--	--	--	--	--	--	--	100	ND	--	--	--	--	100	ND	--	--
Chrysene	ug/kg		137000		--	--	--	--	--	--	--	--	--	--	--	--	10	ND	--	--	--	--	10	ND	--	--
Dibenz(a,h)anthracene	ug/kg		137		--	--	--	--	--	--	--	--	--	--	--	--	10	ND	--	--	--	--	10	ND	--	--
Dibenzofuran	ug/kg			80000	--	--	--	--	--	--	--	--	--	--	--	--	100	ND	--	--	--	--	100	ND	--	--
Diethyl phthalate	ug/kg			64000000	--	--	--	--	--	--	--	--	--	--	--	--	100	ND	--	--	--	--	100	ND	--	--
Dimethyl phthalate	ug/kg				--	--	--	--	--	--	--	--	--	--	--	--	100	ND	--	--	--	--	100	ND	--	--
Di-n-butyl phthalate	ug/kg			8000000	--	--	--	--	--	--	--	--	--	--	--	--	130	ND	--	--	--	--	130	ND	--	--
Di-n-octyl phthalate	ug/kg			800000	--	--	--	--	--	--	--	--	--	--	--	--	100	ND	--	--	--	--	100	ND	--	--
Fluoranthene	ug/kg			3200000	--	--	--	--	--	--	--	--	--	--	--	--	10	16	--	--	--	--	10	11	--	--
Fluorene	ug/kg			3200000	--	--	--	--	--	--	--	--	--	--	--	--	10	ND	--	--	--	--	10	ND	--	--
Hexachlorobenzene	ug/kg		625	64000	--	--	--	--	--	--	--	--	--	--	--	--	100	ND	--	--	--	--	100	ND	--	--
Hexachlorobutadiene	ug/kg		12800	80000	--	--	--	--	--	--	--	--	--	--	--	--	100	ND	--	--	--	--	100	ND	--	--
Hexachlorocyclopentadiene	ug/kg			480000	--	--	--	--	--	--	--	--	--	--	--	--	500	ND	--	--	--	--	500	ND	--	--
Hexachloroethane	ug/kg		25000	56000	--	--	--	--	--	--	--	--	--	--	--	--	100	ND	--	--	--	--	100	ND	--	--
Indeno(1,2,3-cd)pyrene	ug/kg		1370		--	--	--	--	--	--	--	--	--	--	--	--	10	ND	--	--	--	--	10	ND	--	--
Isophorone	ug/kg		1053000	16000000	--	--	--	--	--	--	--	--	--	--	--	--	100	ND	--	--	--	--	100	ND	--	--
Naphthalene	ug/kg	5000		1600000	--	--	--	--	--	--	--	--	--	--	--	--	10	30	--	--	--	--	10	ND	--	--
Nitrobenzene	ug/kg			160000	--	--	--	--	--	--	--	--	--	--	--	--	100	ND	--	--	--	--	100	ND	--	--
n-Nitrosodimethylamine	ug/kg		19.6	640	--	--	--	--	--	--	--	--	--	--	--	--	100	ND	--	--	--	--	100	ND	--	--
n-Nitrosodi-n-propylamine	ug/kg		143		--	--	--	--	--	--	--	--	--	--	--	--	100	ND	--	--	--	--	100	ND	--	--
n-Nitrosodiphenylamine	ug/kg		204000		--	--	--	--	--	--	--	--	--	--	--	--	100	ND	--	--	--	--	100	ND	--	--
Pentachlorophenol	ug/kg		2500	400000	--	--	--	--	--	--	--	--	--	--	--	--	500	ND	--	--	--	--	500	ND	--	--
Phenanthrene	ug/kg				--	--	--	--	--	--	--	--	--	--	--	--	10	18	--	--	--	--	10	12	--	--
Phenol	ug/kg			24000000	--	--	--	--	--	--	--	--	--	--	--	--	100	ND	--	--	--	--	100	ND	--	--
Pyrene	ug/kg			2400000	--	--	--	--	--	--	--	--	--	--	--	--	10	20	--	--	--	--	10	13	--	--
Pyridine	ug/kg			80000	--	--	--	--	--	--	--	--	--	--	--	--	200	ND	--	--	--	--	200	ND	--	--
VOCs																										
1,1,1,2-Tetrachloroethane	ug/kg		38500	2400000	--	--	--	--	--	--	--	--	--	--	--	--	10	ND	10	ND	10	ND	10	ND	--	--
1,1,1-Trichloroethane	ug/kg	2000		160000000	--	--	--	--	--	--	--	--	--	--	--	--	10	ND	10	ND	10	ND	10	ND	--	--
1,1,2,2-Tetrachloroethane	ug/kg		5000	1600000	--	--	--	--	--	--	--	--	--	--	--	--	10	ND	10	ND	10	ND	10	ND	--	--
1,1,2-Trichloroethane	ug/kg		17500	320000	--	--	--	--	--	--	--	--	--	--	--	--	10	ND	10	ND	10	ND	10	ND	--	--
1,1-Dichloroethane	ug/kg		175000	16000000	--	--	--	--	--	--	--	--	--	--	--	--	10	ND	10	ND	10	ND	10	ND	--	--
1,1-Dichloroethylene	ug/kg			4000000	--	--	--	--	--	--	--	--	--	--	--	--	10	ND	10	ND	10	ND	10	ND	--	--
1,1-Dichloropropene	ug/kg				--	--	--	--	--	--	--	--	--	--	--	--	10	ND	10	ND	10	ND	10	ND	--	--
1,2,3-Trichlorobenzene	ug/kg				--	--	--	--	--	--	--	--	--	--	--	--	10	ND	10	ND	10	ND	10	ND	--	--
1,2,3-Trichloropropane	ug/kg		33.3	320000	--	--	--	--	--	--	--	--	--	--	--	--	10	ND	10	ND	10	ND	10	ND	--	--
1,2,4-Trichlorobenzene	ug/kg		34500	800000	--	--	--	--	--	--	--	--	--	--	--	--	10	ND	10	ND	10	ND	10	ND	--	--
1,2,4-Trimethylbenzene	ug/kg				--	--	--	--	--	--	--	--	--	--	--	--	10	ND	10	ND	10	ND	10	ND	--	--
1,2-Dibromo-3-chloropropane (DBCP)	ug/kg		1250	16000	--	--	--	--	--	--	--	--	--	--	--	--	50	ND	50	ND	50	ND	50	ND	--	--
1,2-Dibromoethane (EDB)	ug/kg	5.00	500	720000	--	--	--	--	--	--	--	--	--	--	--	--	5.0	ND	5.0	ND	5.0	ND	5.0	ND	--	--
1,2-Dichlorobenzene	ug/kg			7200000	--	--	--	--	--	--	--	--	--	--	--	--	10	ND	10	ND	10	ND	10	ND	--	--
1,2-Dichloroethane	ug/kg		11000	480000	--	--	--	--	--	--	--	--	--	--	--	--	10	ND	10	ND	10	ND	10	ND	--	--
1,2-Dichloroethylene, cis	ug/kg			160000	--	--	--	--	--	--	--	--	--	--	--	--	10	ND	10	ND	10	ND	10	ND	--	--
1,2-Dichloroethylene, trans	ug/kg			1600000	--	--	--	--	--	--	--	--	--	--	--	--	10	ND	10	ND	10	ND	10	ND	--	--
1,2-Dichloropropane	ug/kg		27800	7200000	--	--	--	--	--	--	--	--	--	--	--	--	10	ND	10	ND	10	ND	10	ND	--	--
1,3,5-Trimethylbenzene	ug/kg			800000	--	--	--	--	--	--	--	--	--	--	--	--	10	ND	10	ND	10	ND	10	ND	--	--
1,3-Dichlorobenzene	ug/kg				--	--	--	--	--	--	--	--	--	--	--	--	10	ND	10	ND	10	ND	10	ND	--	--
1,3-Dichloropropane	ug/kg				--	--	--	--	--	--	--	--	--	--	--	--	10	ND	10	ND	10	ND	10	ND	--	--
1,3-Dichloropropene, cis	ug/kg		10000	2400000	--	--	--	--	--	--	--	--	--	--	--	--	10	ND	10	ND	10	ND	10	ND	--	--
1,3-Dichloropropene, trans	ug/kg		10000	2400000	--	--	--	--	--	--	--	--	--	--	--	--	10	ND	10	ND	10	ND	10	ND	--	--
1,4-Dichlorobenzene	ug/kg		185000	5600000	--	--	--	--	--	--	--	--	--	--	--	--	10	ND	10	ND	10	ND	10	ND	--	--
2,2-Dichloropropane	ug/kg				--	--	--	--	--	--	--	--	--	--	--	--	10	ND	10	ND	10	ND	10	ND	--	--
2-Hexanone	ug/kg				--	--	--	--	--	--	--	--	--	--	--	--	50	ND	50	ND	50	ND	50	ND	--	--
Acetone	ug/kg			72000000	--	--	--	--	--	--	--	--	--	--	--	--	50	ND	50	ND	50	ND	50	ND	--	--
Acrylonitrile	ug/kg		1850	3200000	--	--	--	--	--	--	--	--	--	--	--	--	50	ND	50	ND	50	ND	50	ND	--	--
Benzene	ug/kg	30.0	18200	320000	--	--	--	--	--	--	--	--	--	--	--	--	5.0	ND	5.0	ND	5.0	ND	5.0	ND	--	--
Bromobenzene	ug/kg				--	--	--	--	--	--	--	--	--	--	--	--	10	ND	10	ND	10	ND	10	ND	--	--
Bromochloromethane	ug/kg				--	--	--	--	--	--	--	--	--	--	--	--	10	ND	10	ND	10	ND	10	ND	--	--
Bromodichloromethane	ug/kg		16100	1600000	--	--	--	--	--	--	--	--	--	--	--	--	10	ND	10	ND	10	ND	10	ND	--	--

Table 1
Historical Soil Data Review - 2013 Landau PQLs vs. MTCA Cleanup Levels
Yakima Mill Site

				Location	FPP-B13		FPP-B14		FPP-B14		FPP-B15		FPP-B16		FPP-B17		FPP-B17		FPP-B18		FPP-B19		FPP-B20		FPP-B21	
				Date	6/17/2013		6/17/2013		6/17/2013		6/17/2013		6/17/2013		6/21/2013		6/21/2013		6/19/2013		6/19/2013		6/20/2013		6/20/2013	
				Depth	5.5 - 6.5 ft		14 - 15 ft		18.5 - 19.5 ft		13.5 - 14.5 ft		11.7 - 12.7 ft		0.5 - 1.5 ft		16 - 17 ft		16.5 - 17.5 ft		11 - 12 ft		10 - 11 ft		13 - 14 ft	
				Sample Type	N		N		N		N		N		N		N		N		N		N		N	
				Result Type	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result
				Data Status	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource
Parameter	Analysis Location	Washington Method A Unrestricted Land Use	Washington Method B Cancer Direct Contact	Washington Method B Noncancer Direct Contact																						
Effective Date		07/01/2015	07/01/2015	07/01/2015																						
Exceedance Key		No Exceedances	▨ Shade	No Exceedances																						
Bromoform	ug/kg		127000	1600000	--	--	--	--	--	--	--	--	--	--	--	--	10	ND	10	ND	10	ND	10	ND	--	--
Bromomethane	ug/kg			112000	--	--	--	--	--	--	--	--	--	--	--	--	10	ND	10	ND	10	ND	10	ND	--	--
Butylbenzene	ug/kg			4000000	--	--	--	--	--	--	--	--	--	--	--	--	10	ND	10	ND	10	ND	10	ND	--	--
Butylbenzene, sec	ug/kg			8000000	--	--	--	--	--	--	--	--	--	--	--	--	10	ND	10	ND	10	ND	10	ND	--	--
Butylbenzene, tert	ug/kg			8000000	--	--	--	--	--	--	--	--	--	--	--	--	10	ND	10	ND	10	ND	10	ND	--	--
Carbon disulfide	ug/kg			8000000	--	--	--	--	--	--	--	--	--	--	--	--	10	ND	10	ND	10	ND	10	ND	--	--
Carbon tetrachloride	ug/kg		14300	320000	--	--	--	--	--	--	--	--	--	--	--	--	10	ND	10	ND	10	ND	10	ND	--	--
Chlorobenzene	ug/kg			1600000	--	--	--	--	--	--	--	--	--	--	--	--	10	ND	10	ND	10	ND	10	ND	--	--
Chlorodibromomethane	ug/kg		11900	1600000	--	--	--	--	--	--	--	--	--	--	--	--	10	ND	10	ND	10	ND	10	ND	--	--
Chloroethane	ug/kg				--	--	--	--	--	--	--	--	--	--	--	--	10	ND	10	ND	10	ND	10	ND	--	--
Chloroform	ug/kg		32300	800000	--	--	--	--	--	--	--	--	--	--	--	--	10	ND	10	ND	10	ND	10	ND	--	--
Chloromethane	ug/kg				--	--	--	--	--	--	--	--	--	--	--	--	10	ND	10	ND	10	ND	10	ND	--	--
Chlorotoluene, o	ug/kg			1600000	--	--	--	--	--	--	--	--	--	--	--	--	10	ND	10	ND	10	ND	10	ND	--	--
Chlorotoluene, p	ug/kg				--	--	--	--	--	--	--	--	--	--	--	--	10	ND	10	ND	10	ND	10	ND	--	--
Cumene (isopropyl benzene)	ug/kg			8000000	--	--	--	--	--	--	--	--	--	--	--	--	10	ND	10	ND	10	ND	10	ND	--	--
Cymene p- (toluene isopropyl p-)	ug/kg				--	--	--	--	--	--	--	--	--	--	--	--	10	ND	10	ND	10	ND	10	ND	--	--
Dibromomethane (methylene bromide)	ug/kg			800000	--	--	--	--	--	--	--	--	--	--	--	--	10	ND	10	ND	10	ND	10	ND	--	--
Dichlorodifluoromethane (Freon-12)	ug/kg			16000000	--	--	--	--	--	--	--	--	--	--	--	--	10	ND	10	ND	10	ND	10	ND	--	--
Ethyl benzene	ug/kg	6000		8000000	--	--	--	--	--	--	--	--	--	--	--	--	10	ND	10	ND	10	ND	10	ND	--	--
Hexachlorobutadiene	ug/kg		12800	80000	--	--	--	--	--	--	--	--	--	--	--	--	10	ND	10	ND	10	ND	10	ND	--	--
Methyl ethyl ketone (2-butanone)	ug/kg			48000000	--	--	--	--	--	--	--	--	--	--	--	--	50	ND	50	ND	50	ND	50	ND	--	--
Methyl isobutyl ketone (MIBK)	ug/kg			6400000	--	--	--	--	--	--	--	--	--	--	--	--	50	ND	50	ND	50	ND	50	ND	--	--
Methyl tertiary butyl ether (MTBE)	ug/kg	100	556000		--	--	--	--	--	--	--	--	--	--	--	--	10	ND	10	ND	10	ND	10	ND	--	--
Methylene chloride	ug/kg	20.0	500000	480000	--	--	--	--	--	--	--	--	--	--	--	--	20	ND	20	ND	20	ND	20	ND	--	--
Naphthalene	ug/kg	5000		1600000	--	--	--	--	--	--	--	--	--	--	--	--	10	ND	10	ND	10	ND	10	ND	--	--
Propylbenzene	ug/kg			8000000	--	--	--	--	--	--	--	--	--	--	--	--	10	ND	10	ND	10	ND	10	ND	--	--
Styrene	ug/kg			16000000	--	--	--	--	--	--	--	--	--	--	--	--	10	ND	10	ND	10	ND	10	ND	--	--
Tetrachloroethylene	ug/kg	50.0	476000	480000	--	--	--	--	--	--	--	--	--	--	--	--	10	ND	10	ND	10	ND	10	ND	--	--
Toluene	ug/kg	7000		6400000	--	--	--	--	--	--	--	--	--	--	--	--	10	ND	10	ND	10	ND	10	ND	--	--
Trichloroethylene (TCE)	ug/kg	30.0	12000	40000	--	--	--	--	--	--	--	--	--	--	--	--	10	ND	10	ND	10	ND	10	ND	--	--
Trichlorofluoromethane (Freon-11)	ug/kg			24000000	--	--	--	--	--	--	--	--	--	--	--	--	10	ND	10	ND	10	ND	10	ND	--	--
Vinyl chloride	ug/kg			240000	--	--	--	--	--	--	--	--	--	--	--	--	10	ND	10	ND	10	ND	10	ND	--	--
Xylene, m & p	ug/kg			16000000	--	--	--	--	--	--	--	--	--	--	--	--	20	ND	20	ND	20	ND	20	ND	--	--
Xylene, o	ug/kg			16000000	--	--	--	--	--	--	--	--	--	--	--	--	10	ND	10	ND	10	ND	10	ND	--	--
PCBs																										
Aroclor 1016	mg/kg		14.3	5.6	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	0.10	ND	--	--
Aroclor 1221	mg/kg				--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	0.10	ND	--	--
Aroclor 1232	mg/kg				--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	0.10	ND	--	--
Aroclor 1242	mg/kg				--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	0.10	ND	--	--
Aroclor 1248	mg/kg				--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	0.10	ND	--	--
Aroclor 1254	mg/kg		0.5	1.6	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	0.10	ND	--	--
Aroclor 1260	mg/kg		0.5		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	0.10	ND	--	--
Aroclor 1268	mg/kg				--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	0.10	ND	--	--
Total Petroleum Hydrocarbons																										
Total Petroleum Hydrocarbons (as diesel)	mg/kg	2000			25	ND	25	ND	25	ND	25	ND	25	ND	25	ND	25	ND	25	ND	25	ND	25	ND	25	ND
Total Petroleum Hydrocarbons (as gasoline)	mg/kg	30.0			--	--	--	--	--	--	--	--	--	--	--	--	3.0	ND	--	--	3.0	ND	3.0	ND	--	--
Total Petroleum Hydrocarbons (as motor oil)	mg/kg	2000			50	ND	50	ND	50	960	50	ND	50	150	50	87	50	88	50	190	50	140	50	130	50	ND

Barr qualifier - *: Estimated value, QA/QC criteria not met.
Landau qualifier - J: Indicates the analyte was positively identified; the associated numerical value is the approximate concentration of the analyte in the sample.
N: Normal Sample.
FD: Field Duplicate Sample.
ND: Not detected.
PQL: Practical Quantitation Limit.
SSource: Laboratory and/or field data obtained from a secondary source external to Barr. Second source QA/QC evaluation procedures may or may not have been performed beyond the original data generator.

Table 1
Historical Soil Data Review - 2013 Landau PQLs vs. MTCA Cleanup Levels
Yakima Mill Site

				Location	FPP-B22		FPP-B23		FPP-B24		FPP-B25		FPP-B26		FPP-B27		FPP-B28		FPP-B29A		FPP-B29B		FPP-B29C		FPP-B30	
				Date	6/20/2013		6/20/2013		6/20/2013		8/21/2013		8/21/2013		8/21/2013		8/23/2013		8/22/2013		8/23/2013		8/23/2013		8/22/2013	
				Depth	12.5 - 13.5 ft		11.5 - 12.5 ft		15 - 16.5 ft		15 - 16 ft		15 - 16 ft		5 - 6 ft		15 - 16 ft		15 - 16 ft		15 - 16 ft		15 - 16 ft		14 - 15 ft	
				Sample Type	N		N		N		N		N		N		N		N		N		N		N	
				Result Type	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result
				Data Status	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource
Parameter	Analysis Location	Washington Method A Unrestricted Land Use	Washington Method B Cancer Direct Contact	Washington Method B Noncancer Direct Contact																						
Effective Date		07/01/2015	07/01/2015	07/01/2015																						
Exceedance Key		No Exceedances	Shade	No Exceedances																						
General Parameters																										
Carbon, total organic	%				0.10	ND	--	--	0.10	2.2	--	--	0.050	0.14	--	--	--	--	--	--	--	--	--	--	0.050	2.8
pH	pH units				1.0	8.33	--	--	1.0	8.10	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Solids, percent	%				0	93.2	--	--	0	78.1	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Metals																										
Arsenic	mg/kg	20	0.667	24	1.0	2.0	1.0	1.9	1.0	2.4	1.0	2.0	1.0	1.9	1.0	ND	1.0	2.0	1.0	3.7	1.0	4.0	1.0	3.0	1.0	3.0
Cadmium	mg/kg	2		80	0.50	ND	0.50	ND	0.50	ND	0.50	ND	0.50	ND	0.50	ND	0.50	ND	0.50	ND	0.50	ND	0.50	ND	0.50	ND
Chromium	mg/kg				0.50	15	0.50	12	0.50	17	0.50	110	0.50	25	0.50	19	0.50	17	0.50	20	0.50	17	0.50	20	0.50	16
Chromium, hexavalent	mg/kg	19		240	--	--	--	--	5.0	ND	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Iron	mg/kg			56000	50	22000	50	24000	50	24000	50	40000	50	21000	50	20000	50	21000	50	31000	50	30000	50	31000	50	29000
Lead	mg/kg	250			0.50	3.3	0.50	2.9	0.50	6.7	0.50	3.8	0.50	3.3	0.50	11	0.50	4.2	0.50	5.3	0.50	5.5	0.50	5.7	0.50	23
Manganese	mg/kg			11200	0.50	310	0.50	370	0.50	250	0.50	320	0.50	250	0.50	300	0.50	220	0.50	570	0.50	560	0.50	410	0.50	460
Mercury	mg/kg	2			0.020	0.024	0.020	0.031	0.020	0.028	0.020	ND	0.020	0.023	0.020	0.15	0.020	0.021	0.020	0.092	0.020	0.082	0.020	0.12	0.020	0.093
SVOCs																										
1,2,4-Trichlorobenzene	ug/kg		34500	800000	--	--	--	--	100	ND	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,2-Dichlorobenzene	ug/kg			7200000	--	--	--	--	100	ND	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,3-Dichlorobenzene	ug/kg				--	--	--	--	100	ND	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,4-Dichlorobenzene	ug/kg		185000	5600000	--	--	--	--	100	ND	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1-Methylnaphthalene	ug/kg		34500	5600000	--	--	--	--	10	ND	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
2,2'-oxybis (1-chloropropane)	ug/kg		14300	3200000	--	--	--	--	100	ND	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
2,3,4,6-Tetrachlorophenol	ug/kg			2400000	--	--	--	--	250	ND	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
2,4,5-Trichlorophenol	ug/kg			8000000	--	--	--	--	100	ND	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
2,4,6-Trichlorophenol	ug/kg		90900	80000	--	--	--	--	100	ND	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
2,4-Dichlorophenol	ug/kg			240000	--	--	--	--	100	ND	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
2,4-Dimethylphenol	ug/kg			1600000	--	--	--	--	100	ND	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
2,4-Dinitrophenol	ug/kg			160000	--	--	--	--	250	ND	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
2,4-Dinitrotoluene	ug/kg		3230	160000	--	--	--	--	250	ND	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
2,6-Dichlorophenol	ug/kg				--	--	--	--	100	ND	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
2,6-Dinitrotoluene	ug/kg		667	24000	--	--	--	--	250	ND	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
2-Chloronaphthalene	ug/kg			6400000	--	--	--	--	100	ND	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
2-Chlorophenol	ug/kg			400000	--	--	--	--	100	ND	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
2-Methyl-4,6-dinitrophenol	ug/kg				--	--	--	--	100	ND	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
2-Methylnaphthalene	ug/kg			320000	--	--	--	--	10	ND	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
2-Methylphenol (o-cresol)	ug/kg			4000000	--	--	--	--	100	ND	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
2-Nitroaniline	ug/kg			800000	--	--	--	--	250	ND	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
2-Nitrophenol	ug/kg				--	--	--	--	250	ND	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
3,3`-Dichlorobenzidine	ug/kg		2220		--	--	--	--	250	ND	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
3,4-Methylphenol (m,p cresols)	ug/kg				--	--	--	--	100	ND	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
3-Nitroaniline	ug/kg				--	--	--	--	250	ND	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
4-Bromophenyl phenyl ether	ug/kg				--	--	--	--	100	ND	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
4-Chloro-3-methylphenol	ug/kg				--	--	--	--	100	ND	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
4-Chloroaniline	ug/kg		5000	320000	--	--	--	--	100	ND	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
4-Chlorophenyl phenyl ether	ug/kg				--	--	--	--	100	ND	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
4-Nitroaniline	ug/kg				--	--	--	--	250	ND	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
4-Nitrophenol	ug/kg				--	--	--	--	500	ND	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Acenaphthene	ug/kg			4800000	--	--	--	--	10	ND	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Acenaphthylene	ug/kg				--	--	--	--	10	ND	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Aniline	ug/kg		175000	560000	--	--	--	--	100	ND	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Anthracene	ug/kg			24000000	--	--	--	--	10	ND	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Azobenzene	ug/kg		9090		--	--	--	--	100	ND	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Benz(a)anthracene	ug/kg		1370		--	--	--	--	10	ND	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Benzo(a)pyrene	ug/kg	100	137		--	--	--	--	10	ND	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Benzo(b)fluoranthene	ug/kg		1370		--	--	--	--	10	ND	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Benzo(g,h,i)perylene	ug/kg				--	--	--	--	10	ND	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Benzo(k)fluoranthene	ug/kg		13700		--	--	--	--	10	ND	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Benzoic acid	ug/kg			320000000	--	--	--	--	1000	ND	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Benzyl alcohol	ug/kg			8000000	--	--	--	--	100	ND	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Bis(2-chloroethoxy)methane	ug/kg				--	--	--	--	100	ND	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Bis(2-chloroethyl)ether	ug/kg		909		--	--	--	--	100	ND	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Bis(2-ethylhexyl)phthalate	ug/kg		71400	1600000	--	--	--	--	130	ND	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--

Table 1
Historical Soil Data Review - 2013 Landau PQLs vs. MTCA Cleanup Levels
Yakima Mill Site

				Location	**FPP-B22**		**FPP-B23**		**FPP-B24**		**FPP-B25**		**FPP-B26**		**FPP-B27**		**FPP-B28**		**FPP-B29A**		**FPP-B29B**		**FPP-B29C**		**FPP-B30**	
				Date	**6/20/2013**		**6/20/2013**		**6/20/2013**		**8/21/2013**		**8/21/2013**		**8/21/2013**		**8/23/2013**		**8/22/2013**		**8/23/2013**		**8/23/2013**		**8/22/2013**	
				Depth	**12.5 - 13.5 ft**		**11.5 - 12.5 ft**		**15 - 16.5 ft**		**15 - 16 ft**		**15 - 16 ft**		**5 - 6 ft**		**15 - 16 ft**		**15 - 16 ft**		**15 - 16 ft**		**15 - 16 ft**		**14 - 15 ft**	
				Sample Type	**N**		**N**		**N**		**N**		**N**		**N**		**N**		**N**		**N**		**N**		**N**	
				Result Type	**PQL**	**Result**	**PQL**	**Result**	**PQL**	**Result**	**PQL**	**Result**	**PQL**	**Result**	**PQL**	**Result**	**PQL**	**Result**	**PQL**	**Result**	**PQL**	**Result**	**PQL**	**Result**	**PQL**	**Result**
				Data Status	**SSource**	**SSource**	**SSource**	**SSource**	**SSource**	**SSource**	**SSource**	**SSource**	**SSource**	**SSource**	**SSource**	**SSource**	**SSource**	**SSource**	**SSource**	**SSource**	**SSource**	**SSource**	**SSource**	**SSource**	**SSource**	**SSource**
Parameter	Analysis Location	Washington Method A Unrestricted Land Use	Washington Method B Cancer Direct Contact	Washington Method B Noncancer Direct Contact																						
Effective Date		07/01/2015	07/01/2015	07/01/2015																						
Exceedance Key		No Exceedances	Shade	No Exceedances																						
Butyl benzyl phthalate	ug/kg		526000	16000000	--	--	--	--	100	ND	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Carbazole	ug/kg				--	--	--	--	100	ND	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Chrysene	ug/kg		137000		--	--	--	--	10	ND	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Dibenz(a,h)anthracene	ug/kg		137		--	--	--	--	10	ND	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Dibenzofuran	ug/kg			80000	--	--	--	--	100	ND	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Diethyl phthalate	ug/kg			64000000	--	--	--	--	100	ND	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Dimethyl phthalate	ug/kg				--	--	--	--	100	ND	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Di-n-butyl phthalate	ug/kg			8000000	--	--	--	--	130	ND	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Di-n-octyl phthalate	ug/kg			800000	--	--	--	--	100	ND	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Fluoranthene	ug/kg			3200000	--	--	--	--	10	12	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Fluorene	ug/kg			3200000	--	--	--	--	10	ND	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Hexachlorobenzene	ug/kg		625	64000	--	--	--	--	100	ND	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Hexachlorobutadiene	ug/kg		12800	80000	--	--	--	--	100	ND	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Hexachlorocyclopentadiene	ug/kg			480000	--	--	--	--	500	ND	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Hexachloroethane	ug/kg		25000	56000	--	--	--	--	100	ND	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Indeno(1,2,3-cd)pyrene	ug/kg		1370		--	--	--	--	10	ND	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Isophorone	ug/kg		1053000	16000000	--	--	--	--	100	ND	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Naphthalene	ug/kg	5000		1600000	--	--	--	--	10	14	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Nitrobenzene	ug/kg			160000	--	--	--	--	100	ND	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
n-Nitrosodimethylamine	ug/kg		19.6	640	--	--	--	--	100	ND	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
n-Nitrosodi-n-propylamine	ug/kg		143		--	--	--	--	100	ND	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
n-Nitrosodiphenylamine	ug/kg		204000		--	--	--	--	100	ND	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Pentachlorophenol	ug/kg		2500	400000	--	--	--	--	500	ND	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Phenanthrene	ug/kg				--	--	--	--	10	15	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Phenol	ug/kg			24000000	--	--	--	--	100	ND	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Pyrene	ug/kg			2400000	--	--	--	--	10	15	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Pyridine	ug/kg			80000	--	--	--	--	200	ND	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
VOCs																										
1,1,1,2-Tetrachloroethane	ug/kg		38500	2400000	--	--	--	--	10	ND	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,1,1-Trichloroethane	ug/kg	2000		160000000	--	--	--	--	10	ND	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,1,2,2-Tetrachloroethane	ug/kg		5000	1600000	--	--	--	--	10	ND	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,1,2-Trichloroethane	ug/kg		17500	320000	--	--	--	--	10	ND	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,1-Dichloroethane	ug/kg		175000	16000000	--	--	--	--	10	ND	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,1-Dichloroethylene	ug/kg			4000000	--	--	--	--	10	ND	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,1-Dichloropropene	ug/kg				--	--	--	--	10	ND	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,2,3-Trichlorobenzene	ug/kg				--	--	--	--	10	ND	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,2,3-Trichloropropane	ug/kg		33.3	320000	--	--	--	--	10	ND	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,2,4-Trichlorobenzene	ug/kg		34500	800000	--	--	--	--	10	ND	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,2,4-Trimethylbenzene	ug/kg				--	--	--	--	10	ND	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,2-Dibromo-3-chloropropane (DBCP)	ug/kg		1250	16000	--	--	--	--	50	ND	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,2-Dibromoethane (EDB)	ug/kg	5.00	500	720000	--	--	--	--	5.0	ND	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,2-Dichlorobenzene	ug/kg			7200000	--	--	--	--	10	ND	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,2-Dichloroethane	ug/kg		11000	480000	--	--	--	--	10	ND	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,2-Dichloroethylene, cis	ug/kg			160000	--	--	--	--	10	ND	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,2-Dichloroethylene, trans	ug/kg			1600000	--	--	--	--	10	ND	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,2-Dichloropropane	ug/kg		27800	7200000	--	--	--	--	10	ND	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,3,5-Trimethylbenzene	ug/kg			800000	--	--	--	--	10	ND	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,3-Dichlorobenzene	ug/kg				--	--	--	--	10	ND	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,3-Dichloropropane	ug/kg				--	--	--	--	10	ND	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,3-Dichloropropene, cis	ug/kg		10000	2400000	--	--	--	--	10	ND	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,3-Dichloropropene, trans	ug/kg		10000	2400000	--	--	--	--	10	ND	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,4-Dichlorobenzene	ug/kg		185000	5600000	--	--	--	--	10	ND	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
2,2-Dichloropropane	ug/kg				--	--	--	--	10	ND	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
2-Hexanone	ug/kg				--	--	--	--	50	ND	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Acetone	ug/kg			72000000	--	--	--	--	50	ND	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Acrylonitrile	ug/kg		1850	3200000	--	--	--	--	50	ND	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Benzene	ug/kg	30.0	18200	320000	--	--	--	--	5.0	ND	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Bromobenzene	ug/kg				--	--	--	--	10	ND	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Bromochloromethane	ug/kg				--	--	--	--	10	ND	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Bromodichloromethane	ug/kg		16100	1600000	--	--	--	--	10	ND	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--

Table 1
Historical Soil Data Review - 2013 Landau PQLs vs. MTCA Cleanup Levels
Yakima Mill Site

Location					FPP-B22		FPP-B23		FPP-B24		FPP-B25		FPP-B26		FPP-B27		FPP-B28		FPP-B29A		FPP-B29B		FPP-B29C		FPP-B30	
Date					6/20/2013		6/20/2013		6/20/2013		8/21/2013		8/21/2013		8/21/2013		8/23/2013		8/22/2013		8/23/2013		8/23/2013		8/22/2013	
Depth					12.5 - 13.5 ft		11.5 - 12.5 ft		15 - 16.5 ft		15 - 16 ft		15 - 16 ft		5 - 6 ft		15 - 16 ft		15 - 16 ft		15 - 16 ft		15 - 16 ft		14 - 15 ft	
Sample Type					N		N		N		N		N		N		N		N		N		N		N	
Result Type					PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result
Data Status					SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource
Parameter	Analysis Location	Washington Method A Unrestricted Land Use	Washington Method B Cancer Direct Contact	Washington Method B Noncancer Direct Contact																						
Effective Date		07/01/2015	07/01/2015	07/01/2015																						
Exceedance Key		No Exceedances	Shade	No Exceedances																						
Bromoform	ug/kg		127000	1600000	--	--	--	--	10	ND	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Bromomethane	ug/kg			112000	--	--	--	--	10	ND	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Butylbenzene	ug/kg			4000000	--	--	--	--	10	ND	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Butylbenzene, sec	ug/kg			8000000	--	--	--	--	10	ND	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Butylbenzene, tert	ug/kg			8000000	--	--	--	--	10	ND	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Carbon disulfide	ug/kg			8000000	--	--	--	--	10	ND	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Carbon tetrachloride	ug/kg		14300	320000	--	--	--	--	10	ND	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Chlorobenzene	ug/kg			1600000	--	--	--	--	10	ND	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Chlorodibromomethane	ug/kg		11900	1600000	--	--	--	--	10	ND	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Chloroethane	ug/kg				--	--	--	--	10	ND	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Chloroform	ug/kg		32300	800000	--	--	--	--	10	ND	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Chloromethane	ug/kg				--	--	--	--	10	ND	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Chlorotoluene, o	ug/kg			1600000	--	--	--	--	10	ND	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Chlorotoluene, p	ug/kg				--	--	--	--	10	ND	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Cumene (isopropyl benzene)	ug/kg			8000000	--	--	--	--	10	ND	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Cymene p- (toluene isopropyl p-)	ug/kg				--	--	--	--	10	ND	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Dibromomethane (methylene bromide)	ug/kg			800000	--	--	--	--	10	ND	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Dichlorodifluoromethane (Freon-12)	ug/kg			16000000	--	--	--	--	10	ND	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Ethyl benzene	ug/kg	6000		8000000	--	--	--	--	10	ND	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Hexachlorobutadiene	ug/kg		12800	80000	--	--	--	--	10	ND	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Methyl ethyl ketone (2-butanone)	ug/kg			48000000	--	--	--	--	50	ND	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Methyl isobutyl ketone (MIBK)	ug/kg			6400000	--	--	--	--	50	ND	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Methyl tertiary butyl ether (MTBE)	ug/kg	100	556000		--	--	--	--	10	ND	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Methylene chloride	ug/kg	20.0	500000	480000	--	--	--	--	20	ND	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Naphthalene	ug/kg	5000		1600000	--	--	--	--	10	ND	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Propylbenzene	ug/kg			8000000	--	--	--	--	10	ND	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Styrene	ug/kg			16000000	--	--	--	--	10	ND	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Tetrachloroethylene	ug/kg	50.0	476000	480000	--	--	--	--	10	ND	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Toluene	ug/kg	7000		6400000	--	--	--	--	10	ND	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Trichloroethylene (TCE)	ug/kg	30.0	12000	40000	--	--	--	--	10	ND	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Trichlorofluoromethane (Freon-11)	ug/kg			24000000	--	--	--	--	10	ND	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Vinyl chloride	ug/kg			240000	--	--	--	--	10	ND	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Xylene, m & p	ug/kg			16000000	--	--	--	--	20	ND	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Xylene, o	ug/kg			16000000	--	--	--	--	10	ND	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
PCBs																										
Aroclor 1016	mg/kg		14.3	5.6	--	--	--	--	0.10	ND	--	--	--	--	--	--	--	--	0.10	ND	--	--	--	--	--	--
Aroclor 1221	mg/kg				--	--	--	--	0.10	ND	--	--	--	--	--	--	--	--	0.10	ND	--	--	--	--	--	--
Aroclor 1232	mg/kg				--	--	--	--	0.10	ND	--	--	--	--	--	--	--	--	0.10	ND	--	--	--	--	--	--
Aroclor 1242	mg/kg				--	--	--	--	0.10	ND	--	--	--	--	--	--	--	--	0.10	ND	--	--	--	--	--	--
Aroclor 1248	mg/kg				--	--	--	--	0.10	ND	--	--	--	--	--	--	--	--	0.10	ND	--	--	--	--	--	--
Aroclor 1254	mg/kg		0.5	1.6	--	--	--	--	0.10	ND	--	--	--	--	--	--	--	--	0.10	ND	--	--	--	--	--	--
Aroclor 1260	mg/kg		0.5		--	--	--	--	0.10	ND	--	--	--	--	--	--	--	--	0.10	ND	--	--	--	--	--	--
Aroclor 1268	mg/kg				--	--	--	--	0.10	ND	--	--	--	--	--	--	--	--	0.10	ND	--	--	--	--	--	--
Total Petroleum Hydrocarbons																										
Total Petroleum Hydrocarbons (as diesel)	mg/kg	2000			25	ND	25	ND	25	ND	25	ND	25	44	50	ND	250	ND	120	ND	25	ND	120	ND	25	130
Total Petroleum Hydrocarbons (as gasoline)	mg/kg	30.0			--	--	--	--	3.0	ND	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Total Petroleum Hydrocarbons (as motor oil)	mg/kg	2000			50	ND	50	ND	50	440	50	ND	50	140	100	1300	500	6100	250	2000	50	560	250	3500	50	240

Barr qualifier - *: Estimated value, QA/QC criteria not met.
Landau qualifier - J: Indicates the analyte was positively identified; the associated numerical value is the approximate concentration of the analyte in the sample.
N: Normal Sample.
FD: Field Duplicate Sample.
ND: Not detected.
PQL: Practical Quantitation Limit.
SSource: Laboratory and/or field data obtained from a secondary source external to Barr. Second source QA/QC evaluation procedures may or may not have been performed beyond the original data generator.

11-06-2017

Table 1
Historical Soil Data Review - 2013 Landau PQLs vs. MTCA Cleanup Levels
Yakima Mill Site

				Location	FPP-B31		FPP-B32		FPP-B33		FPP-B34		FPP-MW-01		FPP-MW-02		FPP-MW-03		TP-B01		TP-B01		TP-B02		TP-B03	
				Date	8/22/2013		8/22/2013		8/22/2013		8/22/2013		8/20/2013		8/20/2013		8/20/2013		6/21/2013		6/21/2013		6/20/2013		6/20/2013	
				Depth	15 - 16 ft		15 - 16 ft		10 - 11 ft		15 - 16 ft		8.5 - 9 ft		8.5 - 9.5 ft		13.5 - 14.5 ft		1 - 2 ft		6.5 - 7.5 ft		13 - 14 ft		15 - 16 ft	
				Sample Type	N		N		N		N		N		N		N		N		N		N		N	
				Result Type	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result
				Data Status	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource
Parameter	Analysis Location	Washington Method A Unrestricted Land Use	Washington Method B Cancer Direct Contact	Washington Method B Noncancer Direct Contact																						
Effective Date		07/01/2015	07/01/2015	07/01/2015																						
Exceedance Key		No Exceedances	Shade	No Exceedances																						
General Parameters																										
Carbon, total organic	%				--	--	--	--	0.050	0.091	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
pH	pH units				--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Solids, percent	%				--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Metals																										
Arsenic	mg/kg	20	0.667	24	1.0	2.1	1.0	2.6	1.0	1.9	1.0	2.1	1.0	2.3	1.0	2.1	1.0	2.9	1.0	3.7	1.0	1.9	1.0	1.9	1.0	1.9
Cadmium	mg/kg	2		80	0.50	ND	0.50	ND	0.50	ND	0.50	ND	0.50	ND	0.50	ND	0.50	ND	0.50	ND	0.50	ND	0.50	ND	0.50	ND
Chromium	mg/kg				0.50	17	0.50	18	0.50	21	0.50	35	0.50	50	0.50	26	0.50	16	0.50	17	0.50	11	0.50	12	0.50	9.4
Chromium, hexavalent	mg/kg	19		240	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	5.0	ND	--	--	5.0	ND
Iron	mg/kg			56000	50	21000	50	24000	50	21000	50	23000	50	28000	50	25000	50	18000	50	29000	50	21000	50	23000	50	22000
Lead	mg/kg	250			0.50	10	0.50	5.4	0.50	2.5	0.50	5.0	0.50	6.2	0.50	4.1	0.50	6.6	0.50	20	0.50	4.8	0.50	5.4	0.50	3.3
Manganese	mg/kg			11200	0.50	300	0.50	370	0.50	290	0.50	300	0.50	330	0.50	310	0.50	200	0.50	530	0.50	350	0.50	350	0.50	330
Mercury	mg/kg	2			0.020	0.050	0.020	0.15	0.020	0.022	0.020	0.022	0.020	0.024	0.020	0.025	0.020	0.028	0.020	0.12	0.020	0.027	0.020	0.12	0.020	0.027
SVOCs																										
1,2,4-Trichlorobenzene	ug/kg		34500	800000	--	--	--	--	--	--	--	--	--	--	--	--	--	--	100	ND	100	ND	100	ND	--	--
1,2-Dichlorobenzene	ug/kg			7200000	--	--	--	--	--	--	--	--	--	--	--	--	--	--	100	ND	100	ND	100	ND	--	--
1,3-Dichlorobenzene	ug/kg				--	--	--	--	--	--	--	--	--	--	--	--	--	--	100	ND	100	ND	100	ND	--	--
1,4-Dichlorobenzene	ug/kg		185000	5600000	--	--	--	--	--	--	--	--	--	--	--	--	--	--	100	ND	100	ND	100	ND	--	--
1-Methylnaphthalene	ug/kg		34500	5600000	--	--	--	--	--	--	--	--	--	--	--	--	--	--	10	ND	10	ND	10	ND	--	--
2,2'-oxybis (1-chloropropane)	ug/kg		14300	3200000	--	--	--	--	--	--	--	--	--	--	--	--	--	--	100	ND	100	ND	100	ND	--	--
2,3,4,6-Tetrachlorophenol	ug/kg			2400000	--	--	--	--	--	--	--	--	--	--	--	--	--	--	250	ND	250	ND	250	ND	--	--
2,4,5-Trichlorophenol	ug/kg			8000000	--	--	--	--	--	--	--	--	--	--	--	--	--	--	100	ND	100	ND	100	ND	--	--
2,4,6-Trichlorophenol	ug/kg		90900	80000	--	--	--	--	--	--	--	--	--	--	--	--	--	--	100	ND	100	ND	100	ND	--	--
2,4-Dichlorophenol	ug/kg			240000	--	--	--	--	--	--	--	--	--	--	--	--	--	--	100	ND	100	ND	100	ND	--	--
2,4-Dimethylphenol	ug/kg			1600000	--	--	--	--	--	--	--	--	--	--	--	--	--	--	100	ND	100	ND	100	ND	--	--
2,4-Dinitrophenol	ug/kg			160000	--	--	--	--	--	--	--	--	--	--	--	--	--	--	250	ND	250	ND	250	ND	--	--
2,4-Dinitrotoluene	ug/kg		3230	160000	--	--	--	--	--	--	--	--	--	--	--	--	--	--	250	ND	250	ND	250	ND	--	--
2,6-Dichlorophenol	ug/kg				--	--	--	--	--	--	--	--	--	--	--	--	--	--	100	ND	100	ND	100	ND	--	--
2,6-Dinitrotoluene	ug/kg		667	24000	--	--	--	--	--	--	--	--	--	--	--	--	--	--	250	ND	250	ND	250	ND	--	--
2-Chloronaphthalene	ug/kg			6400000	--	--	--	--	--	--	--	--	--	--	--	--	--	--	100	ND	100	ND	100	ND	--	--
2-Chlorophenol	ug/kg			400000	--	--	--	--	--	--	--	--	--	--	--	--	--	--	100	ND	100	ND	100	ND	--	--
2-Methyl-4,6-dinitrophenol	ug/kg				--	--	--	--	--	--	--	--	--	--	--	--	--	--	100	ND	100	ND	100	ND	--	--
2-Methylnaphthalene	ug/kg			320000	--	--	--	--	--	--	--	--	--	--	--	--	--	--	10	ND	10	ND	10	ND	--	--
2-Methylphenol (o-cresol)	ug/kg			4000000	--	--	--	--	--	--	--	--	--	--	--	--	--	--	100	ND	100	ND	100	ND	--	--
2-Nitroaniline	ug/kg			800000	--	--	--	--	--	--	--	--	--	--	--	--	--	--	250	ND	250	ND	250	ND	--	--
2-Nitrophenol	ug/kg				--	--	--	--	--	--	--	--	--	--	--	--	--	--	250	ND	250	ND	250	ND	--	--
3,3`-Dichlorobenzidine	ug/kg		2220		--	--	--	--	--	--	--	--	--	--	--	--	--	--	250	ND	250	ND	250	ND	--	--
3,4-Methylphenol (m,p cresols)	ug/kg				--	--	--	--	--	--	--	--	--	--	--	--	--	--	100	ND	100	ND	100	ND	--	--
3-Nitroaniline	ug/kg				--	--	--	--	--	--	--	--	--	--	--	--	--	--	250	ND	250	ND	250	ND	--	--
4-Bromophenyl phenyl ether	ug/kg				--	--	--	--	--	--	--	--	--	--	--	--	--	--	100	ND	100	ND	100	ND	--	--
4-Chloro-3-methylphenol	ug/kg				--	--	--	--	--	--	--	--	--	--	--	--	--	--	100	ND	100	ND	100	ND	--	--
4-Chloroaniline	ug/kg		5000	320000	--	--	--	--	--	--	--	--	--	--	--	--	--	--	100	ND	100	ND	100	ND	--	--
4-Chlorophenyl phenyl ether	ug/kg				--	--	--	--	--	--	--	--	--	--	--	--	--	--	100	ND	100	ND	100	ND	--	--
4-Nitroaniline	ug/kg				--	--	--	--	--	--	--	--	--	--	--	--	--	--	250	ND	250	ND	250	ND	--	--
4-Nitrophenol	ug/kg				--	--	--	--	--	--	--	--	--	--	--	--	--	--	500	ND	500	ND	500	ND	--	--
Acenaphthene	ug/kg			4800000	--	--	--	--	--	--	--	--	--	--	--	--	--	--	10	ND	10	ND	10	ND	--	--
Acenaphthylene	ug/kg				--	--	--	--	--	--	--	--	--	--	--	--	--	--	10	ND	10	ND	10	ND	--	--
Aniline	ug/kg		175000	560000	--	--	--	--	--	--	--	--	--	--	--	--	--	--	100	ND	100	ND	100	ND	--	--
Anthracene	ug/kg			24000000	--	--	--	--	--	--	--	--	--	--	--	--	--	--	10	ND	10	ND	10	ND	--	--
Azobenzene	ug/kg		9090		--	--	--	--	--	--	--	--	--	--	--	--	--	--	100	ND	100	ND	100	ND	--	--
Benz(a)anthracene	ug/kg		1370		--	--	--	--	--	--	--	--	--	--	--	--	--	--	10	ND	10	ND	10	ND	--	--
Benzo(a)pyrene	ug/kg	100	137		--	--	--	--	--	--	--	--	--	--	--	--	--	--	10	ND	10	ND	10	ND	--	--
Benzo(b)fluoranthene	ug/kg		1370		--	--	--	--	--	--	--	--	--	--	--	--	--	--	10	14	10	ND	10	ND	--	--
Benzo(g,h,i)perylene	ug/kg				--	--	--	--	--	--	--	--	--	--	--	--	--	--	10	28	10	ND	10	ND	--	--
Benzo(k)fluoranthene	ug/kg		13700		--	--	--	--	--	--	--	--	--	--	--	--	--	--	10	ND	10	ND	10	ND	--	--
Benzoic acid	ug/kg			320000000	--	--	--	--	--	--	--	--	--	--	--	--	--	--	1000	ND	1000	ND	1000	ND	--	--
Benzyl alcohol	ug/kg			8000000	--	--	--	--	--	--	--	--	--	--	--	--	--	--	100	ND	100	ND	100	ND	--	--
Bis(2-chloroethoxy)methane	ug/kg				--	--	--	--	--	--	--	--	--	--	--	--	--	--	100	ND	100	ND	100	ND	--	--
Bis(2-chloroethyl)ether	ug/kg		909		--	--	--	--	--	--	--	--	--	--	--	--	--	--	100	ND	100	ND	100	ND	--	--
Bis(2-ethylhexyl)phthalate	ug/kg		71400	1600000	--	--	--	--	--	--	--	--	--	--	--	--	--	--	130	ND	130	ND	130	ND	--	--

Table 1
Historical Soil Data Review - 2013 Landau PQLs vs. MTCA Cleanup Levels
Yakima Mill Site

				Location	FPP-B31		FPP-B32		FPP-B33		FPP-B34		FPP-MW-01		FPP-MW-02		FPP-MW-03		TP-B01		TP-B01		TP-B02		TP-B03	
				Date	8/22/2013		8/22/2013		8/22/2013		8/22/2013		8/20/2013		8/20/2013		8/20/2013		6/21/2013		6/21/2013		6/20/2013		6/20/2013	
				Depth	15 - 16 ft		15 - 16 ft		10 - 11 ft		15 - 16 ft		8.5 - 9 ft		8.5 - 9.5 ft		13.5 - 14.5 ft		1 - 2 ft		6.5 - 7.5 ft		13 - 14 ft		15 - 16 ft	
				Sample Type	N		N		N		N		N		N		N		N		N		N		N	
				Result Type	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result
				Data Status	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource
Parameter	Analysis Location	Washington Method A Unrestricted Land Use	Washington Method B Cancer Direct Contact	Washington Method B Noncancer Direct Contact																						
Effective Date		07/01/2015	07/01/2015	07/01/2015																						
Exceedance Key		No Exceedances	Shade	No Exceedances																						
Butyl benzyl phthalate	ug/kg		526000	16000000	--	--	--	--	--	--	--	--	--	--	--	--	--	--	100	ND	100	ND	100	ND	--	--
Carbazole	ug/kg				--	--	--	--	--	--	--	--	--	--	--	--	--	--	100	ND	100	ND	100	ND	--	--
Chrysene	ug/kg		137000		--	--	--	--	--	--	--	--	--	--	--	--	--	--	10	ND	10	ND	10	ND	--	--
Dibenz(a,h)anthracene	ug/kg		137		--	--	--	--	--	--	--	--	--	--	--	--	--	--	10	ND	10	ND	10	ND	--	--
Dibenzofuran	ug/kg			80000	--	--	--	--	--	--	--	--	--	--	--	--	--	--	100	ND	100	ND	100	ND	--	--
Diethyl phthalate	ug/kg			64000000	--	--	--	--	--	--	--	--	--	--	--	--	--	--	100	ND	100	ND	100	ND	--	--
Dimethyl phthalate	ug/kg				--	--	--	--	--	--	--	--	--	--	--	--	--	--	100	ND	100	ND	100	ND	--	--
Di-n-butyl phthalate	ug/kg			8000000	--	--	--	--	--	--	--	--	--	--	--	--	--	--	130	ND	130	ND	130	ND	--	--
Di-n-octyl phthalate	ug/kg			800000	--	--	--	--	--	--	--	--	--	--	--	--	--	--	100	ND	100	ND	100	ND	--	--
Fluoranthene	ug/kg			3200000	--	--	--	--	--	--	--	--	--	--	--	--	--	--	10	12	10	ND	10	ND	--	--
Fluorene	ug/kg			3200000	--	--	--	--	--	--	--	--	--	--	--	--	--	--	10	ND	10	ND	10	ND	--	--
Hexachlorobenzene	ug/kg		625	64000	--	--	--	--	--	--	--	--	--	--	--	--	--	--	100	ND	100	ND	100	ND	--	--
Hexachlorobutadiene	ug/kg		12800	80000	--	--	--	--	--	--	--	--	--	--	--	--	--	--	100	ND	100	ND	100	ND	--	--
Hexachlorocyclopentadiene	ug/kg			480000	--	--	--	--	--	--	--	--	--	--	--	--	--	--	500	ND	500	ND	500	ND	--	--
Hexachloroethane	ug/kg		25000	56000	--	--	--	--	--	--	--	--	--	--	--	--	--	--	100	ND	100	ND	100	ND	--	--
Indeno(1,2,3-cd)pyrene	ug/kg		1370		--	--	--	--	--	--	--	--	--	--	--	--	--	--	10	18	10	ND	10	ND	--	--
Isophorone	ug/kg		1053000	16000000	--	--	--	--	--	--	--	--	--	--	--	--	--	--	100	ND	100	ND	100	ND	--	--
Naphthalene	ug/kg	5000		1600000	--	--	--	--	--	--	--	--	--	--	--	--	--	--	10	ND	10	ND	10	ND	--	--
Nitrobenzene	ug/kg			160000	--	--	--	--	--	--	--	--	--	--	--	--	--	--	100	ND	100	ND	100	ND	--	--
n-Nitrosodimethylamine	ug/kg		19.6	640	--	--	--	--	--	--	--	--	--	--	--	--	--	--	100	ND	100	ND	100	ND	--	--
n-Nitrosodi-n-propylamine	ug/kg		143		--	--	--	--	--	--	--	--	--	--	--	--	--	--	100	ND	100	ND	100	ND	--	--
n-Nitrosodiphenylamine	ug/kg		204000		--	--	--	--	--	--	--	--	--	--	--	--	--	--	100	ND	100	ND	100	ND	--	--
Pentachlorophenol	ug/kg		2500	400000	--	--	--	--	--	--	--	--	--	--	--	--	--	--	500	ND	500	ND	500	ND	--	--
Phenanthrene	ug/kg				--	--	--	--	--	--	--	--	--	--	--	--	--	--	10	11	10	ND	10	ND	--	--
Phenol	ug/kg			24000000	--	--	--	--	--	--	--	--	--	--	--	--	--	--	100	ND	100	ND	100	ND	--	--
Pyrene	ug/kg			2400000	--	--	--	--	--	--	--	--	--	--	--	--	--	--	10	16	10	ND	10	ND	--	--
Pyridine	ug/kg			80000	--	--	--	--	--	--	--	--	--	--	--	--	--	--	200	ND	200	ND	200	ND	--	--
VOCs																										
1,1,1,2-Tetrachloroethane	ug/kg		38500	2400000	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	10	ND	10	ND	10	ND
1,1,1-Trichloroethane	ug/kg	2000		160000000	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	10	ND	10	ND	10	ND
1,1,2,2-Tetrachloroethane	ug/kg		5000	1600000	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	10	ND	10	ND	10	ND
1,1,2-Trichloroethane	ug/kg		17500	320000	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	10	ND	10	ND	10	ND
1,1-Dichloroethane	ug/kg		175000	16000000	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	10	ND	10	ND	10	ND
1,1-Dichloroethylene	ug/kg			4000000	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	10	ND	10	ND	10	ND
1,1-Dichloropropene	ug/kg				--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	10	ND	10	ND	10	ND
1,2,3-Trichlorobenzene	ug/kg				--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	10	ND	10	ND	10	ND
1,2,3-Trichloropropane	ug/kg		33.3	320000	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	10	ND	10	ND	10	ND
1,2,4-Trichlorobenzene	ug/kg		34500	800000	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	10	ND	10	ND	10	ND
1,2,4-Trimethylbenzene	ug/kg				--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	10	ND	10	ND	10	ND
1,2-Dibromo-3-chloropropane (DBCP)	ug/kg		1250	16000	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	50	ND	50	ND	50	ND
1,2-Dibromoethane (EDB)	ug/kg	5.00	500	720000	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	5.0	ND	5.0	ND	5.0	ND
1,2-Dichlorobenzene	ug/kg			7200000	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	10	ND	10	ND	10	ND
1,2-Dichloroethane	ug/kg		11000	480000	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	10	ND	10	ND	10	ND
1,2-Dichloroethylene, cis	ug/kg			160000	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	10	ND	10	ND	10	ND
1,2-Dichloroethylene, trans	ug/kg			1600000	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	10	ND	10	ND	10	ND
1,2-Dichloropropane	ug/kg		27800	7200000	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	10	ND	10	ND	10	ND
1,3,5-Trimethylbenzene	ug/kg			800000	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	10	ND	10	ND	10	ND
1,3-Dichlorobenzene	ug/kg				--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	10	ND	10	ND	10	ND
1,3-Dichloropropane	ug/kg				--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	10	ND	10	ND	10	ND
1,3-Dichloropropene, cis	ug/kg		10000	2400000	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	10	ND	10	ND	10	ND
1,3-Dichloropropene, trans	ug/kg		10000	2400000	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	10	ND	10	ND	10	ND
1,4-Dichlorobenzene	ug/kg		185000	5600000	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	10	ND	10	ND	10	ND
2,2-Dichloropropane	ug/kg				--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	10	ND	10	ND	10	ND
2-Hexanone	ug/kg				--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	50	ND	50	ND	50	ND
Acetone	ug/kg			72000000	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	50	ND	50	ND	50	ND
Acrylonitrile	ug/kg		1850	3200000	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	50	ND	50	ND	50	ND
Benzene	ug/kg	30.0	18200	320000	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	5.0	ND	5.0	ND	5.0	ND
Bromobenzene	ug/kg				--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	10	ND	10	ND	10	ND
Bromochloromethane	ug/kg				--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	10	ND	10	ND	10	ND
Bromodichloromethane	ug/kg		16100	1600000	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	10	ND	10	ND	10	ND

Table 1
Historical Soil Data Review - 2013 Landau PQLs vs. MTCA Cleanup Levels
Yakima Mill Site

				Location	FPP-B31		FPP-B32		FPP-B33		FPP-B34		FPP-MW-01		FPP-MW-02		FPP-MW-03		TP-B01		TP-B01		TP-B02		TP-B03	
				Date	8/22/2013		8/22/2013		8/22/2013		8/22/2013		8/20/2013		8/20/2013		8/20/2013		6/21/2013		6/21/2013		6/20/2013		6/20/2013	
				Depth	15 - 16 ft		15 - 16 ft		10 - 11 ft		15 - 16 ft		8.5 - 9 ft		8.5 - 9.5 ft		13.5 - 14.5 ft		1 - 2 ft		6.5 - 7.5 ft		13 - 14 ft		15 - 16 ft	
				Sample Type	N		N		N		N		N		N		N		N		N		N		N	
				Result Type	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result
				Data Status	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource
Parameter	Analysis Location	Washington Method A Unrestricted Land Use	Washington Method B Cancer Direct Contact	Washington Method B Noncancer Direct Contact																						
Effective Date		07/01/2015	07/01/2015	07/01/2015																						
Exceedance Key		No Exceedances	Shade	No Exceedances																						
Bromoform	ug/kg		127000	1600000	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	10	ND	10	ND	10	ND
Bromomethane	ug/kg			112000	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	10	ND	10	ND	10	ND
Butylbenzene	ug/kg			4000000	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	10	ND	10	ND	10	ND
Butylbenzene, sec	ug/kg			8000000	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	10	ND	10	ND	10	ND
Butylbenzene, tert	ug/kg			8000000	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	10	ND	10	ND	10	ND
Carbon disulfide	ug/kg			8000000	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	10	ND	10	ND	10	ND
Carbon tetrachloride	ug/kg		14300	320000	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	10	ND	10	ND	10	ND
Chlorobenzene	ug/kg			1600000	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	10	ND	10	ND	10	ND
Chlorodibromomethane	ug/kg		11900	1600000	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	10	ND	10	ND	10	ND
Chloroethane	ug/kg				--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	10	ND	10	ND	10	ND
Chloroform	ug/kg		32300	800000	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	10	ND	10	ND	10	ND
Chloromethane	ug/kg				--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	10	ND	10	ND	10	ND
Chlorotoluene, o	ug/kg			1600000	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	10	ND	10	ND	10	ND
Chlorotoluene, p	ug/kg				--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	10	ND	10	ND	10	ND
Cumene (isopropyl benzene)	ug/kg			8000000	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	10	ND	10	ND	10	ND
Cymene p- (toluene isopropyl p-)	ug/kg				--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	10	ND	10	ND	10	ND
Dibromomethane (methylene bromide)	ug/kg			800000	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	10	ND	10	ND	10	ND
Dichlorodifluoromethane (Freon-12)	ug/kg			16000000	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	10	ND	10	ND	10	ND
Ethyl benzene	ug/kg	6000		8000000	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	10	ND	10	ND	10	ND
Hexachlorobutadiene	ug/kg		12800	80000	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	10	ND	10	ND	10	ND
Methyl ethyl ketone (2-butanone)	ug/kg			48000000	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	50	ND	50	ND	50	ND
Methyl isobutyl ketone (MIBK)	ug/kg			6400000	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	50	ND	50	ND	50	ND
Methyl tertiary butyl ether (MTBE)	ug/kg	100	556000		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	10	ND	10	ND	10	ND
Methylene chloride	ug/kg	20.0	500000	480000	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	20	ND	20	ND	20	ND
Naphthalene	ug/kg	5000		1600000	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	10	ND	10	ND	10	ND
Propylbenzene	ug/kg			8000000	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	10	ND	10	ND	10	ND
Styrene	ug/kg			16000000	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	10	ND	10	ND	10	ND
Tetrachloroethylene	ug/kg	50.0	476000	480000	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	10	ND	10	ND	10	ND
Toluene	ug/kg	7000		6400000	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	10	ND	10	ND	10	ND
Trichloroethylene (TCE)	ug/kg	30.0	12000	40000	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	10	ND	10	ND	10	ND
Trichlorofluoromethane (Freon-11)	ug/kg			24000000	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	10	ND	10	ND	10	ND
Vinyl chloride	ug/kg			240000	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	10	ND	10	ND	10	ND
Xylene, m & p	ug/kg			16000000	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	20	ND	20	ND	20	ND
Xylene, o	ug/kg			16000000	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	10	ND	10	ND	10	ND
PCBs																										
Aroclor 1016	mg/kg		14.3	5.6	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	0.10	ND	--	--	--	--
Aroclor 1221	mg/kg				--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	0.10	ND	--	--	--	--
Aroclor 1232	mg/kg				--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	0.10	ND	--	--	--	--
Aroclor 1242	mg/kg				--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	0.10	ND	--	--	--	--
Aroclor 1248	mg/kg				--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	0.10	ND	--	--	--	--
Aroclor 1254	mg/kg		0.5	1.6	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	0.10	ND	--	--	--	--
Aroclor 1260	mg/kg		0.5		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	0.10	ND	--	--	--	--
Aroclor 1268	mg/kg				--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	0.10	ND	--	--	--	--
Total Petroleum Hydrocarbons																										
Total Petroleum Hydrocarbons (as diesel)	mg/kg	2000			25	ND	25	ND	25	ND	25	ND	25	ND	25	ND	25	46	25	ND	25	ND	25	ND	25	ND
Total Petroleum Hydrocarbons (as gasoline)	mg/kg	30.0			--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	3.0	ND	3.0	ND	--	--
Total Petroleum Hydrocarbons (as motor oil)	mg/kg	2000			50	820 J	50	ND	50	ND	50	ND	50	ND	50	67	50	55	50	57	50	ND	50	ND	50	ND

Barr qualifier - *: Estimated value, QA/QC criteria not met.
Landau qualifier - J: Indicates the analyte was positively identified; the associated numerical value is the approximate concentration of the analyte in the sample.
N: Normal Sample.
FD: Field Duplicate Sample.
ND: Not detected.
PQL: Practical Quantitation Limit.
SSource: Laboratory and/or field data obtained from a secondary source external to Barr. Second source QA/QC evaluation procedures may or may not have been performed beyond the original data generator.

Table 1
Historical Soil Data Review - 2013 Landau PQLs vs. MTCA Cleanup Levels
Yakima Mill Site

				Location	TP-B04		TP-B04B		TP-B06		TP-B07		TP-B08		TP-B08		TP-B09		TP-B09		TP-MW-01		TP-MW-02	
				Date	6/20/2013		6/20/2013		6/20/2013		6/21/2013		6/21/2013		6/21/2013		6/21/2013		6/21/2013		8/19/2013		8/19/2013	
				Depth	2 - 3 ft		11.5 - 13 ft		13.5 - 14 ft		14 - 15 ft		16 - 17.5 ft		7 - 8 ft		13 - 14 ft		6 - 7 ft		13.5 - 14.5 ft		14 - 15 ft	
				Sample Type	N		N		N		N		N		N		N		N		N		N	
				Result Type	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result
				Data Status	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource
Parameter	Analysis Location	Washington Method A Unrestricted Land Use	Washington Method B Cancer Direct Contact	Washington Method B Noncancer Direct Contact																				
Effective Date		07/01/2015	07/01/2015	07/01/2015																				
Exceedance Key		No Exceedances	Shade	No Exceedances																				
General Parameters																								
Carbon, total organic	%				--	--	0.10	1.9	0.10	1.6	--	--	--	--	--	--	0.10	4.2	--	--	--	--	--	--
pH	pH units				--	--	--	--	--	--	--	--	--	--	--	--	1.0	6.29	--	--	--	--	--	--
Solids, percent	%				--	--	0	92.0	0	61.4	--	--	--	--	--	--	0	71.4	--	--	--	--	--	--
Metals																								
Arsenic	mg/kg	20	0.667	24	1.5	5.8	1.0	1.8	1.2	4.4	1.2	3.1	1.0	2.5	1.0	2.7	1.0	2.1	1.1	4.5	1.0	2.1	1.0	2.3
Cadmium	mg/kg	2		80	0.50	ND	0.50	ND	0.50	ND	0.50	ND	0.50	ND	0.50	ND	0.50	ND	0.50	ND	0.50	ND	0.50	ND
Chromium	mg/kg				0.74	17	0.50	19	0.60	22	0.60	22	0.50	16	0.50	13	0.52	20	0.56	22	0.50	12	0.50	16
Chromium, hexavalent	mg/kg	19		240	--	--	--	--	--	--	--	--	--	--	--	--	5.0	ND	--	--	--	--	--	--
Iron	mg/kg			56000	67	33000	50	24000	55	29000	55	32000	50	24000	50	16000	50	21000	51	28000	50	22000	50	21000
Lead	mg/kg	250			0.50	28	0.50	3.4	0.50	7.4	0.50	8.0	0.50	4.9	0.50	6.9	0.50	7.7	0.50	32	0.50	3.3	0.50	3.4
Manganese	mg/kg			11200	0.58	1200	0.50	290	0.50	300	0.50	300	0.50	250	0.50	260	0.50	170	0.50	430	0.50	300	0.50	240
Mercury	mg/kg	2			0.020	0.091	0.020	0.023	0.020	0.094	0.020	0.076	0.020	0.085	0.020	0.038	0.020	0.092	0.020	0.055	0.020	0.025	0.020	0.021
SVOCs																								
1,2,4-Trichlorobenzene	ug/kg		34500	800000	--	--	100	ND	--	--	100	ND	100	ND	--	--	100	ND	--	--	--	--	--	--
1,2-Dichlorobenzene	ug/kg			7200000	--	--	100	ND	--	--	100	ND	100	ND	--	--	100	ND	--	--	--	--	--	--
1,3-Dichlorobenzene	ug/kg				--	--	100	ND	--	--	100	ND	100	ND	--	--	100	ND	--	--	--	--	--	--
1,4-Dichlorobenzene	ug/kg		185000	5600000	--	--	100	ND	--	--	100	ND	100	ND	--	--	100	ND	--	--	--	--	--	--
1-Methylnaphthalene	ug/kg		34500	5600000	--	--	10	ND	--	--	10	ND	10	ND	--	--	10	11	--	--	--	--	--	--
2,2'-oxybis (1-chloropropane)	ug/kg		14300	3200000	--	--	100	ND	--	--	100	ND	100	ND	--	--	100	ND	--	--	--	--	--	--
2,3,4,6-Tetrachlorophenol	ug/kg			2400000	--	--	250	ND	--	--	250	ND	250	ND	--	--	250	ND	--	--	--	--	--	--
2,4,5-Trichlorophenol	ug/kg			8000000	--	--	100	ND	--	--	100	ND	100	ND	--	--	100	ND	--	--	--	--	--	--
2,4,6-Trichlorophenol	ug/kg		90900	80000	--	--	100	ND	--	--	100	ND	100	ND	--	--	100	ND	--	--	--	--	--	--
2,4-Dichlorophenol	ug/kg			240000	--	--	100	ND	--	--	100	ND	100	ND	--	--	100	ND	--	--	--	--	--	--
2,4-Dimethylphenol	ug/kg			1600000	--	--	100	ND	--	--	100	ND	100	ND	--	--	100	ND	--	--	--	--	--	--
2,4-Dinitrophenol	ug/kg			160000	--	--	250	ND	--	--	250	ND	250	ND	--	--	250	ND	--	--	--	--	--	--
2,4-Dinitrotoluene	ug/kg		3230	160000	--	--	250	ND	--	--	250	ND	250	ND	--	--	250	ND	--	--	--	--	--	--
2,6-Dichlorophenol	ug/kg				--	--	100	ND	--	--	100	ND	100	ND	--	--	100	ND	--	--	--	--	--	--
2,6-Dinitrotoluene	ug/kg		667	24000	--	--	250	ND	--	--	250	ND	250	ND	--	--	250	ND	--	--	--	--	--	--
2-Chloronaphthalene	ug/kg			6400000	--	--	100	ND	--	--	100	ND	100	ND	--	--	100	ND	--	--	--	--	--	--
2-Chlorophenol	ug/kg			400000	--	--	100	ND	--	--	100	ND	100	ND	--	--	100	ND	--	--	--	--	--	--
2-Methyl-4,6-dinitrophenol	ug/kg				--	--	100	ND	--	--	120	ND	100	ND	--	--	100	ND	--	--	--	--	--	--
2-Methylnaphthalene	ug/kg			320000	--	--	10	ND	--	--	10	ND	10	ND	--	--	10	12	--	--	--	--	--	--
2-Methylphenol (o-cresol)	ug/kg			4000000	--	--	100	ND	--	--	100	ND	100	ND	--	--	100	ND	--	--	--	--	--	--
2-Nitroaniline	ug/kg			800000	--	--	250	ND	--	--	250	ND	250	ND	--	--	250	ND	--	--	--	--	--	--
2-Nitrophenol	ug/kg				--	--	250	ND	--	--	250	ND	250	ND	--	--	250	ND	--	--	--	--	--	--
3,3`-Dichlorobenzidine	ug/kg		2220		--	--	250	ND	--	--	270	ND	250	ND	--	--	250	ND	--	--	--	--	--	--
3,4-Methylphenol (m,p cresols)	ug/kg				--	--	100	ND	--	--	100	ND	100	ND	--	--	100	ND	--	--	--	--	--	--
3-Nitroaniline	ug/kg				--	--	250	ND	--	--	250	ND	250	ND	--	--	250	ND	--	--	--	--	--	--
4-Bromophenyl phenyl ether	ug/kg				--	--	100	ND	--	--	100	ND	100	ND	--	--	100	ND	--	--	--	--	--	--
4-Chloro-3-methylphenol	ug/kg				--	--	100	ND	--	--	100	ND	100	ND	--	--	100	ND	--	--	--	--	--	--
4-Chloroaniline	ug/kg		5000	320000	--	--	100	ND	--	--	110	ND	100	ND	--	--	100	ND	--	--	--	--	--	--
4-Chlorophenyl phenyl ether	ug/kg				--	--	100	ND	--	--	100	ND	100	ND	--	--	100	ND	--	--	--	--	--	--
4-Nitroaniline	ug/kg				--	--	250	ND	--	--	250	ND	250	ND	--	--	250	ND	--	--	--	--	--	--
4-Nitrophenol	ug/kg				--	--	500	ND	--	--	500	ND	500	ND	--	--	500	ND	--	--	--	--	--	--
Acenaphthene	ug/kg			4800000	--	--	10	ND	--	--	10	ND	10	ND	--	--	10	ND	--	--	--	--	--	--
Acenaphthylene	ug/kg				--	--	10	ND	--	--	10	25	10	ND	--	--	10	32	--	--	--	--	--	--
Aniline	ug/kg		175000	560000	--	--	100	ND	--	--	100	ND	100	ND	--	--	100	ND	--	--	--	--	--	--
Anthracene	ug/kg			24000000	--	--	10	ND	--	--	10	ND	10	ND	--	--	10	ND	--	--	--	--	--	--
Azobenzene	ug/kg		9090		--	--	100	ND	--	--	100	ND	100	ND	--	--	100	ND	--	--	--	--	--	--
Benz(a)anthracene	ug/kg		1370		--	--	10	ND	--	--	10	20	10	ND	--	--	10	ND	--	--	--	--	--	--
Benzo(a)pyrene	ug/kg	100	137		--	--	10	ND	--	--	10	22	10	ND	--	--	10	ND	--	--	--	--	--	--
Benzo(b)fluoranthene	ug/kg		1370		--	--	10	ND	--	--	10	16	10	ND	--	--	10	ND	--	--	--	--	--	--
Benzo(g,h,i)perylene	ug/kg				--	--	10	ND	--	--	10	18	10	ND	--	--	10	ND	--	--	--	--	--	--
Benzo(k)fluoranthene	ug/kg		13700		--	--	10	ND	--	--	10	15	10	ND	--	--	10	ND	--	--	--	--	--	--
Benzoic acid	ug/kg			320000000	--	--	1000	ND	--	--	1000	ND	1000	ND	--	--	1000	ND	--	--	--	--	--	--
Benzyl alcohol	ug/kg			8000000	--	--	100	ND	--	--	100	ND	100	ND	--	--	100	ND	--	--	--	--	--	--
Bis(2-chloroethoxy)methane	ug/kg				--	--	100	ND	--	--	100	ND	100	ND	--	--	100	ND	--	--	--	--	--	--
Bis(2-chloroethyl)ether	ug/kg		909		--	--	100	ND	--	--	100	ND	100	ND	--	--	100	ND	--	--	--	--	--	--
Bis(2-ethylhexyl)phthalate	ug/kg		71400	1600000	--	--	130	ND	--	--	130	ND	130	ND	--	--	130	ND	--	--	--	--	--	--

Table 1
Historical Soil Data Review - 2013 Landau PQLs vs. MTCA Cleanup Levels
Yakima Mill Site

				Location	TP-B04		TP-B04B		TP-B06		TP-B07		TP-B08		TP-B08		TP-B09		TP-B09		TP-MW-01		TP-MW-02	
				Date	6/20/2013		6/20/2013		6/20/2013		6/21/2013		6/21/2013		6/21/2013		6/21/2013		6/21/2013		8/19/2013		8/19/2013	
				Depth	2 - 3 ft		11.5 - 13 ft		13.5 - 14 ft		14 - 15 ft		16 - 17.5 ft		7 - 8 ft		13 - 14 ft		6 - 7 ft		13.5 - 14.5 ft		14 - 15 ft	
				Sample Type	N		N		N		N		N		N		N		N		N		N	
				Result Type	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result
				Data Status	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource
Parameter	Analysis Location	Washington Method A Unrestricted Land Use	Washington Method B Cancer Direct Contact	Washington Method B Noncancer Direct Contact																				
Effective Date		07/01/2015	07/01/2015	07/01/2015																				
Exceedance Key		No Exceedances	Shade	No Exceedances																				
Butyl benzyl phthalate	ug/kg		526000	16000000	--	--	100	ND	--	--	100	ND	100	ND	--	--	100	ND	--	--	--	--	--	--
Carbazole	ug/kg				--	--	100	ND	--	--	110	ND	100	ND	--	--	100	ND	--	--	--	--	--	--
Chrysene	ug/kg		137000		--	--	10	ND	--	--	10	18	10	ND	--	--	10	ND	--	--	--	--	--	--
Dibenz(a,h)anthracene	ug/kg		137		--	--	10	ND	--	--	10	ND	10	ND	--	--	10	ND	--	--	--	--	--	--
Dibenzofuran	ug/kg			80000	--	--	100	ND	--	--	100	ND	100	ND	--	--	100	ND	--	--	--	--	--	--
Diethyl phthalate	ug/kg			64000000	--	--	100	ND	--	--	100	ND	100	ND	--	--	100	ND	--	--	--	--	--	--
Dimethyl phthalate	ug/kg				--	--	100	ND	--	--	100	ND	100	ND	--	--	100	ND	--	--	--	--	--	--
Di-n-butyl phthalate	ug/kg			8000000	--	--	130	ND	--	--	130	ND	130	ND	--	--	130	ND	--	--	--	--	--	--
Di-n-octyl phthalate	ug/kg			800000	--	--	100	ND	--	--	100	ND	100	ND	--	--	100	ND	--	--	--	--	--	--
Fluoranthene	ug/kg			3200000	--	--	10	ND	--	--	10	45	10	10	--	--	10	28	--	--	--	--	--	--
Fluorene	ug/kg			3200000	--	--	10	ND	--	--	10	ND	10	ND	--	--	10	ND	--	--	--	--	--	--
Hexachlorobenzene	ug/kg		625	64000	--	--	100	ND	--	--	100	ND	100	ND	--	--	100	ND	--	--	--	--	--	--
Hexachlorobutadiene	ug/kg		12800	80000	--	--	100	ND	--	--	100	ND	100	ND	--	--	100	ND	--	--	--	--	--	--
Hexachlorocyclopentadiene	ug/kg			480000	--	--	500	ND	--	--	500	ND	500	ND	--	--	500	ND	--	--	--	--	--	--
Hexachloroethane	ug/kg		25000	56000	--	--	100	ND	--	--	100	ND	100	ND	--	--	100	ND	--	--	--	--	--	--
Indeno(1,2,3-cd)pyrene	ug/kg		1370		--	--	10	ND	--	--	10	16	10	ND	--	--	10	ND	--	--	--	--	--	--
Isophorone	ug/kg		1053000	16000000	--	--	100	ND	--	--	100	ND	100	ND	--	--	100	ND	--	--	--	--	--	--
Naphthalene	ug/kg	5000		1600000	--	--	10	ND	--	--	10	59	10	21	--	--	10	70	--	--	--	--	--	--
Nitrobenzene	ug/kg			160000	--	--	100	ND	--	--	100	ND	100	ND	--	--	100	ND	--	--	--	--	--	--
n-Nitrosodimethylamine	ug/kg		19.6	640	--	--	100	ND	--	--	100	ND	100	ND	--	--	100	ND	--	--	--	--	--	--
n-Nitrosodi-n-propylamine	ug/kg		143		--	--	100	ND	--	--	100	ND	100	ND	--	--	100	ND	--	--	--	--	--	--
n-Nitrosodiphenylamine	ug/kg		204000		--	--	100	ND	--	--	100	ND	100	ND	--	--	100	ND	--	--	--	--	--	--
Pentachlorophenol	ug/kg		2500	400000	--	--	500	ND	--	--	500	ND	500	ND	--	--	500	ND	--	--	--	--	--	--
Phenanthrene	ug/kg				--	--	10	ND	--	--	10	31	10	13	--	--	10	40	--	--	--	--	--	--
Phenol	ug/kg			24000000	--	--	100	ND	--	--	100	ND	100	ND	--	--	100	ND	--	--	--	--	--	--
Pyrene	ug/kg			2400000	--	--	10	ND	--	--	10	51	10	12	--	--	10	30	--	--	--	--	--	--
Pyridine	ug/kg			80000	--	--	200	ND	--	--	200	ND	200	ND	--	--	200	ND	--	--	--	--	--	--
VOCs																								
1,1,1,2-Tetrachloroethane	ug/kg		38500	2400000	--	--	10	ND	--	--	10	ND	10	ND	--	--	10	ND	10	ND	--	--	--	--
1,1,1-Trichloroethane	ug/kg	2000		160000000	--	--	10	ND	--	--	10	ND	10	ND	--	--	10	ND	10	ND	--	--	--	--
1,1,2,2-Tetrachloroethane	ug/kg		5000	1600000	--	--	10	ND	--	--	10	ND	10	ND	--	--	10	ND	10	ND	--	--	--	--
1,1,2-Trichloroethane	ug/kg		17500	320000	--	--	10	ND	--	--	10	ND	10	ND	--	--	10	ND	10	ND	--	--	--	--
1,1-Dichloroethane	ug/kg		175000	16000000	--	--	10	ND	--	--	10	ND	10	ND	--	--	10	ND	10	ND	--	--	--	--
1,1-Dichloroethylene	ug/kg			4000000	--	--	10	ND	--	--	10	ND	10	ND	--	--	10	ND	10	ND	--	--	--	--
1,1-Dichloropropene	ug/kg				--	--	10	ND	--	--	10	ND	10	ND	--	--	10	ND	10	ND	--	--	--	--
1,2,3-Trichlorobenzene	ug/kg				--	--	10	ND	--	--	10	ND	10	ND	--	--	10	ND	10	ND	--	--	--	--
1,2,3-Trichloropropane	ug/kg		33.3	320000	--	--	10	ND	--	--	10	ND	10	ND	--	--	10	ND	10	ND	--	--	--	--
1,2,4-Trichlorobenzene	ug/kg		34500	800000	--	--	10	ND	--	--	10	ND	10	ND	--	--	10	ND	10	ND	--	--	--	--
1,2,4-Trimethylbenzene	ug/kg				--	--	10	ND	--	--	10	ND	10	ND	--	--	10	ND	10	ND	--	--	--	--
1,2-Dibromo-3-chloropropane (DBCP)	ug/kg		1250	16000	--	--	50	ND	--	--	50	ND	50	ND	--	--	50	ND	50	ND	--	--	--	--
1,2-Dibromoethane (EDB)	ug/kg	5.00	500	720000	--	--	5.0	ND	--	--	5.0	ND	5.0	ND	--	--	5.0	ND	5.0	ND	--	--	--	--
1,2-Dichlorobenzene	ug/kg			7200000	--	--	10	ND	--	--	10	ND	10	ND	--	--	10	ND	10	ND	--	--	--	--
1,2-Dichloroethane	ug/kg		11000	480000	--	--	10	ND	--	--	10	ND	10	ND	--	--	10	ND	10	ND	--	--	--	--
1,2-Dichloroethylene, cis	ug/kg			160000	--	--	10	ND	--	--	10	ND	10	ND	--	--	10	ND	10	ND	--	--	--	--
1,2-Dichloroethylene, trans	ug/kg			1600000	--	--	10	ND	--	--	10	ND	10	ND	--	--	10	ND	10	ND	--	--	--	--
1,2-Dichloropropane	ug/kg		27800	7200000	--	--	10	ND	--	--	10	ND	10	ND	--	--	10	ND	10	ND	--	--	--	--
1,3,5-Trimethylbenzene	ug/kg			800000	--	--	10	ND	--	--	10	ND	10	ND	--	--	10	ND	10	ND	--	--	--	--
1,3-Dichlorobenzene	ug/kg				--	--	10	ND	--	--	10	ND	10	ND	--	--	10	ND	10	ND	--	--	--	--
1,3-Dichloropropane	ug/kg				--	--	10	ND	--	--	10	ND	10	ND	--	--	10	ND	10	ND	--	--	--	--
1,3-Dichloropropene, cis	ug/kg		10000	2400000	--	--	10	ND	--	--	10	ND	10	ND	--	--	10	ND	10	ND	--	--	--	--
1,3-Dichloropropene, trans	ug/kg		10000	2400000	--	--	10	ND	--	--	10	ND	10	ND	--	--	10	ND	10	ND	--	--	--	--
1,4-Dichlorobenzene	ug/kg		185000	5600000	--	--	10	ND	--	--	10	ND	10	ND	--	--	10	ND	10	ND	--	--	--	--
2,2-Dichloropropane	ug/kg				--	--	10	ND	--	--	10	ND	10	ND	--	--	10	ND	10	ND	--	--	--	--
2-Hexanone	ug/kg				--	--	50	ND	--	--	50	ND	50	ND	--	--	50	ND	50	ND	--	--	--	--
Acetone	ug/kg			72000000	--	--	50	ND	--	--	50	ND	50	ND	--	--	50	ND	50	ND	--	--	--	--
Acrylonitrile	ug/kg		1850	3200000	--	--	50	ND	--	--	50	ND	50	ND	--	--	50	ND	50	ND	--	--	--	--
Benzene	ug/kg	30.0	18200	320000	--	--	5.0	ND	--	--	5.0	ND	5.0	ND	--	--	5.0	ND	5.0	ND	--	--	--	--
Bromobenzene	ug/kg				--	--	10	ND	--	--	10	ND	10	ND	--	--	10	ND	10	ND	--	--	--	--
Bromochloromethane	ug/kg				--	--	10	ND	--	--	10	ND	10	ND	--	--	10	ND	10	ND	--	--	--	--
Bromodichloromethane	ug/kg		16100	1600000	--	--	10	ND	--	--	10	ND	10	ND	--	--	10	ND	10	ND	--	--	--	--

Table 1
Historical Soil Data Review - 2013 Landau PQLs vs. MTCA Cleanup Levels
Yakima Mill Site

				Location	TP-B04		TP-B04B		TP-B06		TP-B07		TP-B08		TP-B08		TP-B09		TP-B09		TP-MW-01		TP-MW-02	
				Date	6/20/2013		6/20/2013		6/20/2013		6/21/2013		6/21/2013		6/21/2013		6/21/2013		6/21/2013		8/19/2013		8/19/2013	
				Depth	2 - 3 ft		11.5 - 13 ft		13.5 - 14 ft		14 - 15 ft		16 - 17.5 ft		7 - 8 ft		13 - 14 ft		6 - 7 ft		13.5 - 14.5 ft		14 - 15 ft	
				Sample Type	N		N		N		N		N		N		N		N		N		N	
				Result Type	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result
				Data Status	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource
Parameter	Analysis Location	Washington Method A Unrestricted Land Use	Washington Method B Cancer Direct Contact	Washington Method B Noncancer Direct Contact																				
Effective Date		07/01/2015	07/01/2015	07/01/2015																				
Exceedance Key		No Exceedances	▨ Shade	No Exceedances																				
Bromoform	ug/kg		127000	1600000	--	--	10	ND	--	--	10	ND	10	ND	--	--	10	ND	10	ND	--	--	--	--
Bromomethane	ug/kg			112000	--	--	10	ND	--	--	10	ND	10	ND	--	--	10	ND	10	ND	--	--	--	--
Butylbenzene	ug/kg			4000000	--	--	10	ND	--	--	10	ND	10	ND	--	--	10	ND	10	ND	--	--	--	--
Butylbenzene, sec	ug/kg			8000000	--	--	10	ND	--	--	10	ND	10	ND	--	--	10	ND	10	ND	--	--	--	--
Butylbenzene, tert	ug/kg			8000000	--	--	10	ND	--	--	10	ND	10	ND	--	--	10	ND	10	ND	--	--	--	--
Carbon disulfide	ug/kg			8000000	--	--	10	ND	--	--	10	ND	10	ND	--	--	10	ND	10	ND	--	--	--	--
Carbon tetrachloride	ug/kg		14300	320000	--	--	10	ND	--	--	10	ND	10	ND	--	--	10	ND	10	ND	--	--	--	--
Chlorobenzene	ug/kg			1600000	--	--	10	ND	--	--	10	ND	10	ND	--	--	10	ND	10	ND	--	--	--	--
Chlorodibromomethane	ug/kg		11900	1600000	--	--	10	ND	--	--	10	ND	10	ND	--	--	10	ND	10	ND	--	--	--	--
Chloroethane	ug/kg				--	--	10	ND	--	--	10	ND	10	ND	--	--	10	ND	10	ND	--	--	--	--
Chloroform	ug/kg		32300	800000	--	--	10	ND	--	--	10	ND	10	ND	--	--	10	ND	10	ND	--	--	--	--
Chloromethane	ug/kg				--	--	10	ND	--	--	10	ND	10	ND	--	--	10	ND	10	ND	--	--	--	--
Chlorotoluene, o	ug/kg			1600000	--	--	10	ND	--	--	10	ND	10	ND	--	--	10	ND	10	ND	--	--	--	--
Chlorotoluene, p	ug/kg				--	--	10	ND	--	--	10	ND	10	ND	--	--	10	ND	10	ND	--	--	--	--
Cumene (isopropyl benzene)	ug/kg			8000000	--	--	10	ND	--	--	10	ND	10	ND	--	--	10	ND	10	ND	--	--	--	--
Cymene p- (toluene isopropyl p-)	ug/kg				--	--	10	ND	--	--	10	ND	10	ND	--	--	10	ND	10	ND	--	--	--	--
Dibromomethane (methylene bromide)	ug/kg			800000	--	--	10	ND	--	--	10	ND	10	ND	--	--	10	ND	10	ND	--	--	--	--
Dichlorodifluoromethane (Freon-12)	ug/kg			16000000	--	--	10	ND	--	--	10	ND	10	ND	--	--	10	ND	10	ND	--	--	--	--
Ethyl benzene	ug/kg	6000		8000000	--	--	10	ND	--	--	10	ND	10	ND	--	--	10	ND	10	ND	--	--	--	--
Hexachlorobutadiene	ug/kg		12800	80000	--	--	10	ND	--	--	10	ND	10	ND	--	--	10	ND	10	ND	--	--	--	--
Methyl ethyl ketone (2-butanone)	ug/kg			48000000	--	--	50	ND	--	--	50	ND	50	ND	--	--	50	ND	50	ND	--	--	--	--
Methyl isobutyl ketone (MIBK)	ug/kg			6400000	--	--	50	ND	--	--	50	ND	50	ND	--	--	50	ND	50	ND	--	--	--	--
Methyl tertiary butyl ether (MTBE)	ug/kg	100	556000		--	--	10	ND	--	--	10	ND	10	ND	--	--	10	ND	10	ND	--	--	--	--
Methylene chloride	ug/kg	20.0	500000	480000	--	--	20	ND	--	--	20	ND	20	ND	--	--	20	ND	20	ND	--	--	--	--
Naphthalene	ug/kg	5000		1600000	--	--	10	ND	--	--	10	ND	10	ND	--	--	10	ND	10	ND	--	--	--	--
Propylbenzene	ug/kg			8000000	--	--	10	ND	--	--	10	ND	10	ND	--	--	10	ND	10	ND	--	--	--	--
Styrene	ug/kg			16000000	--	--	10	ND	--	--	10	ND	10	ND	--	--	10	ND	10	ND	--	--	--	--
Tetrachloroethylene	ug/kg	50.0	476000	480000	--	--	10	ND	--	--	10	ND	10	ND	--	--	10	ND	10	ND	--	--	--	--
Toluene	ug/kg	7000		6400000	--	--	10	ND	--	--	10	ND	10	ND	--	--	10	ND	10	ND	--	--	--	--
Trichloroethylene (TCE)	ug/kg	30.0	12000	40000	--	--	10	ND	--	--	10	ND	10	ND	--	--	10	ND	10	ND	--	--	--	--
Trichlorofluoromethane (Freon-11)	ug/kg			24000000	--	--	10	ND	--	--	10	ND	10	ND	--	--	10	ND	10	ND	--	--	--	--
Vinyl chloride	ug/kg			240000	--	--	10	ND	--	--	10	ND	10	ND	--	--	10	ND	10	ND	--	--	--	--
Xylene, m & p	ug/kg			16000000	--	--	20	ND	--	--	20	ND	20	ND	--	--	20	ND	20	ND	--	--	--	--
Xylene, o	ug/kg			16000000	--	--	10	ND	--	--	10	ND	10	ND	--	--	10	ND	10	ND	--	--	--	--
PCBs																								
Aroclor 1016	mg/kg		14.3	5.6	--	--	0.10	ND	--	--	--	--	0.10	ND	--	--	0.10	ND	--	--	--	--	--	--
Aroclor 1221	mg/kg				--	--	0.10	ND	--	--	--	--	0.10	ND	--	--	0.10	ND	--	--	--	--	--	--
Aroclor 1232	mg/kg				--	--	0.10	ND	--	--	--	--	0.10	ND	--	--	0.10	ND	--	--	--	--	--	--
Aroclor 1242	mg/kg				--	--	0.10	ND	--	--	--	--	0.10	ND	--	--	0.10	ND	--	--	--	--	--	--
Aroclor 1248	mg/kg				--	--	0.10	ND	--	--	--	--	0.10	ND	--	--	0.10	ND	--	--	--	--	--	--
Aroclor 1254	mg/kg		0.5	1.6	--	--	0.10	ND	--	--	--	--	0.10	ND	--	--	0.10	ND	--	--	--	--	--	--
Aroclor 1260	mg/kg		0.5		--	--	0.10	ND	--	--	--	--	0.10	ND	--	--	0.10	ND	--	--	--	--	--	--
Aroclor 1268	mg/kg				--	--	0.10	ND	--	--	--	--	0.10	ND	--	--	0.10	ND	--	--	--	--	--	--
Total Petroleum Hydrocarbons																								
Total Petroleum Hydrocarbons (as diesel)	mg/kg	2000			35	ND	50	ND	30	ND	29	ND	25	360	25	ND	27	ND	29	ND	25	ND	25	48
Total Petroleum Hydrocarbons (as gasoline)	mg/kg	30.0			--	--	3.0	ND	--	--	--	--	3.0	ND	3.0	17	3.0	ND	--	--	--	--	--	--
Total Petroleum Hydrocarbons (as motor oil)	mg/kg	2000			50	510	100	1700	50	61	50	76	50	ND	50	180	50	59	50	130	50	ND	50	ND

Barr qualifier - *: Estimated value, QA/QC criteria not met.

Landau qualifier - J: Indicates the analyte was positively identified; the associated numerical value is the approximate concentration of the analyte in the sample.

N: Normal Sample.

FD: Field Duplicate Sample.

ND: Not detected.

PQL: Practical Quantitation Limit.

SSource: Laboratory and/or field data obtained from a secondary source external to Barr. Second source QA/QC evaluation procedures may or may not have been performed beyond the original data generator.

Table 2
Historical Groundwater Data - 2013 Landau PQLs vs. MTCA Cleanup Levels
Yakima Mill Site

					Location	FPP-B01		FPP-B02		FPP-B03		FPP-B04		FPP-B05		FPP-B07		FPP-B08		FPP-B09		FPP-B11		FPP-B12		FPP-B13	
					Date	6/18/2013		6/19/2013		6/18/2013		6/18/2013		6/19/2013		6/19/2013		6/18/2013		6/19/2013		6/18/2013		6/17/2013		6/17/2013	
					Depth	17 ft		19 ft		17 ft		15 ft		18 ft		17 ft		17 ft		18 ft		18 ft		18 ft		13 ft	
					Sample Type	N		N		N		N		N		N		N		N		N		N		N	
					Data Status	PQL SSource	Result SSource	PQL SSource	Result SSource	PQL SSource	Result SSource	PQL SSource	Result SSource	PQL SSource	Result SSource	PQL SSource	Result SSource	PQL SSource	Result SSource	PQL SSource	Result SSource	PQL SSource	Result SSource	PQL SSource	Result SSource	PQL SSource	Result SSource
Parameter	Total or Dissolved	Units	Washington GW Method A	Washington GW Method B Cancer	Washington GW Method B Noncancer																						
Effective Date			07/01/2015	07/01/2015	07/01/2015																						
Exceedance Key			**Bold**	Shade	Border																						
General Parameters																											
Carbon, total organic	NA	ug/l				--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Solids, total dissolved	NA	ug/l				--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Metals																											
Arsenic	Dissolved	ug/l	5.00	0.0583	4.80	1.0	ND	1.0	ND	1.0	ND	1.0	1.4	1.0	ND	1.0	ND	1.0	1.1	1.0	1.0	1.0	1.3	1.0	1.5	--	--
Arsenic	Total	ug/l	5.00	0.0583	4.80	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	1.0	2.5
Cadmium	Dissolved	ug/l	5.00		8.00	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	--	--
Cadmium	Total	ug/l	5.00		8.00	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	1.0	ND
Chromium	Dissolved	ug/l	50.0			2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	2.6	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--
Chromium	Total	ug/l	50.0			--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	2.0	10
Chromium, hexavalent	Dissolved	ug/l			48.0	--	--	10	ND	--	--	--	--	10	ND	--	--	--	--	10	ND	--	--	--	--	--	--
Chromium, hexavalent	Total	ug/l			48.0	--	--	10	ND	--	--	--	--	10	ND	--	--	--	--	10	ND	--	--	--	--	--	--
Iron	Dissolved	ug/l			11200	50	ND	50	80	50	ND	50	4900	50	3800	50	5200	50	430	50	4300	50	76	50	9500	--	--
Iron	Total	ug/l			11200	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	50	13000
Lead	Dissolved	ug/l	15.0			1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	--	--
Lead	Total	ug/l	15.0			--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	1.0	2.8
Manganese	Dissolved	ug/l			2240	2.0	830	2.0	1300	2.0	1900	2.0	2000	10	2700	2.0	1800	2.0	1300	10	3500	2.0	1600	2.0	1600	--	--
Manganese	Total	ug/l			2240	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	2.0	1700
Mercury	Dissolved	ug/l	2.00			0.20	ND	0.20	ND	0.20	ND	0.20	ND	0.20	ND	0.20	ND	0.20	ND	0.20	ND	0.20	ND	0.20	ND	--	--
Mercury	Total	ug/l	2.00			--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	0.20	ND
Sodium	Dissolved	ug/l				50	13000	50	14000	50	19000	50	79000	50	59000	50	22000	50	43000	50	41000	50	23000	50	41000	--	--
Sodium	Total	ug/l				--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	50	150000
SVOCs																											
1,2,4-Trichlorobenzene	NA	ug/l		1.51	80.0	2.0	ND	2.0	ND	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	2.0	ND
1,2-Dichlorobenzene	NA	ug/l			720	2.0	ND	2.0	ND	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	2.0	ND
1,3-Dichlorobenzene	NA	ug/l				2.0	ND	2.0	ND	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	2.0	ND
1,4-Dichlorobenzene	NA	ug/l		8.10	560	2.0	ND	2.0	ND	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	2.0	ND
1-Methylnaphthalene	NA	ug/l		1.51	560	2.0	ND	2.0	ND	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	2.0	ND
2,2'-oxybis (1-chloropropane)	NA	ug/l		0.625	320	2.0	ND	2.0	ND	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	2.0	ND
2,3,4,6-Tetrachlorophenol	NA	ug/l			480	2.0	ND	2.0	ND	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	2.0	ND
2,4,5-Trichlorophenol	NA	ug/l			800	2.0	ND	2.0	ND	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	2.0	ND
2,4,6-Trichlorophenol	NA	ug/l		3.98	8.00	2.0	ND	2.0	ND	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	2.0	ND
2,4-Dichlorophenol	NA	ug/l			24.0	2.0	ND	2.0	ND	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	2.0	ND
2,4-Dimethylphenol	NA	ug/l			160	2.0	ND	2.0	ND	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	2.0	ND
2,4-Dinitrophenol	NA	ug/l			32.0	10	ND	10	ND	--	--	10	ND	10	ND	10	ND	10	ND	10	ND	--	--	--	--	10	ND
2,4-Dinitrotoluene	NA	ug/l		0.282	32.0	2.0	ND	2.0	ND	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	2.0	ND
2,6-Dichlorophenol	NA	ug/l				2.0	ND	2.0	ND	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	2.0	ND
2,6-Dinitrotoluene	NA	ug/l		0.0583	4.80	2.0	ND	2.0	ND	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	2.0	ND
2-Chloronaphthalene	NA	ug/l			640	2.0	ND	2.0	ND	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	2.0	ND
2-Chlorophenol	NA	ug/l			40.0	2.0	ND	2.0	ND	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	2.0	ND
2-Methyl-4,6-dinitrophenol	NA	ug/l				2.0	ND	2.0	ND	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	2.0	ND
2-Methylnaphthalene	NA	ug/l			32.0	2.0	ND	2.0	ND	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	2.0	ND
2-Methylphenol (o-cresol)	NA	ug/l			400	2.0	ND	2.0	ND	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	2.0	ND
2-Nitroaniline	NA	ug/l			160	2.0	ND	2.0	ND	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	2.0	ND
2-Nitrophenol	NA	ug/l				2.0	ND	2.0	ND	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	2.0	ND
3,3`-Dichlorobenzidine	NA	ug/l		0.194		2.0	ND	2.0	ND	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	2.0	ND
3,4-Methylphenol (m,p cresols)	NA	ug/l				2.0	ND	2.0	ND	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	2.0	ND
3-Nitroaniline	NA	ug/l				5.0	ND	5.0	ND	--	--	5.0	ND	5.0	ND	5.0	ND	5.0	ND	5.0	ND	--	--	--	--	5.0	ND
4-Bromophenyl phenyl ether	NA	ug/l				2.0	ND	2.0	ND	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	2.0	ND
4-Chloro-3-methylphenol	NA	ug/l				2.0	ND UJ*	2.0	ND UJ*	--	--	2.0	ND UJ*	2.0	ND UJ*	2.0	ND UJ*	2.0	ND UJ*	2.0	ND UJ*	--	--	--	--	2.0	ND UJ*
4-Chloroaniline	NA	ug/l		0.219	32.0	2.0	ND	2.0	ND	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	2.0	ND
4-Chlorophenyl phenyl ether	NA	ug/l				2.0	ND	2.0	ND	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	2.0	ND
4-Nitroaniline	NA	ug/l				2.0	ND	2.0	ND	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	2.0	ND
4-Nitrophenol	NA	ug/l				2.0	ND	2.0	ND	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	2.0	ND
Acenaphthene	NA	ug/l			960	2.0	ND	2.0	ND	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	2.0	ND
Acenaphthylene	NA	ug/l				2.0	ND	2.0	ND	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	2.0	ND
Aniline	NA	ug/l		7.68	56.0	2.0	ND	2.0	ND	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	2.0	ND
Anthracene	NA	ug/l			4800	2.0	ND	2.0	ND	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	2.0	ND
Azobenzene	NA	ug/l		0.795		2.0	ND	2.0	ND	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	2.0	ND
Benz(a)anthracene	NA	ug/l		0.120		2.0	ND	2.0	ND	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	2.0	ND
Benzo(a)pyrene	NA	ug/l	**0.100**	0.0120		**2.0**	ND	**2.0**	ND	--	--	**2.0**	ND	**2.0**	ND	**2.0**	ND	**2.0**	ND	**2.0**	ND	--	--	--	--	**2.0**	ND
Benzo(b)fluoranthene	NA	ug/l		0.120		2.0	ND	2.0	ND	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	2.0	ND
Benzo(g,h,i)perylene	NA	ug/l				2.0	ND	2.0	ND	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	2.0	ND
Benzo(k)fluoranthene	NA	ug/l		1.20		2.0	ND	2.0	ND	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	2.0	ND
Benzoic acid	NA	ug/l			64000	10	ND	10	ND	--	--	10	ND	10	ND	10	ND	10	ND	10	ND	--	--	--	--	10	ND
Benzyl alcohol	NA	ug/l			800	2.0	ND	2.0	ND	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	2.0	ND

11-06-2017

Table 2
Historical Groundwater Data - 2013 Landau PQLs vs. MTCA Cleanup Levels
Yakima Mill Site

					Location	FPP-B01		FPP-B02		FPP-B03		FPP-B04		FPP-B05		FPP-B07		FPP-B08		FPP-B09		FPP-B11		FPP-B12		FPP-B13	
					Date	6/18/2013		6/19/2013		6/18/2013		6/18/2013		6/19/2013		6/19/2013		6/18/2013		6/19/2013		6/18/2013		6/17/2013		6/17/2013	
					Depth	17 ft		19 ft		17 ft		15 ft		18 ft		17 ft		17 ft		18 ft		18 ft		18 ft		13 ft	
					Sample Type	N		N		N		N		N		N		N		N		N		N		N	
						PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result
					Data Status	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource
Parameter	Total or Dissolved	Units	Washington GW Method A	Washington GW Method B Cancer	Washington GW Method B Noncancer																						
Effective Date			07/01/2015	07/01/2015	07/01/2015																						
Exceedance Key			**Bold**	Shade	Border																						
Bis(2-chloroethoxy)methane	NA	ug/l				2.0	ND	2.0	ND	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	2.0	ND
Bis(2-chloroethyl)ether	NA	ug/l		0.0398		2.0	ND	2.0	ND	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	2.0	ND
Bis(2-ethylhexyl)phthalate	NA	ug/l		6.25	320	2.0	ND	2.0	ND	--	--	2.0	ND	2.0	5.5	2.0	ND	2.0	ND	2.0	2.1	--	--	--	--	2.0	ND
Butyl benzyl phthalate	NA	ug/l		46.1	3200	2.0	ND	2.0	ND	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	2.0	ND
Carbazole	NA	ug/l				2.0	ND	2.0	ND	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	2.0	ND
Chrysene	NA	ug/l		12.0		2.0	ND	2.0	ND	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	2.0	ND
Dibenz(a,h)anthracene	NA	ug/l		0.0120		2.0	ND	2.0	ND	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	2.0	ND
Dibenzofuran	NA	ug/l			16.0	2.0	ND	2.0	ND	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	2.0	ND
Diethyl phthalate	NA	ug/l			12800	2.0	ND	2.0	ND	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	2.0	ND
Dimethyl phthalate	NA	ug/l				2.0	ND	2.0	ND	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	2.0	ND
Di-n-butyl phthalate	NA	ug/l			1600	2.0	ND	2.0	ND	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	2.0	ND
Di-n-octyl phthalate	NA	ug/l			160	2.0	ND	2.0	ND	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	2.0	ND
Fluoranthene	NA	ug/l			640	2.0	ND	2.0	ND	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	2.0	ND
Fluorene	NA	ug/l			640	2.0	ND	2.0	ND	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	2.0	ND
Hexachlorobenzene	NA	ug/l		0.0547	12.8	2.0	ND	2.0	ND	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	2.0	ND
Hexachlorobutadiene	NA	ug/l		0.561	8.00	2.0	ND	2.0	ND	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	2.0	ND
Hexachlorocyclopentadiene	NA	ug/l			48.0	2.0	ND	2.0	ND	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	2.0	ND
Hexachloroethane	NA	ug/l		1.09	5.60	2.0	ND	2.0	ND	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	2.0	ND
Indeno(1,2,3-cd)pyrene	NA	ug/l		0.120		2.0	ND	2.0	ND	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	2.0	ND
Isophorone	NA	ug/l		46.1	1600	2.0	ND	2.0	ND	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	2.0	ND
Naphthalene	NA	ug/l	160		160	2.0	ND	2.0	ND	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	2.0	ND
Nitrobenzene	NA	ug/l			16.0	2.0	ND	2.0	ND	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	2.0	ND
n-Nitrosodimethylamine	NA	ug/l		0.000858	0.0640	2.0	ND	2.0	ND	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	2.0	ND
n-Nitrosodi-n-propylamine	NA	ug/l		0.0125		2.0	ND	2.0	ND	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	2.0	ND
n-Nitrosodiphenylamine	NA	ug/l		17.9		2.0	ND	2.0	ND	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	2.0	ND
Pentachlorophenol	NA	ug/l		0.219	80.0	5.0	ND	5.0	ND	--	--	5.0	ND	5.0	ND	5.0	ND	5.0	ND	5.0	ND	--	--	--	--	5.0	ND
Phenanthrene	NA	ug/l				2.0	ND	2.0	ND	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	2.0	ND
Phenol	NA	ug/l			2400	2.0	ND	2.0	ND	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	2.0	ND
Pyrene	NA	ug/l			480	2.0	ND	2.0	ND	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	2.0	ND
Pyridine	NA	ug/l			8.00	2.0	ND	2.0	ND	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	2.0	ND
VOCs																											
1,1,1,2-Tetrachloroethane	NA	ug/l		1.68	240	2.0	ND	2.0	ND	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	2.0	ND
1,1,1-Trichloroethane	NA	ug/l	200		16000	2.0	ND	2.0	ND	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	2.0	ND
1,1,2,2-Tetrachloroethane	NA	ug/l		0.219	160	2.0	ND	2.0	ND	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	2.0	ND
1,1,2-Trichloroethane	NA	ug/l		0.768	32.0	2.0	ND	2.0	ND	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	2.0	ND
1,1-Dichloroethane	NA	ug/l		7.68	1600	2.0	ND	2.0	ND	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	2.0	ND
1,1-Dichloroethylene	NA	ug/l			400	2.0	ND	2.0	ND	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	2.0	ND
1,1-Dichloropropene	NA	ug/l				2.0	ND	2.0	ND	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	2.0	ND
1,2,3-Trichlorobenzene	NA	ug/l				2.0	ND	2.0	ND	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	2.0	ND
1,2,3-Trichloropropane	NA	ug/l		0.00146	32.0	2.0	ND	2.0	ND	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	2.0	ND
1,2,4-Trichlorobenzene	NA	ug/l		1.51	80.0	2.0	ND	2.0	ND	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	2.0	ND
1,2,4-Trimethylbenzene	NA	ug/l				2.0	ND	2.0	ND	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	2.0	ND
1,2-Dibromo-3-chloropropane (DBCP)	NA	ug/l		0.0547	1.60	10	ND	10	ND	--	--	10	ND	10	ND	10	ND	10	ND	10	ND	--	--	--	--	10	ND
1,2-Dibromoethane (EDB)	NA	ug/l	0.0100	0.0219	72.0	0.010	ND	0.010	ND	--	--	0.010	ND	0.010	ND	0.010	ND	0.010	ND	0.010	ND	--	--	--	--	0.010	ND
1,2-Dichlorobenzene	NA	ug/l			720	2.0	ND	2.0	ND	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	2.0	ND
1,2-Dichloroethane	NA	ug/l	5.00	0.481	48.0	2.0	ND	2.0	ND	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	2.0	ND
1,2-Dichloroethylene, cis	NA	ug/l			16.0	2.0	ND	2.0	ND	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	2.0	ND
1,2-Dichloroethylene, trans	NA	ug/l			160	2.0	ND	2.0	ND	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	2.0	ND
1,2-Dichloropropane	NA	ug/l		1.22	720	2.0	ND	2.0	ND	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	2.0	ND
1,3,5-Trimethylbenzene	NA	ug/l			80.0	2.0	ND	2.0	ND	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	2.0	ND
1,3-Dichlorobenzene	NA	ug/l				2.0	ND	2.0	ND	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	2.0	ND
1,3-Dichloropropane	NA	ug/l				2.0	ND	2.0	ND	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	2.0	ND
1,3-Dichloropropene, cis	NA	ug/l		0.438	240	2.0	ND	2.0	ND	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	2.0	ND
1,3-Dichloropropene, trans	NA	ug/l		0.438	240	2.0	ND	2.0	ND	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	2.0	ND
1,4-Dichlorobenzene	NA	ug/l		8.10	560	2.0	ND	2.0	ND	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	2.0	ND
2,2-Dichloropropane	NA	ug/l				2.0	ND	2.0	ND	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	2.0	ND
2-Hexanone	NA	ug/l				10	ND	10	ND	--	--	10	ND	10	ND	10	ND	10	ND	10	ND	--	--	--	--	10	ND
Acetone	NA	ug/l			7200	25	ND	25	ND	--	--	25	ND	25	ND	25	ND	25	ND	25	ND	--	--	--	--	25	ND
Acrylonitrile	NA	ug/l		0.0810	320	10	ND	10	ND	--	--	10	ND	10	ND	10	ND	10	ND	10	ND	--	--	--	--	10	ND
Benzene	NA	ug/l	5.00	0.795	32.0	2.0	ND	2.0	ND	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	2.0	ND
Bromobenzene	NA	ug/l				2.0	ND	2.0	ND	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	2.0	ND
Bromochloromethane	NA	ug/l				2.0	ND	2.0	ND	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	2.0	ND
Bromodichloromethane	NA	ug/l		0.706	160	2.0	ND	2.0	ND	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	2.0	ND
Bromoform	NA	ug/l		5.54	160	2.0	ND	2.0	ND	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	2.0	ND
Bromomethane	NA	ug/l			11.2	2.0	ND	2.0	ND	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	2.0	ND

Table 2
Historical Groundwater Data - 2013 Landau PQLs vs. MTCA Cleanup Levels
Yakima Mill Site

					Location	FPP-B01		FPP-B02		FPP-B03		FPP-B04		FPP-B05		FPP-B07		FPP-B08		FPP-B09		FPP-B11		FPP-B12		FPP-B13	
					Date	6/18/2013		6/19/2013		6/18/2013		6/18/2013		6/19/2013		6/19/2013		6/18/2013		6/19/2013		6/18/2013		6/17/2013		6/17/2013	
					Depth	17 ft		19 ft		17 ft		15 ft		18 ft		17 ft		17 ft		18 ft		18 ft		18 ft		13 ft	
					Sample Type	N		N		N		N		N		N		N		N		N		N		N	
						PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result
					Data Status	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource
Parameter	Total or Dissolved	Units	Washington GW Method A	Washington GW Method B Cancer	Washington GW Method B Noncancer																						
Effective Date			07/01/2015	07/01/2015	07/01/2015																						
Exceedance Key			**Bold**	Shade	Border																						
Butylbenzene	NA	ug/l			400	2.0	ND	2.0	ND	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	2.0	ND
Butylbenzene, sec	NA	ug/l			800	2.0	ND	2.0	ND	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	2.0	ND
Butylbenzene, tert	NA	ug/l			800	2.0	ND	2.0	ND	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	2.0	ND
Carbon disulfide	NA	ug/l			800	2.0	ND	2.0	ND	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	2.0	ND
Carbon tetrachloride	NA	ug/l		0.625	32.0	2.0	ND	2.0	ND	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	2.0	ND
Chlorobenzene	NA	ug/l			160	2.0	ND	2.0	ND	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	2.0	ND
Chlorodibromomethane	NA	ug/l		0.521	160	2.0	ND	2.0	ND	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	2.0	ND
Chloroethane	NA	ug/l				2.0	ND	2.0	ND	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	2.0	ND
Chloroform	NA	ug/l		1.41	80.0	2.0	3.3	2.0	2.8	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	2.0	ND
Chloromethane	NA	ug/l				2.0	ND	2.0	ND	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	2.0	ND
Chlorotoluene, o	NA	ug/l			160	2.0	ND	2.0	ND	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	2.0	ND
Chlorotoluene, p	NA	ug/l				2.0	ND	2.0	ND	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	2.0	ND
Cumene (isopropyl benzene)	NA	ug/l			800	2.0	ND	2.0	ND	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	2.0	ND
Cymene p- (toluene isopropyl p-)	NA	ug/l				2.0	ND	2.0	ND	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	2.0	ND
Dibromomethane (methylene bromide)	NA	ug/l			80.0	2.0	ND	2.0	ND	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	2.0	ND
Dichlorodifluoromethane (Freon-12)	NA	ug/l			1600	2.0	ND	2.0	ND	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	2.0	ND
Ethyl benzene	NA	ug/l	700		800	2.0	ND	2.0	ND	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	2.0	ND
Hexachlorobutadiene	NA	ug/l		0.561	8.00	2.0	ND	2.0	ND	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	2.0	ND
Methyl ethyl ketone (2-butanone)	NA	ug/l			4800	10	ND	10	ND	--	--	10	ND	10	ND	10	ND	10	ND	10	ND	--	--	--	--	10	ND
Methyl isobutyl ketone (MIBK)	NA	ug/l			640	10	ND	10	ND	--	--	10	ND	10	ND	10	ND	10	ND	10	ND	--	--	--	--	10	ND
Methyl tertiary butyl ether (MTBE)	NA	ug/l	20.0	24.3		2.0	ND	2.0	ND	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	2.0	ND
Methylene chloride	NA	ug/l	5.00	21.9	48.0	5.0	ND	5.0	ND	--	--	5.0	ND	5.0	ND	5.0	ND	5.0	ND	5.0	ND	--	--	--	--	5.0	ND
Naphthalene	NA	ug/l	160		160	2.0	ND	2.0	ND	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	2.0	ND
Propylbenzene	NA	ug/l			800	2.0	ND	2.0	ND	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	2.0	ND
Styrene	NA	ug/l			1600	2.0	ND	2.0	ND	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	2.0	ND
Tetrachloroethylene	NA	ug/l	5.00	20.8	48.0	2.0	ND	2.0	ND	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	2.0	ND
Toluene	NA	ug/l	1000		640	2.0	ND	2.0	ND	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	2.0	ND
Trichloroethylene (TCE)	NA	ug/l	5.00	0.540	4.00	0.020	ND	0.020	ND	--	--	0.020	ND	0.020	ND	0.020	ND	0.020	ND	0.020	ND	--	--	--	--	0.020	ND
Trichlorofluoromethane (Freon-11)	NA	ug/l			2400	2.0	ND	2.0	ND	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	2.0	ND
Vinyl chloride	NA	ug/l	0.200		24.0	0.020	ND	0.020	ND	--	--	0.020	ND	0.020	ND	0.020	ND	0.020	ND	0.020	ND	--	--	--	--	0.020	ND
Xylene, m & p	NA	ug/l			1600	4.0	ND	4.0	ND	--	--	4.0	ND	4.0	ND	4.0	ND	4.0	ND	4.0	ND	--	--	--	--	4.0	ND
Xylene, o	NA	ug/l			1600	2.0	ND	2.0	ND	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	2.0	ND
PCBs																											
Aroclor 1016	NA	ug/l		1.25	1.12	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Aroclor 1221	NA	ug/l				--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Aroclor 1232	NA	ug/l				--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Aroclor 1242	NA	ug/l				--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Aroclor 1248	NA	ug/l				--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Aroclor 1254	NA	ug/l		0.0438	0.320	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Aroclor 1260	NA	ug/l		0.0438		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Aroclor 1268	NA	ug/l				--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Total Petroleum Hydrocarbons																											
Total Petroleum Hydrocarbons (as diesel)	NA	ug/l	**500**			130	ND	130	ND	130	ND	130	1700	**620**	ND	130	ND	130	ND	130	ND	130	ND	130	ND	130	ND
Total Petroleum Hydrocarbons (as gasoline)	NA	ug/l	800			50	ND	50	ND	--	--	50	ND	50	51	50	ND	50	ND	50	ND	--	--	--	--	50	ND
Total Petroleum Hydrocarbons (as motor oil)	NA	ug/l	500			250	ND	250	ND	250	ND	250	5000	250	7500	250	ND	250	600	250	ND	250	ND	250	ND	250	ND

Barr qualifier - *: Estimated value, QA/QC criteria not met.

Barr qualifier - b: Potential false positive value based on blank data validation procedures. Concentrations identified as potential false positive are excluded from calculations.

Landau qualifier - J: Indicates the analyte was positively identified; the associated numerical value is the approximate concentration of the analyte in the sample.

Landau qualifier - UJ: The analyte was not detected in the sample; the reported sample reporting limit is an estimate.

N: Normal Sample.

FD: Field Duplicate Sample.

ND: Not detected.

PQL: Practical Quantitation Limit.

SSource: Laboratory and/or field data obtained from a secondary source external to Barr. Second source QA/QC evaluation procedures may or may not have been performed beyond the original data generator.

Table 2
Historical Groundwater Data - 2013 Landau PQLs vs. MTCA Cleanup Levels
Yakima Mill Site

					Location	**FPP-B15**		**FPP-B17**		**FPP-B19**		**FPP-B20**		**FPP-B24**		**FPP-B25**		**FPP-B26**		**FPP-B27**		**FPP-B28**		**FPP-B29B**		**FPP-B31**	
					Date	**6/17/2013**		**6/21/2013**		**6/19/2013**		**6/20/2013**		**6/20/2013**		**8/21/2013**		**8/21/2013**		**8/21/2013**		**8/23/2013**		**8/23/2013**		**8/22/2013**	
					Depth	**18 ft**		**17 ft**		**17 ft**		**11 ft**		**16 ft**		**18.5 ft**		**19.5 ft**		**16 ft**		**19 ft**		**19 ft**		**19 ft**	
					Sample Type	**N**		**N**		**N**		**N**		**N**		**N**		**N**		**N**		**N**		**N**		**N**	
						PQL	**Result**	**PQL**	**Result**	**PQL**	**Result**	**PQL**	**Result**	**PQL**	**Result**	**PQL**	**Result**	**PQL**	**Result**	**PQL**	**Result**	**PQL**	**Result**	**PQL**	**Result**	**PQL**	**Result**
					Data Status	**SSource**	**SSource**	**SSource**	**SSource**	**SSource**	**SSource**	**SSource**	**SSource**	**SSource**	**SSource**	**SSource**	**SSource**	**SSource**	**SSource**	**SSource**	**SSource**	**SSource**	**SSource**	**SSource**	**SSource**	**SSource**	**SSource**
Parameter	Total or Dissolved	Units	Washington GW Method A	Washington GW Method B Cancer	Washington GW Method B Noncancer																						
Effective Date			07/01/2015	07/01/2015	07/01/2015																						
Exceedance Key			**Bold**	Shade	Border																						
General Parameters																											
Carbon, total organic	NA	ug/l				--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Solids, total dissolved	NA	ug/l				--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Metals																											
Arsenic	Dissolved	ug/l	5.00	0.0583	4.80	1.0	ND	1.0	ND	--	--	1.0	2.7	1.0	ND	1.0	ND	1.0	1.1	5.0	35	1.0	ND	1.0	3.6	1.0	1.9
Arsenic	Total	ug/l	5.00	0.0583	4.80	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Cadmium	Dissolved	ug/l	5.00		8.00	1.0	ND	1.0	ND	--	--	1.0	ND	1.0	ND	1.0	ND	1.0	ND	5.0	ND	1.0	ND	1.0	ND	1.0	ND
Cadmium	Total	ug/l	5.00		8.00	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Chromium	Dissolved	ug/l	50.0			2.0	ND	2.0	ND	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND	10	ND	2.0	ND	2.0	ND	2.0	ND
Chromium	Total	ug/l	50.0			--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Chromium, hexavalent	Dissolved	ug/l			48.0	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Chromium, hexavalent	Total	ug/l			48.0	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Iron	Dissolved	ug/l			11200	50	71	50	1200	--	--	50	21000	50	84	50	9700	50	18000	250	580	50	24000	50	23000	50	14000
Iron	Total	ug/l			11200	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Lead	Dissolved	ug/l	15.0			1.0	ND	1.0	ND	--	--	1.0	ND	1.0	ND	1.0	ND	1.0	ND	5.0	9.2	1.0	ND	1.0	ND	1.0	ND
Lead	Total	ug/l	15.0			--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Manganese	Dissolved	ug/l			2240	2.0	420	2.0	1800	--	--	2.0	4700	2.0	700	2.0	1100	2.0	1600	10	90	2.0	2300	40	6100	2.0	1600
Manganese	Total	ug/l			2240	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Mercury	Dissolved	ug/l	2.00			0.20	ND	0.20	ND	--	--	0.20	ND	0.20	ND	0.20	ND	0.20	ND	0.20	ND	0.20	ND	0.20	ND	0.20	ND
Mercury	Total	ug/l	2.00			--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Sodium	Dissolved	ug/l				50	18000	50	47000	--	--	50	130000	50	53000	50	18000	50	23000	1000	1500000	50	68000	50	110000	50	20000
Sodium	Total	ug/l				--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
SVOCs																											
1,2,4-Trichlorobenzene	NA	ug/l		1.51	80.0	--	--	2.0	ND	--	--	2.0	ND	2.0	ND	--	--	--	--	--	--	--	--	--	--	--	--
1,2-Dichlorobenzene	NA	ug/l			720	--	--	2.0	ND	--	--	2.0	ND	2.0	ND	--	--	--	--	--	--	--	--	--	--	--	--
1,3-Dichlorobenzene	NA	ug/l				--	--	2.0	ND	--	--	2.0	ND	2.0	ND	--	--	--	--	--	--	--	--	--	--	--	--
1,4-Dichlorobenzene	NA	ug/l		8.10	560	--	--	2.0	ND	--	--	2.0	ND	2.0	ND	--	--	--	--	--	--	--	--	--	--	--	--
1-Methylnaphthalene	NA	ug/l		1.51	560	--	--	2.0	ND	--	--	2.0	ND	2.0	ND	--	--	--	--	--	--	--	--	--	--	--	--
2,2'-oxybis (1-chloropropane)	NA	ug/l		0.625	320	--	--	2.0	ND	--	--	2.0	ND	2.0	ND	--	--	--	--	--	--	--	--	--	--	--	--
2,3,4,6-Tetrachlorophenol	NA	ug/l			480	--	--	2.0	ND	--	--	2.0	ND	2.0	ND	--	--	--	--	--	--	--	--	--	--	--	--
2,4,5-Trichlorophenol	NA	ug/l			800	--	--	2.0	ND	--	--	2.0	ND	2.0	ND	--	--	--	--	--	--	--	--	--	--	--	--
2,4,6-Trichlorophenol	NA	ug/l		3.98	8.00	--	--	2.0	ND	--	--	2.0	ND	2.0	ND	--	--	--	--	--	--	--	--	--	--	--	--
2,4-Dichlorophenol	NA	ug/l			24.0	--	--	2.0	ND	--	--	2.0	ND	2.0	ND	--	--	--	--	--	--	--	--	--	--	--	--
2,4-Dimethylphenol	NA	ug/l			160	--	--	2.0	ND	--	--	2.0	ND	2.0	8.1	--	--	--	--	--	--	--	--	--	--	--	--
2,4-Dinitrophenol	NA	ug/l			32.0	--	--	10	ND	--	--	10	ND	10	ND	--	--	--	--	--	--	--	--	--	--	--	--
2,4-Dinitrotoluene	NA	ug/l		0.282	32.0	--	--	2.0	ND	--	--	2.0	ND	2.0	ND	--	--	--	--	--	--	--	--	--	--	--	--
2,6-Dichlorophenol	NA	ug/l				--	--	2.0	ND	--	--	2.0	ND	2.0	ND	--	--	--	--	--	--	--	--	--	--	--	--
2,6-Dinitrotoluene	NA	ug/l		0.0583	4.80	--	--	2.0	ND	--	--	2.0	ND	2.0	ND	--	--	--	--	--	--	--	--	--	--	--	--
2-Chloronaphthalene	NA	ug/l			640	--	--	2.0	ND	--	--	2.0	ND	2.0	ND	--	--	--	--	--	--	--	--	--	--	--	--
2-Chlorophenol	NA	ug/l			40.0	--	--	2.0	ND	--	--	2.0	ND	2.0	ND	--	--	--	--	--	--	--	--	--	--	--	--
2-Methyl-4,6-dinitrophenol	NA	ug/l				--	--	2.0	ND	--	--	2.0	ND	2.0	ND	--	--	--	--	--	--	--	--	--	--	--	--
2-Methylnaphthalene	NA	ug/l			32.0	--	--	2.0	ND	--	--	2.0	ND	2.0	ND	--	--	--	--	--	--	--	--	--	--	--	--
2-Methylphenol (o-cresol)	NA	ug/l			400	--	--	2.0	ND	--	--	2.0	ND	2.0	ND	--	--	--	--	--	--	--	--	--	--	--	--
2-Nitroaniline	NA	ug/l			160	--	--	2.0	ND	--	--	2.0	ND	2.0	ND	--	--	--	--	--	--	--	--	--	--	--	--
2-Nitrophenol	NA	ug/l				--	--	2.0	ND	--	--	2.0	ND	2.0	ND	--	--	--	--	--	--	--	--	--	--	--	--
3,3`-Dichlorobenzidine	NA	ug/l		0.194		--	--	2.0	ND	--	--	2.0	ND	2.0	ND	--	--	--	--	--	--	--	--	--	--	--	--
3,4-Methylphenol (m,p cresols)	NA	ug/l				--	--	2.0	ND	--	--	2.0	ND	2.0	ND	--	--	--	--	--	--	--	--	--	--	--	--
3-Nitroaniline	NA	ug/l				--	--	5.0	ND	--	--	5.0	ND	5.0	ND	--	--	--	--	--	--	--	--	--	--	--	--
4-Bromophenyl phenyl ether	NA	ug/l				--	--	2.0	ND	--	--	2.0	ND	2.0	ND	--	--	--	--	--	--	--	--	--	--	--	--
4-Chloro-3-methylphenol	NA	ug/l				--	--	2.0	ND UJ*	--	--	2.0	ND UJ*	2.0	ND UJ*	--	--	--	--	--	--	--	--	--	--	--	--
4-Chloroaniline	NA	ug/l		0.219	32.0	--	--	2.0	ND	--	--	2.0	ND	2.0	ND	--	--	--	--	--	--	--	--	--	--	--	--
4-Chlorophenyl phenyl ether	NA	ug/l				--	--	2.0	ND	--	--	2.0	ND	2.0	ND	--	--	--	--	--	--	--	--	--	--	--	--
4-Nitroaniline	NA	ug/l				--	--	2.0	ND	--	--	2.0	ND	2.0	ND	--	--	--	--	--	--	--	--	--	--	--	--
4-Nitrophenol	NA	ug/l				--	--	2.0	ND	--	--	2.0	ND	2.0	ND	--	--	--	--	--	--	--	--	--	--	--	--
Acenaphthene	NA	ug/l			960	--	--	2.0	ND	--	--	2.0	ND	2.0	ND	--	--	--	--	--	--	--	--	--	--	--	--
Acenaphthylene	NA	ug/l				--	--	2.0	ND	--	--	2.0	ND	2.0	ND	--	--	--	--	--	--	--	--	--	--	--	--
Aniline	NA	ug/l		7.68	56.0	--	--	2.0	ND	--	--	2.0	ND	2.0	ND	--	--	--	--	--	--	--	--	--	--	--	--
Anthracene	NA	ug/l			4800	--	--	2.0	ND	--	--	2.0	ND	2.0	ND	--	--	--	--	--	--	--	--	--	--	--	--
Azobenzene	NA	ug/l		0.795		--	--	2.0	ND	--	--	2.0	ND	2.0	ND	--	--	--	--	--	--	--	--	--	--	--	--
Benz(a)anthracene	NA	ug/l		0.120		--	--	2.0	ND	--	--	2.0	ND	2.0	ND	--	--	--	--	--	--	--	--	--	--	--	--
Benzo(a)pyrene	NA	ug/l	**0.100**	0.0120		--	--	**2.0**	ND	--	--	**2.0**	ND	**2.0**	ND	--	--	--	--	--	--	--	--	--	--	--	--
Benzo(b)fluoranthene	NA	ug/l		0.120		--	--	2.0	ND	--	--	2.0	ND	2.0	ND	--	--	--	--	--	--	--	--	--	--	--	--
Benzo(g,h,i)perylene	NA	ug/l				--	--	2.0	ND	--	--	2.0	ND	2.0	ND	--	--	--	--	--	--	--	--	--	--	--	--
Benzo(k)fluoranthene	NA	ug/l		1.20		--	--	2.0	ND	--	--	2.0	ND	2.0	ND	--	--	--	--	--	--	--	--	--	--	--	--
Benzoic acid	NA	ug/l			64000	--	--	10	ND	--	--	10	ND	10	ND	--	--	--	--	--	--	--	--	--	--	--	--
Benzyl alcohol	NA	ug/l			800	--	--	2.0	ND	--	--	2.0	ND	2.0	ND	--	--	--	--	--	--	--	--	--	--	--	--

Table 2
Historical Groundwater Data - 2013 Landau PQLs vs. MTCA Cleanup Levels
Yakima Mill Site

					Location	FPP-B15		FPP-B17		FPP-B19		FPP-B20		FPP-B24		FPP-B25		FPP-B26		FPP-B27		FPP-B28		FPP-B29B		FPP-B31	
					Date	6/17/2013		6/21/2013		6/19/2013		6/20/2013		6/20/2013		8/21/2013		8/21/2013		8/21/2013		8/23/2013		8/23/2013		8/22/2013	
					Depth	18 ft		17 ft		17 ft		11 ft		16 ft		18.5 ft		19.5 ft		16 ft		19 ft		19 ft		19 ft	
					Sample Type	N		N		N		N		N		N		N		N		N		N		N	
						PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result
					Data Status	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource
Parameter	Total or Dissolved	Units	Washington GW Method A	Washington GW Method B Cancer	Washington GW Method B Noncancer																						
Effective Date			07/01/2015	07/01/2015	07/01/2015																						
Exceedance Key			**Bold**	Shade	Border																						
Bis(2-chloroethoxy)methane	NA	ug/l				--	--	2.0	ND	--	--	2.0	ND	2.0	ND	--	--	--	--	--	--	--	--	--	--	--	--
Bis(2-chloroethyl)ether	NA	ug/l		0.0398		--	--	2.0	ND	--	--	2.0	ND	2.0	ND	--	--	--	--	--	--	--	--	--	--	--	--
Bis(2-ethylhexyl)phthalate	NA	ug/l		6.25	320	--	--	2.0	ND	--	--	2.0	ND	2.0	ND	--	--	--	--	--	--	--	--	--	--	--	--
Butyl benzyl phthalate	NA	ug/l		46.1	3200	--	--	2.0	ND	--	--	2.0	ND	2.0	ND	--	--	--	--	--	--	--	--	--	--	--	--
Carbazole	NA	ug/l				--	--	2.0	ND	--	--	2.0	ND	2.0	ND	--	--	--	--	--	--	--	--	--	--	--	--
Chrysene	NA	ug/l		12.0		--	--	2.0	ND	--	--	2.0	ND	2.0	ND	--	--	--	--	--	--	--	--	--	--	--	--
Dibenz(a,h)anthracene	NA	ug/l		0.0120		--	--	2.0	ND	--	--	2.0	ND	2.0	ND	--	--	--	--	--	--	--	--	--	--	--	--
Dibenzofuran	NA	ug/l			16.0	--	--	2.0	ND	--	--	2.0	ND	2.0	ND	--	--	--	--	--	--	--	--	--	--	--	--
Diethyl phthalate	NA	ug/l			12800	--	--	2.0	ND	--	--	2.0	ND	2.0	ND	--	--	--	--	--	--	--	--	--	--	--	--
Dimethyl phthalate	NA	ug/l				--	--	2.0	ND	--	--	2.0	ND	2.0	ND	--	--	--	--	--	--	--	--	--	--	--	--
Di-n-butyl phthalate	NA	ug/l			1600	--	--	2.0	ND	--	--	2.0	ND	2.0	ND	--	--	--	--	--	--	--	--	--	--	--	--
Di-n-octyl phthalate	NA	ug/l			160	--	--	2.0	ND	--	--	2.0	ND	2.0	ND	--	--	--	--	--	--	--	--	--	--	--	--
Fluoranthene	NA	ug/l			640	--	--	2.0	ND	--	--	2.0	ND	2.0	ND	--	--	--	--	--	--	--	--	--	--	--	--
Fluorene	NA	ug/l			640	--	--	2.0	ND	--	--	2.0	ND	2.0	ND	--	--	--	--	--	--	--	--	--	--	--	--
Hexachlorobenzene	NA	ug/l		0.0547	12.8	--	--	2.0	ND	--	--	2.0	ND	2.0	ND	--	--	--	--	--	--	--	--	--	--	--	--
Hexachlorobutadiene	NA	ug/l		0.561	8.00	--	--	2.0	ND	--	--	2.0	ND	2.0	ND	--	--	--	--	--	--	--	--	--	--	--	--
Hexachlorocyclopentadiene	NA	ug/l			48.0	--	--	2.0	ND	--	--	2.0	ND	2.0	ND	--	--	--	--	--	--	--	--	--	--	--	--
Hexachloroethane	NA	ug/l		1.09	5.60	--	--	2.0	ND	--	--	2.0	ND	2.0	ND	--	--	--	--	--	--	--	--	--	--	--	--
Indeno(1,2,3-cd)pyrene	NA	ug/l		0.120		--	--	2.0	ND	--	--	2.0	ND	2.0	ND	--	--	--	--	--	--	--	--	--	--	--	--
Isophorone	NA	ug/l		46.1	1600	--	--	2.0	ND	--	--	2.0	ND	2.0	ND	--	--	--	--	--	--	--	--	--	--	--	--
Naphthalene	NA	ug/l	160		160	--	--	2.0	ND	--	--	2.0	ND	2.0	ND	--	--	--	--	--	--	--	--	--	--	--	--
Nitrobenzene	NA	ug/l			16.0	--	--	2.0	ND	--	--	2.0	ND	2.0	ND	--	--	--	--	--	--	--	--	--	--	--	--
n-Nitrosodimethylamine	NA	ug/l		0.000858	0.0640	--	--	2.0	ND	--	--	2.0	ND	2.0	ND	--	--	--	--	--	--	--	--	--	--	--	--
n-Nitrosodi-n-propylamine	NA	ug/l		0.0125		--	--	2.0	ND	--	--	2.0	ND	2.0	ND	--	--	--	--	--	--	--	--	--	--	--	--
n-Nitrosodiphenylamine	NA	ug/l		17.9		--	--	2.0	ND	--	--	2.0	ND	2.0	ND	--	--	--	--	--	--	--	--	--	--	--	--
Pentachlorophenol	NA	ug/l		0.219	80.0	--	--	5.0	ND	--	--	5.0	ND	5.0	ND	--	--	--	--	--	--	--	--	--	--	--	--
Phenanthrene	NA	ug/l				--	--	2.0	ND	--	--	2.0	ND	2.0	ND	--	--	--	--	--	--	--	--	--	--	--	--
Phenol	NA	ug/l			2400	--	--	2.0	ND	--	--	2.0	ND	2.0	ND	--	--	--	--	--	--	--	--	--	--	--	--
Pyrene	NA	ug/l			480	--	--	2.0	ND	--	--	2.0	ND	2.0	ND	--	--	--	--	--	--	--	--	--	--	--	--
Pyridine	NA	ug/l			8.00	--	--	2.0	ND	--	--	2.0	ND	2.0	ND	--	--	--	--	--	--	--	--	--	--	--	--
VOCs																											
1,1,1,2-Tetrachloroethane	NA	ug/l		1.68	240	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	--	--	--	--	--	--	--	--
1,1,1-Trichloroethane	NA	ug/l	200		16000	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	--	--	--	--	--	--	--	--
1,1,2,2-Tetrachloroethane	NA	ug/l		0.219	160	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	--	--	--	--	--	--	--	--
1,1,2-Trichloroethane	NA	ug/l		0.768	32.0	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	--	--	--	--	--	--	--	--
1,1-Dichloroethane	NA	ug/l		7.68	1600	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	--	--	--	--	--	--	--	--
1,1-Dichloroethylene	NA	ug/l			400	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	--	--	--	--	--	--	--	--
1,1-Dichloropropene	NA	ug/l				--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	--	--	--	--	--	--	--	--
1,2,3-Trichlorobenzene	NA	ug/l				--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	--	--	--	--	--	--	--	--
1,2,3-Trichloropropane	NA	ug/l		0.00146	32.0	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	--	--	--	--	--	--	--	--
1,2,4-Trichlorobenzene	NA	ug/l		1.51	80.0	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	--	--	--	--	--	--	--	--
1,2,4-Trimethylbenzene	NA	ug/l				--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	--	--	--	--	--	--	--	--
1,2-Dibromo-3-chloropropane (DBCP)	NA	ug/l		0.0547	1.60	--	--	10	ND	10	ND	10	ND	10	ND	--	--	--	--	--	--	--	--	--	--	--	--
1,2-Dibromoethane (EDB)	NA	ug/l	0.0100	0.0219	72.0	--	--	0.010	ND	0.010	ND	0.010	ND	0.010	ND	--	--	--	--	--	--	--	--	--	--	--	--
1,2-Dichlorobenzene	NA	ug/l			720	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	--	--	--	--	--	--	--	--
1,2-Dichloroethane	NA	ug/l	5.00	0.481	48.0	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	--	--	--	--	--	--	--	--
1,2-Dichloroethylene, cis	NA	ug/l			16.0	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	--	--	--	--	--	--	--	--
1,2-Dichloroethylene, trans	NA	ug/l			160	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	--	--	--	--	--	--	--	--
1,2-Dichloropropane	NA	ug/l		1.22	720	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	--	--	--	--	--	--	--	--
1,3,5-Trimethylbenzene	NA	ug/l			80.0	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	--	--	--	--	--	--	--	--
1,3-Dichlorobenzene	NA	ug/l				--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	--	--	--	--	--	--	--	--
1,3-Dichloropropane	NA	ug/l				--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	--	--	--	--	--	--	--	--
1,3-Dichloropropene, cis	NA	ug/l		0.438	240	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	--	--	--	--	--	--	--	--
1,3-Dichloropropene, trans	NA	ug/l		0.438	240	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	--	--	--	--	--	--	--	--
1,4-Dichlorobenzene	NA	ug/l		8.10	560	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	--	--	--	--	--	--	--	--
2,2-Dichloropropane	NA	ug/l				--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	--	--	--	--	--	--	--	--
2-Hexanone	NA	ug/l				--	--	10	ND	10	ND	10	ND	10	ND	--	--	--	--	--	--	--	--	--	--	--	--
Acetone	NA	ug/l			7200	--	--	25	ND	25	ND	25	ND	25	ND	--	--	--	--	--	--	--	--	--	--	--	--
Acrylonitrile	NA	ug/l		0.0810	320	--	--	10	ND	10	ND	10	ND	10	ND	--	--	--	--	--	--	--	--	--	--	--	--
Benzene	NA	ug/l	5.00	0.795	32.0	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	--	--	--	--	--	--	--	--
Bromobenzene	NA	ug/l				--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	--	--	--	--	--	--	--	--
Bromochloromethane	NA	ug/l				--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	--	--	--	--	--	--	--	--
Bromodichloromethane	NA	ug/l		0.706	160	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	--	--	--	--	--	--	--	--
Bromoform	NA	ug/l		5.54	160	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	--	--	--	--	--	--	--	--
Bromomethane	NA	ug/l			11.2	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	--	--	--	--	--	--	--	--

Table 2
Historical Groundwater Data - 2013 Landau PQLs vs. MTCA Cleanup Levels
Yakima Mill Site

Location						**FPP-B15**		**FPP-B17**		**FPP-B19**		**FPP-B20**		**FPP-B24**		**FPP-B25**		**FPP-B26**		**FPP-B27**		**FPP-B28**		**FPP-B29B**		**FPP-B31**	
Date						**6/17/2013**		**6/21/2013**		**6/19/2013**		**6/20/2013**		**6/20/2013**		**8/21/2013**		**8/21/2013**		**8/21/2013**		**8/23/2013**		**8/23/2013**		**8/22/2013**	
Depth						**18 ft**		**17 ft**		**17 ft**		**11 ft**		**16 ft**		**18.5 ft**		**19.5 ft**		**16 ft**		**19 ft**		**19 ft**		**19 ft**	
Sample Type						**N**		**N**		**N**		**N**		**N**		**N**		**N**		**N**		**N**		**N**		**N**	
						PQL	**Result**	**PQL**	**Result**	**PQL**	**Result**	**PQL**	**Result**	**PQL**	**Result**	**PQL**	**Result**	**PQL**	**Result**	**PQL**	**Result**	**PQL**	**Result**	**PQL**	**Result**	**PQL**	**Result**
Data Status						**SSource**	**SSource**	**SSource**	**SSource**	**SSource**	**SSource**	**SSource**	**SSource**	**SSource**	**SSource**	**SSource**	**SSource**	**SSource**	**SSource**	**SSource**	**SSource**	**SSource**	**SSource**	**SSource**	**SSource**	**SSource**	**SSource**
Parameter	Total or Dissolved	Units	Washington GW Method A	Washington GW Method B Cancer	Washington GW Method B Noncancer																						
Effective Date			07/01/2015	07/01/2015	07/01/2015																						
Exceedance Key			**Bold**	Shade	Border																						
Butylbenzene	NA	ug/l			400	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	--	--	--	--	--	--	--	--
Butylbenzene, sec	NA	ug/l			800	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	--	--	--	--	--	--	--	--
Butylbenzene, tert	NA	ug/l			800	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	--	--	--	--	--	--	--	--
Carbon disulfide	NA	ug/l			800	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	--	--	--	--	--	--	--	--
Carbon tetrachloride	NA	ug/l		0.625	32.0	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	--	--	--	--	--	--	--	--
Chlorobenzene	NA	ug/l			160	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	--	--	--	--	--	--	--	--
Chlorodibromomethane	NA	ug/l		0.521	160	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	--	--	--	--	--	--	--	--
Chloroethane	NA	ug/l				--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	--	--	--	--	--	--	--	--
Chloroform	NA	ug/l		1.41	80.0	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	--	--	--	--	--	--	--	--
Chloromethane	NA	ug/l				--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	--	--	--	--	--	--	--	--
Chlorotoluene, o	NA	ug/l			160	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	--	--	--	--	--	--	--	--
Chlorotoluene, p	NA	ug/l				--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	--	--	--	--	--	--	--	--
Cumene (isopropyl benzene)	NA	ug/l			800	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	--	--	--	--	--	--	--	--
Cymene p- (toluene isopropyl p-)	NA	ug/l				--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	--	--	--	--	--	--	--	--
Dibromomethane (methylene bromide)	NA	ug/l			80.0	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	--	--	--	--	--	--	--	--
Dichlorodifluoromethane (Freon-12)	NA	ug/l			1600	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	--	--	--	--	--	--	--	--
Ethyl benzene	NA	ug/l	700		800	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	--	--	--	--	--	--	--	--
Hexachlorobutadiene	NA	ug/l		0.561	8.00	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	--	--	--	--	--	--	--	--
Methyl ethyl ketone (2-butanone)	NA	ug/l			4800	--	--	10	ND	10	ND	10	ND	10	ND	--	--	--	--	--	--	--	--	--	--	--	--
Methyl isobutyl ketone (MIBK)	NA	ug/l			640	--	--	10	ND	10	ND	10	ND	10	ND	--	--	--	--	--	--	--	--	--	--	--	--
Methyl tertiary butyl ether (MTBE)	NA	ug/l	20.0	24.3		--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	--	--	--	--	--	--	--	--
Methylene chloride	NA	ug/l	5.00	21.9	48.0	--	--	5.0	ND	5.0	ND	5.0	ND	5.0	ND	--	--	--	--	--	--	--	--	--	--	--	--
Naphthalene	NA	ug/l	160		160	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	--	--	--	--	--	--	--	--
Propylbenzene	NA	ug/l			800	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	--	--	--	--	--	--	--	--
Styrene	NA	ug/l			1600	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	--	--	--	--	--	--	--	--
Tetrachloroethylene	NA	ug/l	5.00	20.8	48.0	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	--	--	--	--	--	--	--	--
Toluene	NA	ug/l	1000		640	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	--	--	--	--	--	--	--	--
Trichloroethylene (TCE)	NA	ug/l	5.00	0.540	4.00	--	--	0.020	ND	0.020	ND	0.020	ND	0.020	ND	--	--	--	--	--	--	--	--	--	--	--	--
Trichlorofluoromethane (Freon-11)	NA	ug/l			2400	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	--	--	--	--	--	--	--	--
Vinyl chloride	NA	ug/l	0.200		24.0	--	--	0.020	ND	0.020	ND	0.020	ND	0.020	ND	--	--	--	--	--	--	--	--	--	--	--	--
Xylene, m & p	NA	ug/l			1600	--	--	4.0	ND	4.0	ND	4.0	ND	4.0	ND	--	--	--	--	--	--	--	--	--	--	--	--
Xylene, o	NA	ug/l			1600	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	--	--	--	--	--	--	--	--
PCBs																											
Aroclor 1016	NA	ug/l		1.25	1.12	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Aroclor 1221	NA	ug/l				--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Aroclor 1232	NA	ug/l				--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Aroclor 1242	NA	ug/l				--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Aroclor 1248	NA	ug/l				--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Aroclor 1254	NA	ug/l		0.0438	0.320	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Aroclor 1260	NA	ug/l		0.0438		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Aroclor 1268	NA	ug/l				--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Total Petroleum Hydrocarbons																											
Total Petroleum Hydrocarbons (as diesel)	NA	ug/l	**500**			130	ND	130	ND	--	--	130	ND	130	ND	130	ND	130	150	**1300**	ND	130	470	130	2000 J	130	ND
Total Petroleum Hydrocarbons (as gasoline)	NA	ug/l	800			--	--	50	ND	50	ND	50	ND	50	ND	--	--	--	--	--	--	--	--	--	--	--	--
Total Petroleum Hydrocarbons (as motor oil)	NA	ug/l	500			250	ND	250	650	--	--	250	ND	250	760	250	ND	250	270	2500	47000	250	470	250	1900	250	ND

Barr qualifier - *: Estimated value, QA/QC criteria not met.

Barr qualifier - b: Potential false positive value based on blank data validation procedures. Concentrations identified as potential false positive are excluded from calculations.

Landau qualifier - J: Indicates the analyte was positively identified; the associated numerical value is the approximate concentration of the analyte in the sample.

Landau qualifier - UJ: The analyte was not detected in the sample; the reported sample reporting limit is an estimate.

N: Normal Sample.

FD: Field Duplicate Sample.

ND: Not detected.

PQL: Practical Quantitation Limit.

SSource: Laboratory and/or field data obtained from a secondary source external to Barr. Second source QA/QC evaluation procedures may or may not have been performed beyond the original data generator.

Table 2
Historical Groundwater Data - 2013 Landau PQLs vs. MTCA Cleanup Levels
Yakima Mill Site

					Location	**FPP-B33**		**FPP-MW-01**		**FPP-MW-02**		**FPP-MW-03**		**FPP-SW-01**		**FPP-SW-02**		**FPP-SW-03**		**MW-09A**		**MW-12**		**TP-B01**	
					Date	**8/22/2013**		**8/23/2013**		**8/23/2013**		**8/23/2013**		**6/20/2013**		**6/20/2013**		**6/20/2013**		**6/20/2013**		**6/20/2013**		**6/21/2013**	
					Depth	**19 ft**																		**19 ft**	
					Sample Type	**N**		**N**		**N**		**N**		**N**		**N**		**N**		**N**		**N**		**N**	
						PQL	**Result**	**PQL**	**Result**	**PQL**	**Result**	**PQL**	**Result**	**PQL**	**Result**	**PQL**	**Result**	**PQL**	**Result**	**PQL**	**Result**	**PQL**	**Result**	**PQL**	**Result**
					Data Status	**SSource**	**SSource**	**SSource**	**SSource**	**SSource**	**SSource**	**SSource**	**SSource**	**SSource**	**SSource**	**SSource**	**SSource**	**SSource**	**SSource**	**SSource**	**SSource**	**SSource**	**SSource**	**SSource**	**SSource**
Parameter	Total or Dissolved	Units	Washington GW Method A	Washington GW Method B Cancer	Washington GW Method B Noncancer																				
Effective Date			07/01/2015	07/01/2015	07/01/2015																				
Exceedance Key			**Bold**	Shade	Border																				
General Parameters																									
Carbon, total organic	NA	ug/l				--	--	12000	38000	10000	18000	10000	17000	--	--	--	--	--	--	500	1300	500	8000	--	--
Solids, total dissolved	NA	ug/l				--	--	--	--	--	--	--	--	--	--	--	--	--	--	5000	160000	5000	370000	--	--
Metals																									
Arsenic	Dissolved	ug/l	5.00	0.0583	4.80	1.0	7.8	1.0	5.3	1.0	1.6	1.0	2.0	--	--	--	--	--	--	1.0	1.0	1.0	1.3	1.0	ND
Arsenic	Total	ug/l	5.00	0.0583	4.80	--	--	--	--	--	--	--	--	--	--	--	--	--	--	1.0	1.0	1.0	1.3	--	--
Cadmium	Dissolved	ug/l	5.00		8.00	1.0	ND	1.0	ND	1.0	ND	1.0	ND	--	--	--	--	--	--	1.0	ND	1.0	ND	1.0	ND
Cadmium	Total	ug/l	5.00		8.00	--	--	--	--	--	--	--	--	--	--	--	--	--	--	1.0	ND	1.0	ND	--	--
Chromium	Dissolved	ug/l	50.0			2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	--	--	2.0	ND	2.0	ND	2.0	ND
Chromium	Total	ug/l	50.0			--	--	--	--	--	--	--	--	--	--	--	--	--	--	2.0	ND	2.0	ND	--	--
Chromium, hexavalent	Dissolved	ug/l			48.0	--	--	--	--	--	--	--	--	--	--	--	--	--	--	10	ND	10	ND	--	--
Chromium, hexavalent	Total	ug/l			48.0	--	--	--	--	--	--	--	--	--	--	--	--	--	--	10	ND	10	ND	--	--
Iron	Dissolved	ug/l			11200	50	24000	50	59000	50	21000	50	330	--	--	--	--	--	--	50	ND	50	16000	50	86
Iron	Total	ug/l			11200	--	--	--	--	--	--	--	--	--	--	--	--	--	--	50	ND	50	18000	--	--
Lead	Dissolved	ug/l	15.0			1.0	ND	1.0	ND	1.0	ND	1.0	ND	--	--	--	--	--	--	1.0	ND	1.0	ND	1.0	ND
Lead	Total	ug/l	15.0			--	--	--	--	--	--	--	--	--	--	--	--	--	--	1.0	ND	1.0	ND	--	--
Manganese	Dissolved	ug/l			2240	2.0	2000	40	9900	2.0	2300	2.0	240	--	--	--	--	--	--	2.0	2.1	10	2400	2.0	72
Manganese	Total	ug/l			2240	--	--	--	--	--	--	--	--	--	--	--	--	--	--	2.0	ND	10	2200	--	--
Mercury	Dissolved	ug/l	2.00			0.20	ND	0.20	ND	0.20	ND	0.20	ND	--	--	--	--	--	--	0.20	ND	0.20	ND	0.20	ND
Mercury	Total	ug/l	2.00			--	--	--	--	--	--	--	--	--	--	--	--	--	--	0.20	ND	0.20	ND	--	--
Sodium	Dissolved	ug/l				50	48000	50	91000	50	50000	50	100000	--	--	--	--	--	--	50	11000	50	45000	50	7600
Sodium	Total	ug/l				--	--	--	--	--	--	--	--	--	--	--	--	--	--	50	11000	50	45000	--	--
SVOCs																									
1,2,4-Trichlorobenzene	NA	ug/l		1.51	80.0	--	--	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	--	--	2.0	ND	2.0	ND	2.0	ND
1,2-Dichlorobenzene	NA	ug/l			720	--	--	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	--	--	2.0	ND	2.0	ND	2.0	ND
1,3-Dichlorobenzene	NA	ug/l				--	--	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	--	--	2.0	ND	2.0	ND	2.0	ND
1,4-Dichlorobenzene	NA	ug/l		8.10	560	--	--	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	--	--	2.0	ND	2.0	ND	2.0	ND
1-Methylnaphthalene	NA	ug/l		1.51	560	--	--	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	--	--	0.020	ND	0.020	ND	2.0	ND
2,2'-oxybis (1-chloropropane)	NA	ug/l		0.625	320	--	--	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	--	--	2.0	ND	2.0	ND	2.0	ND
2,3,4,6-Tetrachlorophenol	NA	ug/l			480	--	--	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	--	--	2.0	ND	2.0	ND	2.0	ND
2,4,5-Trichlorophenol	NA	ug/l			800	--	--	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	--	--	2.0	ND	2.0	ND	2.0	ND
2,4,6-Trichlorophenol	NA	ug/l		3.98	8.00	--	--	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	--	--	2.0	ND	2.0	ND	2.0	ND
2,4-Dichlorophenol	NA	ug/l			24.0	--	--	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	--	--	2.0	ND	2.0	ND	2.0	ND
2,4-Dimethylphenol	NA	ug/l			160	--	--	2.0	ND	2.0	ND	2.0	2.7	--	--	--	--	--	--	2.0	ND	2.0	ND	2.0	ND
2,4-Dinitrophenol	NA	ug/l			32.0	--	--	10	ND	10	ND	10	ND	--	--	--	--	--	--	10	ND	10	ND	10	ND
2,4-Dinitrotoluene	NA	ug/l		0.282	32.0	--	--	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	--	--	2.0	ND	2.0	ND	2.0	ND
2,6-Dichlorophenol	NA	ug/l				--	--	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	--	--	2.0	ND	2.0	ND	2.0	ND
2,6-Dinitrotoluene	NA	ug/l		0.0583	4.80	--	--	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	--	--	2.0	ND	2.0	ND	2.0	ND
2-Chloronaphthalene	NA	ug/l			640	--	--	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	--	--	2.0	ND	2.0	ND	2.0	ND
2-Chlorophenol	NA	ug/l			40.0	--	--	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	--	--	2.0	ND	2.0	ND	2.0	ND
2-Methyl-4,6-dinitrophenol	NA	ug/l				--	--	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	--	--	2.0	ND	2.0	ND	2.0	ND
2-Methylnaphthalene	NA	ug/l			32.0	--	--	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	--	--	0.020	ND	0.020	ND	2.0	ND
2-Methylphenol (o-cresol)	NA	ug/l			400	--	--	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	--	--	2.0	ND	2.0	ND	2.0	ND
2-Nitroaniline	NA	ug/l			160	--	--	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	--	--	2.0	ND	2.0	ND	2.0	ND
2-Nitrophenol	NA	ug/l				--	--	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	--	--	2.0	ND	2.0	ND	2.0	ND
3,3`-Dichlorobenzidine	NA	ug/l		0.194		--	--	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	--	--	2.0	ND	2.0	ND	2.0	ND
3,4-Methylphenol (m,p cresols)	NA	ug/l				--	--	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	--	--	2.0	ND	2.0	ND	2.0	ND
3-Nitroaniline	NA	ug/l				--	--	5.0	ND	5.0	ND	5.0	ND	--	--	--	--	--	--	5.0	ND	5.0	ND	5.0	ND
4-Bromophenyl phenyl ether	NA	ug/l				--	--	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	--	--	2.0	ND	2.0	ND	2.0	ND
4-Chloro-3-methylphenol	NA	ug/l				--	--	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	--	--	2.0	ND UJ*	2.0	ND UJ*	2.0	ND UJ*
4-Chloroaniline	NA	ug/l		0.219	32.0	--	--	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	--	--	2.0	ND	2.0	ND	2.0	ND
4-Chlorophenyl phenyl ether	NA	ug/l				--	--	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	--	--	2.0	ND	2.0	ND	2.0	ND
4-Nitroaniline	NA	ug/l				--	--	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	--	--	2.0	ND	2.0	ND	2.0	ND
4-Nitrophenol	NA	ug/l				--	--	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	--	--	2.0	ND	2.0	ND	2.0	ND
Acenaphthene	NA	ug/l			960	--	--	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	--	--	0.020	ND	0.020	ND	2.0	ND
Acenaphthylene	NA	ug/l				--	--	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	--	--	0.020	ND	0.020	ND	2.0	ND
Aniline	NA	ug/l		7.68	56.0	--	--	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	--	--	2.0	ND	2.0	ND	2.0	ND
Anthracene	NA	ug/l			4800	--	--	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	--	--	0.020	ND	0.020	ND	2.0	ND
Azobenzene	NA	ug/l		0.795		--	--	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	--	--	2.0	ND	2.0	ND	2.0	ND
Benz(a)anthracene	NA	ug/l		0.120		--	--	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	--	--	0.020	ND	0.020	ND	2.0	ND
Benzo(a)pyrene	NA	ug/l	**0.100**	0.0120		--	--	**2.0**	ND	**2.0**	ND	**2.0**	ND	--	--	--	--	--	--	0.029	ND	0.029	ND	**2.0**	ND
Benzo(b)fluoranthene	NA	ug/l		0.120		--	--	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	--	--	0.020	ND	0.020	ND	2.0	ND
Benzo(g,h,i)perylene	NA	ug/l				--	--	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	--	--	0.020	ND	0.020	ND	2.0	ND
Benzo(k)fluoranthene	NA	ug/l		1.20		--	--	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	--	--	0.020	ND	0.020	ND	2.0	ND
Benzoic acid	NA	ug/l			64000	--	--	10	ND	10	ND	10	ND	--	--	--	--	--	--	10	ND	10	ND	10	ND
Benzyl alcohol	NA	ug/l			800	--	--	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	--	--	2.0	ND	2.0	ND	2.0	ND

11-06-2017

Table 2
Historical Groundwater Data - 2013 Landau PQLs vs. MTCA Cleanup Levels
Yakima Mill Site

					Location	FPP-B33		FPP-MW-01		FPP-MW-02		FPP-MW-03		FPP-SW-01		FPP-SW-02		FPP-SW-03		MW-09A		MW-12		TP-B01	
					Date	8/22/2013		8/23/2013		8/23/2013		8/23/2013		6/20/2013		6/20/2013		6/20/2013		6/20/2013		6/20/2013		6/21/2013	
					Depth	19 ft																		19 ft	
					Sample Type	N		N		N		N		N		N		N		N		N		N	
						PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result
					Data Status	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource
Parameter	Total or Dissolved	Units	Washington GW Method A	Washington GW Method B Cancer	Washington GW Method B Noncancer																				
Effective Date			07/01/2015	07/01/2015	07/01/2015																				
Exceedance Key			**Bold**	Shade	Border																				
Bis(2-chloroethoxy)methane	NA	ug/l				--	--	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	--	--	2.0	ND	2.0	ND	2.0	ND
Bis(2-chloroethyl)ether	NA	ug/l		0.0398		--	--	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	--	--	2.0	ND	2.0	ND	2.0	ND
Bis(2-ethylhexyl)phthalate	NA	ug/l		6.25	320	--	--	4.0	ND b	2.8	ND b	13	ND b	--	--	--	--	--	--	2.0	ND	2.0	ND	2.0	ND
Butyl benzyl phthalate	NA	ug/l		46.1	3200	--	--	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	--	--	2.0	ND	2.0	ND	2.0	ND
Carbazole	NA	ug/l				--	--	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	--	--	2.0	ND	2.0	ND	2.0	ND
Chrysene	NA	ug/l		12.0		--	--	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	--	--	0.020	ND	0.020	ND	2.0	ND
Dibenz(a,h)anthracene	NA	ug/l		0.0120		--	--	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	--	--	0.020	ND	0.020	ND	2.0	ND
Dibenzofuran	NA	ug/l			16.0	--	--	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	--	--	2.0	ND	2.0	ND	2.0	ND
Diethyl phthalate	NA	ug/l			12800	--	--	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	--	--	2.0	ND	2.0	ND	2.0	ND
Dimethyl phthalate	NA	ug/l				--	--	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	--	--	2.0	ND	2.0	ND	2.0	ND
Di-n-butyl phthalate	NA	ug/l			1600	--	--	2.0	ND	2.0	ND	2.0	4.7	--	--	--	--	--	--	2.0	ND	2.0	ND	2.0	ND
Di-n-octyl phthalate	NA	ug/l			160	--	--	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	--	--	2.0	ND	2.0	ND	2.0	ND
Fluoranthene	NA	ug/l			640	--	--	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	--	--	0.020	ND	0.020	ND	2.0	ND
Fluorene	NA	ug/l			640	--	--	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	--	--	0.020	ND	0.020	ND	2.0	ND
Hexachlorobenzene	NA	ug/l		0.0547	12.8	--	--	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	--	--	2.0	ND	2.0	ND	2.0	ND
Hexachlorobutadiene	NA	ug/l		0.561	8.00	--	--	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	--	--	2.0	ND	2.0	ND	2.0	ND
Hexachlorocyclopentadiene	NA	ug/l			48.0	--	--	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	--	--	2.0	ND	2.0	ND	2.0	ND
Hexachloroethane	NA	ug/l		1.09	5.60	--	--	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	--	--	2.0	ND	2.0	ND	2.0	ND
Indeno(1,2,3-cd)pyrene	NA	ug/l		0.120		--	--	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	--	--	0.020	ND	0.020	ND	2.0	ND
Isophorone	NA	ug/l		46.1	1600	--	--	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	--	--	2.0	ND	2.0	ND	2.0	ND
Naphthalene	NA	ug/l	160		160	--	--	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	--	--	0.020	ND	0.020	ND	2.0	ND
Nitrobenzene	NA	ug/l			16.0	--	--	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	--	--	2.0	ND	2.0	ND	2.0	ND
n-Nitrosodimethylamine	NA	ug/l		0.000858	0.0640	--	--	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	--	--	2.0	ND	2.0	ND	2.0	ND
n-Nitrosodi-n-propylamine	NA	ug/l		0.0125		--	--	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	--	--	2.0	ND	2.0	ND	2.0	ND
n-Nitrosodiphenylamine	NA	ug/l		17.9		--	--	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	--	--	2.0	ND	2.0	ND	2.0	ND
Pentachlorophenol	NA	ug/l		0.219	80.0	--	--	5.0	ND	5.0	ND	5.0	ND	--	--	--	--	--	--	5.0	ND	5.0	ND	5.0	ND
Phenanthrene	NA	ug/l				--	--	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	--	--	0.020	ND	0.020	ND	2.0	ND
Phenol	NA	ug/l			2400	--	--	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	--	--	2.0	ND	2.0	ND	2.0	ND
Pyrene	NA	ug/l			480	--	--	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	--	--	0.020	ND	0.020	ND	2.0	ND
Pyridine	NA	ug/l			8.00	--	--	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	--	--	2.0	ND	2.0	ND	2.0	ND
VOCs																									
1,1,1,2-Tetrachloroethane	NA	ug/l		1.68	240	--	--	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	--	--	2.0	ND	2.0	ND	2.0	ND
1,1,1-Trichloroethane	NA	ug/l	200		16000	--	--	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	--	--	2.0	ND	2.0	ND	2.0	ND
1,1,2,2-Tetrachloroethane	NA	ug/l		0.219	160	--	--	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	--	--	2.0	ND	2.0	ND	2.0	ND
1,1,2-Trichloroethane	NA	ug/l		0.768	32.0	--	--	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	--	--	2.0	ND	2.0	ND	2.0	ND
1,1-Dichloroethane	NA	ug/l		7.68	1600	--	--	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	--	--	2.0	ND	2.0	ND	2.0	ND
1,1-Dichloroethylene	NA	ug/l			400	--	--	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	--	--	2.0	ND	2.0	ND	2.0	ND
1,1-Dichloropropene	NA	ug/l				--	--	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	--	--	2.0	ND	2.0	ND	2.0	ND
1,2,3-Trichlorobenzene	NA	ug/l				--	--	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	--	--	2.0	ND	2.0	ND	2.0	ND
1,2,3-Trichloropropane	NA	ug/l		0.00146	32.0	--	--	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	--	--	2.0	ND	2.0	ND	2.0	ND
1,2,4-Trichlorobenzene	NA	ug/l		1.51	80.0	--	--	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	--	--	2.0	ND	2.0	ND	2.0	ND
1,2,4-Trimethylbenzene	NA	ug/l				--	--	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	--	--	2.0	ND	2.0	ND	2.0	ND
1,2-Dibromo-3-chloropropane (DBCP)	NA	ug/l		0.0547	1.60	--	--	10	ND	10	ND	10	ND	--	--	--	--	--	--	10	ND	10	ND	10	ND
1,2-Dibromoethane (EDB)	NA	ug/l	0.0100	0.0219	72.0	--	--	0.010	ND	0.010	ND	0.010	ND	--	--	--	--	--	--	0.010	ND	0.010	ND	0.010	ND
1,2-Dichlorobenzene	NA	ug/l			720	--	--	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	--	--	2.0	ND	2.0	ND	2.0	ND
1,2-Dichloroethane	NA	ug/l	5.00	0.481	48.0	--	--	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	--	--	2.0	ND	2.0	ND	2.0	ND
1,2-Dichloroethylene, cis	NA	ug/l			16.0	--	--	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	--	--	2.0	ND	2.0	ND	2.0	ND
1,2-Dichloroethylene, trans	NA	ug/l			160	--	--	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	--	--	2.0	ND	2.0	ND	2.0	ND
1,2-Dichloropropane	NA	ug/l		1.22	720	--	--	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	--	--	2.0	ND	2.0	ND	2.0	ND
1,3,5-Trimethylbenzene	NA	ug/l			80.0	--	--	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	--	--	2.0	ND	2.0	ND	2.0	ND
1,3-Dichlorobenzene	NA	ug/l				--	--	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	--	--	2.0	ND	2.0	ND	2.0	ND
1,3-Dichloropropane	NA	ug/l				--	--	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	--	--	2.0	ND	2.0	ND	2.0	ND
1,3-Dichloropropene, cis	NA	ug/l		0.438	240	--	--	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	--	--	2.0	ND	2.0	ND	2.0	ND
1,3-Dichloropropene, trans	NA	ug/l		0.438	240	--	--	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	--	--	2.0	ND	2.0	ND	2.0	ND
1,4-Dichlorobenzene	NA	ug/l		8.10	560	--	--	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	--	--	2.0	ND	2.0	ND	2.0	ND
2,2-Dichloropropane	NA	ug/l				--	--	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	--	--	2.0	ND	2.0	ND	2.0	ND
2-Hexanone	NA	ug/l				--	--	10	ND	10	ND	10	ND	--	--	--	--	--	--	10	ND	10	ND	10	ND
Acetone	NA	ug/l			7200	--	--	25	ND	25	ND	25	ND	--	--	--	--	--	--	25	ND	25	ND	25	ND
Acrylonitrile	NA	ug/l		0.0810	320	--	--	10	ND	10	ND	10	ND	--	--	--	--	--	--	10	ND	10	ND	10	ND
Benzene	NA	ug/l	5.00	0.795	32.0	--	--	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	--	--	2.0	ND	2.0	ND	2.0	ND
Bromobenzene	NA	ug/l				--	--	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	--	--	2.0	ND	2.0	ND	2.0	ND
Bromochloromethane	NA	ug/l				--	--	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	--	--	2.0	ND	2.0	ND	2.0	ND
Bromodichloromethane	NA	ug/l		0.706	160	--	--	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	--	--	2.0	ND	2.0	ND	2.0	ND
Bromoform	NA	ug/l		5.54	160	--	--	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	--	--	2.0	ND	2.0	ND	2.0	ND
Bromomethane	NA	ug/l			11.2	--	--	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	--	--	2.0	ND	2.0	ND	2.0	ND

Table 2
Historical Groundwater Data - 2013 Landau PQLs vs. MTCA Cleanup Levels
Yakima Mill Site

					Location	FPP-B33		FPP-MW-01		FPP-MW-02		FPP-MW-03		FPP-SW-01		FPP-SW-02		FPP-SW-03		MW-09A		MW-12		TP-B01	
					Date	8/22/2013		8/23/2013		8/23/2013		8/23/2013		6/20/2013		6/20/2013		6/20/2013		6/20/2013		6/20/2013		6/21/2013	
					Depth	19 ft																		19 ft	
					Sample Type	N		N		N		N		N		N		N		N		N		N	
						PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result
					Data Status	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource
Parameter	Total or Dissolved	Units	Washington GW Method A	Washington GW Method B Cancer	Washington GW Method B Noncancer																				
Effective Date			07/01/2015	07/01/2015	07/01/2015																				
Exceedance Key			**Bold**	Shade	Border																				
Butylbenzene	NA	ug/l			400	--	--	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	--	--	2.0	ND	2.0	ND	2.0	ND
Butylbenzene, sec	NA	ug/l			800	--	--	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	--	--	2.0	ND	2.0	ND	2.0	ND
Butylbenzene, tert	NA	ug/l			800	--	--	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	--	--	2.0	ND	2.0	ND	2.0	ND
Carbon disulfide	NA	ug/l			800	--	--	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	--	--	2.0	ND	2.0	ND	2.0	ND
Carbon tetrachloride	NA	ug/l		0.625	32.0	--	--	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	--	--	2.0	ND	2.0	ND	2.0	ND
Chlorobenzene	NA	ug/l			160	--	--	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	--	--	2.0	ND	2.0	ND	2.0	ND
Chlorodibromomethane	NA	ug/l		0.521	160	--	--	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	--	--	2.0	ND	2.0	ND	2.0	ND
Chloroethane	NA	ug/l				--	--	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	--	--	2.0	ND	2.0	ND	2.0	ND
Chloroform	NA	ug/l		1.41	80.0	--	--	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	--	--	2.0	3.9	2.0	ND	2.0	2.7
Chloromethane	NA	ug/l				--	--	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	--	--	2.0	ND	2.0	ND	2.0	ND
Chlorotoluene, o	NA	ug/l			160	--	--	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	--	--	2.0	ND	2.0	ND	2.0	ND
Chlorotoluene, p	NA	ug/l				--	--	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	--	--	2.0	ND	2.0	ND	2.0	ND
Cumene (isopropyl benzene)	NA	ug/l			800	--	--	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	--	--	2.0	ND	2.0	ND	2.0	ND
Cymene p- (toluene isopropyl p-)	NA	ug/l				--	--	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	--	--	2.0	ND	2.0	ND	2.0	ND
Dibromomethane (methylene bromide)	NA	ug/l			80.0	--	--	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	--	--	2.0	ND	2.0	ND	2.0	ND
Dichlorodifluoromethane (Freon-12)	NA	ug/l			1600	--	--	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	--	--	2.0	ND	2.0	ND	2.0	ND
Ethyl benzene	NA	ug/l	700		800	--	--	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	--	--	2.0	ND	2.0	ND	2.0	ND
Hexachlorobutadiene	NA	ug/l		0.561	8.00	--	--	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	--	--	2.0	ND	2.0	ND	2.0	ND
Methyl ethyl ketone (2-butanone)	NA	ug/l			4800	--	--	10	ND	10	ND	10	ND	--	--	--	--	--	--	10	ND	10	ND	10	ND
Methyl isobutyl ketone (MIBK)	NA	ug/l			640	--	--	10	ND	10	ND	10	ND	--	--	--	--	--	--	10	ND	10	ND	10	ND
Methyl tertiary butyl ether (MTBE)	NA	ug/l	20.0	24.3		--	--	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	--	--	2.0	ND	2.0	ND	2.0	ND
Methylene chloride	NA	ug/l	5.00	21.9	48.0	--	--	5.0	ND	5.0	ND	5.0	ND	--	--	--	--	--	--	5.0	ND	5.0	ND	5.0	ND
Naphthalene	NA	ug/l	160		160	--	--	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	--	--	2.0	ND	2.0	ND	2.0	ND
Propylbenzene	NA	ug/l			800	--	--	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	--	--	2.0	ND	2.0	ND	2.0	ND
Styrene	NA	ug/l			1600	--	--	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	--	--	2.0	ND	2.0	ND	2.0	ND
Tetrachloroethylene	NA	ug/l	5.00	20.8	48.0	--	--	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	--	--	2.0	ND	2.0	ND	2.0	ND
Toluene	NA	ug/l	1000		640	--	--	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	--	--	2.0	ND	2.0	ND	2.0	ND
Trichloroethylene (TCE)	NA	ug/l	5.00	0.540	4.00	--	--	--	--	--	--	--	--	--	--	--	--	--	--	0.020	1.2	0.020	1.9	0.020	ND
Trichlorofluoromethane (Freon-11)	NA	ug/l			2400	--	--	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	--	--	2.0	ND	2.0	ND	2.0	ND
Vinyl chloride	NA	ug/l	0.200		24.0	--	--	--	--	--	--	--	--	--	--	--	--	--	--	0.020	ND	0.020	ND	0.020	ND
Xylene, m & p	NA	ug/l			1600	--	--	4.0	ND	4.0	ND	4.0	ND	--	--	--	--	--	--	4.0	ND	4.0	ND	4.0	ND
Xylene, o	NA	ug/l			1600	--	--	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	--	--	2.0	ND	2.0	ND	2.0	ND
PCBs																									
Aroclor 1016	NA	ug/l		1.25	1.12	--	--	--	--	--	--	--	--	--	--	--	--	--	--	0.10	ND	0.10	ND	--	--
Aroclor 1221	NA	ug/l				--	--	--	--	--	--	--	--	--	--	--	--	--	--	0.10	ND	0.10	ND	--	--
Aroclor 1232	NA	ug/l				--	--	--	--	--	--	--	--	--	--	--	--	--	--	0.10	ND	0.10	ND	--	--
Aroclor 1242	NA	ug/l				--	--	--	--	--	--	--	--	--	--	--	--	--	--	0.10	ND	0.10	ND	--	--
Aroclor 1248	NA	ug/l				--	--	--	--	--	--	--	--	--	--	--	--	--	--	0.10	ND	0.10	ND	--	--
Aroclor 1254	NA	ug/l		0.0438	0.320	--	--	--	--	--	--	--	--	--	--	--	--	--	--	0.10	ND	0.10	ND	--	--
Aroclor 1260	NA	ug/l		0.0438		--	--	--	--	--	--	--	--	--	--	--	--	--	--	0.10	ND	0.10	ND	--	--
Aroclor 1268	NA	ug/l				--	--	--	--	--	--	--	--	--	--	--	--	--	--	0.10	ND	0.10	ND	--	--
Total Petroleum Hydrocarbons																									
Total Petroleum Hydrocarbons (as diesel)	NA	ug/l	**500**			130	ND	130	480	130	220	130	240	310	ND	310	ND	310	310	130	ND	130	ND	130	ND
Total Petroleum Hydrocarbons (as gasoline)	NA	ug/l	800			--	--	50	ND	50	ND	50	ND	130	ND	130	ND	130	ND	50	ND	50	ND	50	ND
Total Petroleum Hydrocarbons (as motor oil)	NA	ug/l	500			250	ND	250	ND	250	ND	250	ND	310	310	310	ND	310	310	250	ND	250	ND	250	ND

Barr qualifier - *: Estimated value, QA/QC criteria not met.

Barr qualifier - b: Potential false positive value based on blank data validation procedures. Concentrations identified as potential false positive are excluded from calculations.

Landau qualifier - J: Indicates the analyte was positively identified; the associated numerical value is the approximate concentration of the analyte in the sample.

Landau qualifier - UJ: The analyte was not detected in the sample; the reported sample reporting limit is an estimate.

N: Normal Sample.

FD: Field Duplicate Sample.

ND: Not detected.

PQL: Practical Quantitation Limit.

SSource: Laboratory and/or field data obtained from a secondary source external to Barr. Second source QA/QC evaluation procedures may or may not have been performed beyond the original data generator.

Table 2
Historical Groundwater Data - 2013 Landau PQLs vs. MTCA Cleanup Levels
Yakima Mill Site

					Location	TP-B04B		TP-B06		TP-B08		TP-B09		TP-MW-01		TP-MW-02	
					Date	6/20/2013		6/20/2013		6/21/2013		6/21/2013		8/22/2013		8/22/2013	
					Depth	18 ft		16 ft		18 ft		18 ft					
					Sample Type	N		N		N		N		N		N	
						PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result
					Data Status	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource
Parameter	Total or Dissolved	Units	Washington GW Method A	Washington GW Method B Cancer	Washington GW Method B Noncancer												
Effective Date			07/01/2015	07/01/2015	07/01/2015												
Exceedance Key			**Bold**	Shade	Border												
General Parameters																	
Carbon, total organic	NA	ug/l				--	--	--	--	--	--	--	--	500	1300	500	3500
Solids, total dissolved	NA	ug/l				--	--	--	--	--	--	--	--	--	--	--	--
Metals																	
Arsenic	Dissolved	ug/l	5.00	0.0583	4.80	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	2.5
Arsenic	Total	ug/l	5.00	0.0583	4.80	--	--	--	--	--	--	--	--	--	--	--	--
Cadmium	Dissolved	ug/l	5.00		8.00	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND
Cadmium	Total	ug/l	5.00		8.00	--	--	--	--	--	--	--	--	--	--	--	--
Chromium	Dissolved	ug/l	50.0			2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
Chromium	Total	ug/l	50.0			--	--	--	--	--	--	--	--	--	--	--	--
Chromium, hexavalent	Dissolved	ug/l			48.0	10	ND	--	--	--	--	--	--	--	--	--	--
Chromium, hexavalent	Total	ug/l			48.0	10	ND	--	--	--	--	--	--	--	--	--	--
Iron	Dissolved	ug/l			11200	50	94	50	770	50	220	50	96	50	ND	50	8100
Iron	Total	ug/l			11200	--	--	--	--	--	--	--	--	--	--	--	--
Lead	Dissolved	ug/l	15.0			1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND
Lead	Total	ug/l	15.0			--	--	--	--	--	--	--	--	--	--	--	--
Manganese	Dissolved	ug/l			2240	2.0	85	2.0	1400	2.0	1400	2.0	1300	2.0	140	2.0	1400
Manganese	Total	ug/l			2240	--	--	--	--	--	--	--	--	--	--	--	--
Mercury	Dissolved	ug/l	2.00			0.20	ND	0.20	ND	0.20	ND	0.20	ND	0.20	ND	0.20	ND
Mercury	Total	ug/l	2.00			--	--	--	--	--	--	--	--	--	--	--	--
Sodium	Dissolved	ug/l				50	12000	50	17000	50	17000	50	18000	50	21000	50	24000
Sodium	Total	ug/l				--	--	--	--	--	--	--	--	--	--	--	--
SVOCs																	
1,2,4-Trichlorobenzene	NA	ug/l		1.51	80.0	2.0	ND	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND
1,2-Dichlorobenzene	NA	ug/l			720	2.0	ND	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND
1,3-Dichlorobenzene	NA	ug/l				2.0	ND	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND
1,4-Dichlorobenzene	NA	ug/l		8.10	560	2.0	ND	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND
1-Methylnaphthalene	NA	ug/l		1.51	560	2.0	ND	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND
2,2'-oxybis (1-chloropropane)	NA	ug/l		0.625	320	2.0	ND	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND
2,3,4,6-Tetrachlorophenol	NA	ug/l			480	2.0	ND	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND
2,4,5-Trichlorophenol	NA	ug/l			800	2.0	ND	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND
2,4,6-Trichlorophenol	NA	ug/l		3.98	8.00	2.0	ND	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND
2,4-Dichlorophenol	NA	ug/l			24.0	2.0	ND	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND
2,4-Dimethylphenol	NA	ug/l			160	2.0	ND	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND
2,4-Dinitrophenol	NA	ug/l			32.0	10	ND	--	--	10	ND	10	ND	10	ND	10	ND
2,4-Dinitrotoluene	NA	ug/l		0.282	32.0	2.0	ND	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND
2,6-Dichlorophenol	NA	ug/l				2.0	ND	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND
2,6-Dinitrotoluene	NA	ug/l		0.0583	4.80	2.0	ND	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND
2-Chloronaphthalene	NA	ug/l			640	2.0	ND	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND
2-Chlorophenol	NA	ug/l			40.0	2.0	ND	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND
2-Methyl-4,6-dinitrophenol	NA	ug/l				2.0	ND	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND
2-Methylnaphthalene	NA	ug/l			32.0	2.0	ND	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND
2-Methylphenol (o-cresol)	NA	ug/l			400	2.0	ND	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND
2-Nitroaniline	NA	ug/l			160	2.0	ND	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND
2-Nitrophenol	NA	ug/l				2.0	ND	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND
3,3`-Dichlorobenzidine	NA	ug/l		0.194		2.0	ND	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND
3,4-Methylphenol (m,p cresols)	NA	ug/l				2.0	ND	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND
3-Nitroaniline	NA	ug/l				5.0	ND	--	--	5.0	ND	5.0	ND	5.0	ND	5.0	ND
4-Bromophenyl phenyl ether	NA	ug/l				2.0	ND	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND
4-Chloro-3-methylphenol	NA	ug/l				2.0	ND UJ*	--	--	2.0	ND UJ*	2.0	ND UJ*	2.0	ND	2.0	ND
4-Chloroaniline	NA	ug/l		0.219	32.0	2.0	ND	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND
4-Chlorophenyl phenyl ether	NA	ug/l				2.0	ND	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND
4-Nitroaniline	NA	ug/l				2.0	ND	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND
4-Nitrophenol	NA	ug/l				2.0	ND	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND
Acenaphthene	NA	ug/l			960	2.0	ND	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND
Acenaphthylene	NA	ug/l				2.0	ND	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND
Aniline	NA	ug/l		7.68	56.0	2.0	ND	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND
Anthracene	NA	ug/l			4800	2.0	ND	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND
Azobenzene	NA	ug/l		0.795		2.0	ND	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND
Benz(a)anthracene	NA	ug/l		0.120		2.0	ND	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND
Benzo(a)pyrene	NA	ug/l	**0.100**	0.0120		**2.0**	ND	--	--	**2.0**	ND	**2.0**	ND	**2.0**	ND	**2.0**	ND
Benzo(b)fluoranthene	NA	ug/l		0.120		2.0	ND	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND
Benzo(g,h,i)perylene	NA	ug/l				2.0	ND	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND
Benzo(k)fluoranthene	NA	ug/l		1.20		2.0	ND	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND
Benzoic acid	NA	ug/l			64000	10	ND	--	--	10	ND	10	ND	10	ND	10	ND
Benzyl alcohol	NA	ug/l			800	2.0	ND	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND

Table 2
Historical Groundwater Data - 2013 Landau PQLs vs. MTCA Cleanup Levels
Yakima Mill Site

					Location	TP-B04B		TP-B06		TP-B08		TP-B09		TP-MW-01		TP-MW-02	
					Date	6/20/2013		6/20/2013		6/21/2013		6/21/2013		8/22/2013		8/22/2013	
					Depth	18 ft		16 ft		18 ft		18 ft					
					Sample Type	N		N		N		N		N		N	
						PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result
					Data Status	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource
Parameter	Total or Dissolved	Units	Washington GW Method A	Washington GW Method B Cancer	Washington GW Method B Noncancer												
Effective Date			07/01/2015	07/01/2015	07/01/2015												
Exceedance Key			**Bold**	Shade	Border												
Bis(2-chloroethoxy)methane	NA	ug/l				2.0	ND	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND
Bis(2-chloroethyl)ether	NA	ug/l		0.0398		2.0	ND	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND
Bis(2-ethylhexyl)phthalate	NA	ug/l		6.25	320	2.0	ND	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND
Butyl benzyl phthalate	NA	ug/l		46.1	3200	2.0	ND	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND
Carbazole	NA	ug/l				2.0	ND	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND
Chrysene	NA	ug/l		12.0		2.0	ND	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND
Dibenz(a,h)anthracene	NA	ug/l		0.0120		2.0	ND	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND
Dibenzofuran	NA	ug/l			16.0	2.0	ND	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND
Diethyl phthalate	NA	ug/l			12800	2.0	ND	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND
Dimethyl phthalate	NA	ug/l				2.0	ND	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND
Di-n-butyl phthalate	NA	ug/l			1600	2.0	ND	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND
Di-n-octyl phthalate	NA	ug/l			160	2.0	ND	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND
Fluoranthene	NA	ug/l			640	2.0	ND	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND
Fluorene	NA	ug/l			640	2.0	ND	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND
Hexachlorobenzene	NA	ug/l		0.0547	12.8	2.0	ND	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND
Hexachlorobutadiene	NA	ug/l		0.561	8.00	2.0	ND	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND
Hexachlorocyclopentadiene	NA	ug/l			48.0	2.0	ND	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND
Hexachloroethane	NA	ug/l		1.09	5.60	2.0	ND	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND
Indeno(1,2,3-cd)pyrene	NA	ug/l		0.120		2.0	ND	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND
Isophorone	NA	ug/l		46.1	1600	2.0	ND	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND
Naphthalene	NA	ug/l	160		160	2.0	ND	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND
Nitrobenzene	NA	ug/l			16.0	2.0	ND	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND
n-Nitrosodimethylamine	NA	ug/l		0.000858	0.0640	2.0	ND	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND
n-Nitrosodi-n-propylamine	NA	ug/l		0.0125		2.0	ND	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND
n-Nitrosodiphenylamine	NA	ug/l		17.9		2.0	ND	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND
Pentachlorophenol	NA	ug/l		0.219	80.0	5.0	ND	--	--	5.0	ND	5.0	ND	5.0	ND	5.0	ND
Phenanthrene	NA	ug/l				2.0	ND	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND
Phenol	NA	ug/l			2400	2.0	ND	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND
Pyrene	NA	ug/l			480	2.0	ND	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND
Pyridine	NA	ug/l			8.00	2.0	ND	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND
VOCs																	
1,1,1,2-Tetrachloroethane	NA	ug/l		1.68	240	2.0	ND	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND
1,1,1-Trichloroethane	NA	ug/l	200		16000	2.0	ND	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND
1,1,2,2-Tetrachloroethane	NA	ug/l		0.219	160	2.0	ND	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND
1,1,2-Trichloroethane	NA	ug/l		0.768	32.0	2.0	ND	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND
1,1-Dichloroethane	NA	ug/l		7.68	1600	2.0	ND	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND
1,1-Dichloroethylene	NA	ug/l			400	2.0	ND	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND
1,1-Dichloropropene	NA	ug/l				2.0	ND	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND
1,2,3-Trichlorobenzene	NA	ug/l				2.0	ND	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND
1,2,3-Trichloropropane	NA	ug/l		0.00146	32.0	2.0	ND	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND
1,2,4-Trichlorobenzene	NA	ug/l		1.51	80.0	2.0	ND	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND
1,2,4-Trimethylbenzene	NA	ug/l				2.0	ND	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND
1,2-Dibromo-3-chloropropane (DBCP)	NA	ug/l		0.0547	1.60	10	ND	--	--	10	ND	10	ND	10	ND	10	ND
1,2-Dibromoethane (EDB)	NA	ug/l	0.0100	0.0219	72.0	0.010	ND	--	--	0.010	ND	0.010	ND	0.010	ND	0.010	ND
1,2-Dichlorobenzene	NA	ug/l			720	2.0	ND	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND
1,2-Dichloroethane	NA	ug/l	5.00	0.481	48.0	2.0	ND	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND
1,2-Dichloroethylene, cis	NA	ug/l			16.0	2.0	ND	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND
1,2-Dichloroethylene, trans	NA	ug/l			160	2.0	ND	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND
1,2-Dichloropropane	NA	ug/l		1.22	720	2.0	ND	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND
1,3,5-Trimethylbenzene	NA	ug/l			80.0	2.0	ND	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND
1,3-Dichlorobenzene	NA	ug/l				2.0	ND	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND
1,3-Dichloropropane	NA	ug/l				2.0	ND	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND
1,3-Dichloropropene, cis	NA	ug/l		0.438	240	2.0	ND	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND
1,3-Dichloropropene, trans	NA	ug/l		0.438	240	2.0	ND	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND
1,4-Dichlorobenzene	NA	ug/l		8.10	560	2.0	ND	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND
2,2-Dichloropropane	NA	ug/l				2.0	ND	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND
2-Hexanone	NA	ug/l				10	ND	--	--	10	ND	10	ND	10	ND	10	ND
Acetone	NA	ug/l			7200	25	ND	--	--	25	ND	25	ND	25	ND	25	ND
Acrylonitrile	NA	ug/l		0.0810	320	10	ND	--	--	10	ND	10	ND	10	ND	10	ND
Benzene	NA	ug/l	5.00	0.795	32.0	2.0	ND	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND
Bromobenzene	NA	ug/l				2.0	ND	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND
Bromochloromethane	NA	ug/l				2.0	ND	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND
Bromodichloromethane	NA	ug/l		0.706	160	2.0	ND	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND
Bromoform	NA	ug/l		5.54	160	2.0	ND	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND
Bromomethane	NA	ug/l			11.2	2.0	ND	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND

Table 2
Historical Groundwater Data - 2013 Landau PQLs vs. MTCA Cleanup Levels
Yakima Mill Site

					Location	TP-B04B		TP-B06		TP-B08		TP-B09		TP-MW-01		TP-MW-02	
					Date	6/20/2013		6/20/2013		6/21/2013		6/21/2013		8/22/2013		8/22/2013	
					Depth	18 ft		16 ft		18 ft		18 ft					
					Sample Type	N		N		N		N		N		N	
						PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result
					Data Status	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource
Parameter	Total or Dissolved	Units	Washington GW Method A	Washington GW Method B Cancer	Washington GW Method B Noncancer												
Effective Date			07/01/2015	07/01/2015	07/01/2015												
Exceedance Key			**Bold**	Shade	Border												
Butylbenzene	NA	ug/l			400	2.0	ND	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND
Butylbenzene, sec	NA	ug/l			800	2.0	ND	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND
Butylbenzene, tert	NA	ug/l			800	2.0	ND	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND
Carbon disulfide	NA	ug/l			800	2.0	ND	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND
Carbon tetrachloride	NA	ug/l		0.625	32.0	2.0	ND	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND
Chlorobenzene	NA	ug/l			160	2.0	ND	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND
Chlorodibromomethane	NA	ug/l		0.521	160	2.0	ND	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND
Chloroethane	NA	ug/l				2.0	ND	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND
Chloroform	NA	ug/l		1.41	80.0	2.0	4.3	--	--	2.0	ND	2.0	ND	2.0	2.9	2.0	ND
Chloromethane	NA	ug/l				2.0	ND	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND
Chlorotoluene, o	NA	ug/l			160	2.0	ND	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND
Chlorotoluene, p	NA	ug/l				2.0	ND	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND
Cumene (isopropyl benzene)	NA	ug/l			800	2.0	ND	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND
Cymene p- (toluene isopropyl p-)	NA	ug/l				2.0	ND	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND
Dibromomethane (methylene bromide)	NA	ug/l			80.0	2.0	ND	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND
Dichlorodifluoromethane (Freon-12)	NA	ug/l			1600	2.0	ND	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND
Ethyl benzene	NA	ug/l	700		800	2.0	ND	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND
Hexachlorobutadiene	NA	ug/l		0.561	8.00	2.0	ND	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND
Methyl ethyl ketone (2-butanone)	NA	ug/l			4800	10	ND	--	--	10	ND	10	ND	10	ND	10	ND
Methyl isobutyl ketone (MIBK)	NA	ug/l			640	10	ND	--	--	10	ND	10	ND	10	ND	10	ND
Methyl tertiary butyl ether (MTBE)	NA	ug/l	20.0	24.3		2.0	ND	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND
Methylene chloride	NA	ug/l	5.00	21.9	48.0	5.0	ND	--	--	5.0	ND	5.0	ND	5.0	ND	5.0	ND
Naphthalene	NA	ug/l	160		160	2.0	ND	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND
Propylbenzene	NA	ug/l			800	2.0	ND	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND
Styrene	NA	ug/l			1600	2.0	ND	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND
Tetrachloroethylene	NA	ug/l	5.00	20.8	48.0	2.0	ND	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND
Toluene	NA	ug/l	1000		640	2.0	ND	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND
Trichloroethylene (TCE)	NA	ug/l	5.00	0.540	4.00	0.020	ND	--	--	0.020	ND	0.020	ND	--	--	--	--
Trichlorofluoromethane (Freon-11)	NA	ug/l			2400	2.0	ND	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND
Vinyl chloride	NA	ug/l	0.200		24.0	0.020	ND	--	--	0.020	ND	0.020	ND	--	--	--	--
Xylene, m & p	NA	ug/l			1600	4.0	ND	--	--	4.0	ND	4.0	ND	4.0	ND	4.0	ND
Xylene, o	NA	ug/l			1600	2.0	ND	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND
PCBs																	
Aroclor 1016	NA	ug/l		1.25	1.12	--	--	--	--	--	--	--	--	--	--	--	--
Aroclor 1221	NA	ug/l				--	--	--	--	--	--	--	--	--	--	--	--
Aroclor 1232	NA	ug/l				--	--	--	--	--	--	--	--	--	--	--	--
Aroclor 1242	NA	ug/l				--	--	--	--	--	--	--	--	--	--	--	--
Aroclor 1248	NA	ug/l				--	--	--	--	--	--	--	--	--	--	--	--
Aroclor 1254	NA	ug/l		0.0438	0.320	--	--	--	--	--	--	--	--	--	--	--	--
Aroclor 1260	NA	ug/l		0.0438		--	--	--	--	--	--	--	--	--	--	--	--
Aroclor 1268	NA	ug/l				--	--	--	--	--	--	--	--	--	--	--	--
Total Petroleum Hydrocarbons																	
Total Petroleum Hydrocarbons (as diesel)	NA	ug/l	**500**			130	ND	130	ND	130	ND	130	ND	130	ND	130	ND
Total Petroleum Hydrocarbons (as gasoline)	NA	ug/l	800			50	ND	--	--	50	ND	50	ND	50	ND	50	ND
Total Petroleum Hydrocarbons (as motor oil)	NA	ug/l	500			250	ND	250	ND	250	ND	250	ND	250	ND	250	ND

Barr qualifier - *: Estimated value, QA/QC criteria not met.

Barr qualifier - b: Potential false positive value based on blank data validation procedures. Concentrations identified as potential false positive are excluded from calculations.

Landau qualifier - J: Indicates the analyte was positively identified; the associated numerical value is the approximate concentration of the analyte in the sample.

Landau qualifier - UJ: The analyte was not detected in the sample; the reported sample reporting limit is an estimate.

N: Normal Sample.

FD: Field Duplicate Sample.

ND: Not detected.

PQL: Practical Quantitation Limit.

SSource: Laboratory and/or field data obtained from a secondary source external to Barr. Second source QA/QC evaluation procedures may or may not have been performed beyond the original data generator.

BARR

Standard Operating Procedure

Routine Level General Chemistry Data Evaluation

Revision 6

January 8, 2016

Approved By:

James Taraldsen — James Taraldsen — 01/08/16
Print — Technical Reviewer — Signature — Date

Terri Olson — Terri A. Olson — 01/08/16
Print — QA Manager — Signature — Date

Review of the SOP has been performed and the SOP still reflects current practice.

Initials: ____________ Date: ____________
Initials: ____________ Date: ____________
Initials: ____________ Date: ____________
Initials: ____________ Date: ____________

Minneapolis, MN ● Hibbing, MN ● Duluth, MN ● Ann Arbor, MI ● Jefferson City, MO ● Bismarck, ND ● Calgary, AB, Canada ● Grand Rapids, MI ● Salt Lake City, UT

Routine Level General Chemistry Data Evaluation

1.0 Scope and Applicability

This SOP is intended as a guidance document for the routine level evaluation of general chemistry data provided by laboratories to be used in Barr Engineering Company (Barr) projects.

This SOP is based on the recommendations of the associated approved analytical methods from USEPA, ASTM, and *Standard Methods for the Examination of Water and Wastewate*r and applies to routine general chemistry data evaluation including a variety of approved methods not limited to the following parameters:

Alkalinity as $CaCO_3$

Ammonia, total ($NH_3 + NH_4^-$)

Biological Oxygen Demand (BOD)

Chemical Oxygen Demand (COD)

Chloride

Chromium VI (Hexavalent Chromium)

Conductance, Specific – *in lab*

Cyanide (as CN^-)

Fluoride

Hardness

Oil and Grease (as HEM)

Nitrate (or Nitrite) only

Nitrate + Nitrite

pH – *in lab*

Phosphorus, total

Sulfate

Sulfide

Total Dissolved Solids (TDS)

Total Kjeldahl Nitrogen (TKN)

Total Organic Carbon (TOC)

Total Suspended Solids (TSS)

In the case of specific parameters not listed above, the guidelines within this document will provide the basis upon which to make adequate professional judgment in the evaluation of data submitted for review.

The recommended procedures in this SOP should be followed unless conditions make it impractical or inappropriate to do so. Modifications should be noted in the applicable documentation and communicated to appropriate personnel. Significant changes may result in a revision or newly created SOP.

2.0 Limitations

- Level IV data evaluation is not covered in this SOP and should be performed in accordance with project specific requirements.

3.0 Responsibilities

The laboratory is responsible for generating data from the samples submitted for analysis. In instances where QC criteria are not met for the analysis of samples, the laboratory is responsible for reanalysis of the samples, provided reanalysis is possible (considering matrix interference, holding times and sample volume, etc.), or documenting the impact to the data.

The Data Quality Specialist is responsible for evaluating the data in accordance with this document, in addition to using professional judgment where necessary or appropriate. Project specific requirements, such as those specified in a Quality Assurance Project Plan (QAPP) or Sampling and Analysis Plan (SAP), may differ from these recommendations and professional judgment should be applied before qualifying any data.

4.0 Procedure

The Quality Assurance/Quality Control (QA/QC) data detailed below are the most typical found in a routine level laboratory report. Other QA/QC data may be provided by the laboratory within the laboratory report case narrative, data qualifiers, or cover sheet and should be evaluated using professional judgment (e.g., initial calibration, calibration verification, internal standards, post digestion, serial dilution).

Definitions to common QA/QC terms and terms used within this SOP along with a list of Barr 'Data Qualifiers/Footnotes' that may be applied during review can be found in Barr's "Compendium of Data Quality Assessment Documentation".

4.1 Holding Time and Preservation

The purpose of holding time and preservation evaluation is to ascertain the validity of the analytical results based on the sample condition, preservation, and time elapsed between the date of sample collection and date of analysis.

40 CFR Part 136 and the *Test Methods for Evaluating Solid Waste (SW-846)* are used as guidance for the recommended holding time and preservation acceptance criteria listed in *Table 1*.

Table 1 - Recommended Holding Times and Preservation

Parameter *(Alternate Name)*	**Recommended Hold Time**						**Preservation**					
	24 Hour	48 Hour	7 Day	14 Day	28 Day	180 Day	Ice Only (< 6 °C)	HCl	HNO_3	H_2SO_4	NaOH	ZnAc + NaOH
Alkalinity, as $CaCO_3$				X			X					
Ammonia as N					X		X			X		
Biochemical Oxygen Demand *(BOD)*		X					X					
Chemical Oxygen Demand *(COD)*					X		X			X		
Chloride					X		X					
Chromium, hexavalent	X				a		X					
Conductance, specific - in lab					X		X					
Cyanide				X			X				X	
Dissolved Organic Carbon *(DOC)*					X		X	X[c]		X[c]		
Fluoride					X		X					
Hardness						X			X[c]	X[c]		

(Table 1 continued on next page)

Table 1 - Recommended Holding Times and Preservation

Parameter *(Alternate Name)*	**Recommended Hold Time**						**Preservation**					
	24 Hour	48 Hour	7 Day	14 Day	28 Day	180 Day	Ice Only (< 6 °C)	HCl	HNO_3	H_2SO_4	NaOH	ZnAc + NaOH
Nitrate or Nitrite		X					X					
Nitrate + Nitrite as N					X		X			X		
Oil & Grease, HEM					X		X	X[c]		X[c]		
pH[b] - in lab			X				X					
Phosphorus, total					X		X			X		
Sulfate					X		X					
Sulfide			X				X					X
Total Dissolved Solids *(TDS)*			X				X					
Total Kjeldahl Nitrogen *(TKN)*					X		X			X		
Total Organic Carbon *(TOC)*					X		X	X[c]		X[c]		
Total Suspended Solids *(TSS)*			X				X					

a = Per 40 CFR Part 136.3, a 28-day holding time may be achieved if the ammonium sulfate buffer solution specified in EPA Method 218.6 is used. This footnote supersedes preservation and holding time requirements in approved hexavalent chromium methods, unless this would compromise the measurement and then the method must be followed.

b = Method recommends pH should be measured in the field.; however, for confirmation measurements in the laboratory, a maximum holding time of 7 days from sample collection will be used as a guideline for qualification.

c = Either preservative may be used (pH < 2) - for hardness, HNO_3 only if calculated from Ca and Mg.

If samples do not meet holding time, preservation and analysis recommendations in *Table 1*, consider qualification with an "**h**". Other matrices, such as product samples (e.g. oil, waste rock, drill cores) may not be subjected to the same holding time recommendations.

If the sample was stored on ice upon collection and delivered to the laboratory the same day, the sample may exceed recommended temperature at the time of laboratory receipt. Professional judgment should be applied (considering temperature, matrix, magnitude of the exceedance, etc.) when evaluating the application of qualifiers when criteria are not met.

4.2 Blank Samples

Blank sample evaluation is conducted to determine the existence and magnitude of target analyte contamination as a result of activities in the field during collection and transport or from inter-laboratory sources.

- While not required for all methods, method blanks are recommended for all but the pH analysis. Evaluation pertains to the batch of samples analyzed with the method blank.
- Field or equipment blank collection and analysis frequency is project specific. Evaluation pertains to the field samples associated with the field or equipment blank.
- Blank analyses may not have involved the same weights, volumes, or dilution factors as the associated samples. It may be easier to work with the raw data and/or convert the data to the same units for comparison purposes.

Table 2 – Guidelines for Blank Contamination	
Sample Result	**Recommended Action for Associated Data**
Non-detect	No action required
< 5x blank concentration	Qualify with ‘b’
≥ 5x blank concentration	Use professional judgment

b = Reported value may be a potential false positive based on blank data evaluation procedures

Note: Other multipliers of the blank contamination may be used based on professional judgment (reporting to the MDL, common lab contaminant, etc.)

Professional judgment regarding the usability of the data should be used in cases where gross detections of target analytes are found in the blank sample. A number of factors may be considered including historical data, prior knowledge of the site conditions, target analytes involved, type of blank sample, etc. In such cases, it may be appropriate to qualify the affected data with ‘*****’ (estimated value, QA/QC criteria not met) or ‘******’ (unusable value, QA/QC criteria not met).

4.3 Laboratory Control Samples (LCS) and Laboratory Control Sample Duplicate Samples (LCSD)

The laboratory control sample is used to monitor the overall performance of each step during analysis, including sample preparation. The LCS should be analyzed:

- Once every preparation batch (typically 20 or less samples of the same matrix).
- Once for each matrix.

Laboratory control samples contain a known amount of each target compound and the percent recoveries are evaluated based on the criteria within the laboratory report or project specific requirements. Percent recoveries are calculated for accuracy and the relative percent difference (RPD) is calculated for precision (when an LCSD was analyzed). Accuracy and precision equations can be found in ‘Definitions’ from Barr’s “Compendium of Data Quality Assessment Documentation”.

Table 3 – Guidelines for Laboratory Control Samples		
Criteria	**Recommended Action for Associated Data**	
	Detect	**Non-Detect**
%R and RPD > Upper Limit	Qualify with ‘*’	No qualification
%R < Lower Limit	Qualify with ‘*’ or ‘**’, use professional judgment	
%R and RPD within Limits	No qualification	

* = Reported value is estimated and QA/QC criteria were not met
** = Reported value is unusable and QA/QC criteria were not met

4.4 Laboratory Duplicate Samples

Laboratory duplicate samples are separate aliquots of field samples analyzed to demonstrate acceptable method precision by the laboratory at the time of analysis. Field blanks and proficiency testing (PT) samples should not be used for duplicate analysis. The RPDs are calculated using the equation as provided in 'Definitions' from Barr's "Compendium of Data Quality Assessment Documentation" and are not calculated where data are already qualified with b, U, <, or **. RPD results are dependent on the homogeneity of the samples.

Duplicates should be analyzed (whichever is more frequent):

- One from each matrix (soil or water)
- One from each SDG

The MS/MSD duplicate pairs may be substituted for laboratory duplicates.

Laboratory acceptance criteria or project specific requirement are used to evaluate RPDs. If criteria are not available, use professional judgment when considering qualification of associated results.

Higher RPDs are expected when results are at or near the reporting limits and are not always indicative of poor precision. RPDs are typically only evaluated for samples where both the native and duplicate sample concentrations are greater than five times (>5x) the RL. In cases where either of the samples (native or duplicate) is non-detect for a parameter and the other corresponding sample has detectable concentrations much greater than five times (>5x) the RL, professional judgment should be used to determine if qualification is appropriate.

Table 4 – Guidelines for Laboratory Duplicates

% RPD	**Recommended Action for Associated Data**
RPD < Upper Limit	No action is required
RPD > Upper Limit	Both results are ≤ 5x RL, no action is required
RPD > Upper Limit	Both results are > 5x RL, consider qualifying with '*****'

* = Reported value is estimated and QA/QC criteria were not met

4.5 Field Duplicate Samples

Field duplicate samples (also known as "masked" or "blind" duplicate samples) are used to demonstrate acceptable precision and reproducibility of the field and laboratory procedures. Frequency of collection is project specific. The RPDs are calculated using the equation as provided under precision in 'Definitions' from Barr's "Compendium of Data Quality Assessment Documentation" and are not calculated where data is already qualified with b, U, <, or **. RPD results are dependent on the homogeneity of the samples.

Acceptance criteria for field duplicate samples are subject to the professional judgment of the Data Quality Specialist but typically RPDs ≤ 30% for aqueous samples and ≤ 40% for soil and sediment samples are considered acceptable unless other project specific requirements are defined.

Higher RPDs are expected when results are at or near the reporting limits and are not always indicative of poor precision. RPDs are typically only evaluated for samples where both the native and duplicate sample

concentrations are greater than five times (>5x) the RL. In cases where either of the samples (native or field duplicate) is non-detect for a parameter and the other corresponding sample has detectable concentrations much greater than five times (>5x) the RL, professional judgment should be used to determine if qualification is appropriate.

4.6 Matrix Spikes (MS) and Matrix Spike Duplicate (MSD) Samples

Matrix spike samples contain a known amount of a target compound and provide information about the effect of each samples' matrix on the sample preparation procedures and analytical results. Matrix spikes are typically analyzed at the following frequencies:

- 1 (MS/MSD pair) in every 20 samples
- 1 per preparation batch per matrix
- 1 per SDG

However, the frequency may be project specific and the documents outlining the needs of the project (SAP, QAPP, etc.) should be reviewed. In some cases, MS/MSD analysis is not required.

The percent recoveries are evaluated based on the criteria within the laboratory report or project specific requirements. If a matrix spike recovery does not meet acceptance criteria and is not associated with a project sample, no further action is required unless other systematic evidence warrants qualification.

If the native concentration of a spiked sample is significantly greater than the spike added (>4x), spike recovery cannot be accurately evaluated, therefore the criteria do not apply. Professional judgment should be used for percent recoveries nominally outside laboratory acceptance criteria prior to qualifying data.

If criteria are not available, use guidance found in the NFG. Percent recoveries of matrix spike (and matrix spike duplicate) samples should be calculated using the equation provided under accuracy in 'Definitions' from Barr's "Compendium of Data Quality Assessment Documentation".

Solid samples may have highly variable concentrations of target analytes and percent recoveries (%R) may be influenced by the sampling precision and inherent sample homogeneity. Professional judgment should be used for difficult matrices and the acceptance criteria adjusted accordingly.

Table 5 – Guidelines for Matrix Spikes

Criteria	**Recommended Action for Associated Data**	
	Detect	**Non-Detect**
%R and RPD > Upper Limit	Qualify with '*'	No qualification
%R < Lower Limit	Qualify with '*' or '**', use professional judgment	
%R and RPD within Limits	No qualification	

* = Reported value is estimated and QA/QC criteria were not met
** = Reported value is unusable and QA/QC criteria were not met

While matrix spike duplicates are not required by all methods, if results for MSD analyses are reported, evaluate the RPD for MS and MSD pairs using the equation as provided under precision in 'Definitions' from Barr's "Compendium of Data Quality Assessment Documentation".

4.7 Overall Assessment

The chain-of-custody should be reviewed to determine if the laboratory report matches the requested analyses and that project specific parameters were analyzed as requested. The narrative and other supporting documentation should be evaluated to ensure that sample condition was appropriately documented by the laboratory upon receipt. If available, historical data should be used to assist with data evaluation. Any additional anomalies should be documented and evaluated, if necessary.

5.0 Quality Control and Quality Assurance (QA/QC)

Depending on the project objectives, the data review may include the completion of a Routine Level Quality Control Report (see Barr's "Compendium of Data Quality Assessment Documentation") as part of the evaluation process. Within each QC data section, the reviewer should include references to whether the QC data met or exceeded the acceptance criteria. The qualifiers, added, removed, or retained, should be documented also. Where multiple qualifiers may be applicable to a sample/analyte result, professional judgment should be used to determine if all qualifiers are necessary or if one qualifier would be sufficient to represent the deviations. A statement as to whether the data are acceptable as reported or acceptable with qualification(s) should also be included. If revised reports are required and the revision affects the sample results, notification should be given to the appropriate data management personnel and/or project team members.

The Data Quality Specialist will verify that the qualifiers associated with data tables match the Routine Level Quality Control Report.

6.0 Records

The Routine Level Quality Control Report should be saved to the appropriate internal Barr file and the link uploaded to the tracking system. Periodically, Data Quality staff should check for missing Routine Level Quality Control Reports in the tracking system to help maintain the most current information.

Documentation specific to this SOP are listed below and are available in Barr's "Compendium of Data Quality Assessment Documentation".

- Definitions
- Barr Qualifiers/Footnotes
- Routine Level Quality Control Report

Additional records information can be found in Barr's "Records Management System Manual".

7.0 References

Environmental Protection Agency. *Title 40 of the Code of Federal Regulations, Part 136.3.*

Environmental Protection Agency, *National Functional Guidelines for Inorganic Superfund Data Review.*

Analytical methods listed under the 'Scope and Applicability' section of this SOP.

Attachment 1

Revision History

Revision Number	Date of Revision	Section	Revision Made
3.1	02/2009	Document Wide	Edits to references, formatting; minor language additions and corrections;
		IX	Changed to Section X
		Attachments	Added Attachment 3
		IX (new)	Added Table 9.
3.2	04/2011	Document Wide	Added missing analytical method references.
		Attachments	Updated Attachments to current forms.
3.3	04/2011	References	Update the reference to the current NFG Metals data validation document.
4.0	04/06/12	Document Wide	Major revision
5.0	06/17/13	Cover page	Added Calgary office
		Applicability	Added US to EPA reference
		I	Added waste rock and drill cores to examples of product sample
		III	Added LCSD information
		III, IV, V, VI	Added 'project specific requirements' as possible criteria source
		V	Added 'field and laboratory procedures' to clarify that it's not only a laboratory item
		V	Clarified field duplicate criteria as < one value and not a range
		VIII	Added statement regarding multiple qualifiers
6.0	01/07/16	Document Wide	SOP restructuring, new format

BARR

Standard Operating Procedure

Routine Level Metals Data Evaluation

Revision 6

January 7, 2016

Approved By:

Michael Dupay		01/07/16
Print	Technical Reviewer Signature	Date
Terri Olson	Terri A. Olson	01/07/16
Print	QA Manager Signature	Date

Review of the SOP has been performed and the SOP still reflects current practice.

Initials:		Date:	
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Minneapolis, MN ● Hibbing, MN ● Duluth, MN ● Ann Arbor, MI ● Jefferson City, MO ● Bismarck, ND ● Calgary, AB, Canada ● Grand Rapids, MI ● Salt Lake City, UT

Routine Level Metals Data Evaluation

1.0 Scope and Applicability

This SOP is intended as a guidance document for the routine level evaluation of metals data provided by laboratories to be used in Barr Engineering Company (Barr) projects.

This SOP is based on quality assurance elements, not the specific criteria, of *USEPA Contract Laboratory Program National Functional Guidelines (NFG) for Inorganic Data* and applies to routine metals data evaluation for analyses by the following technologies:

- Inductively Coupled Plasma/Atomic Emission Spectroscopy (ICP/AES)
    - Method examples: EPA 200.7, EPA 6010
- Inductively Coupled Plasma/Mass Spectrometry (ICP/MS)
    - Method examples: EPA 200.8, EPA 6020
- Cold Vapor Atomic Absorption (CVAA)
    - Method examples: EPA 245.1, EPA 7470, EPA 7471, SM 3112 B
- Cold Vapor Atomic Fluorescence Spectrometry (CVAF)
    - Method examples: EPA 245.7, EPA 1631 (low-level mercury), EPA 7474
- Thermal Decomposition / Atomic Absorption Spectrophotometer
    - EPA 7473
- Graphite Furnace Atomic Absorption (GFAA)
    - Method examples: EPA 7010, SM 3113 B
- Methods above in conjunction with Toxicity Characteristic Leachate Procedure (TCLP), EPA 1311
- Methods above in conjunction with Synthetic Precipitation Leachate Procedure (SPLP), EPA 1312

In the case of specific technologies and/or methods not listed above, the guidelines within this document will provide the basis upon which to make adequate professional judgment in the evaluation of data submitted for review.

The recommended procedures in this SOP should be followed unless conditions make it impractical or inappropriate to do so. Modifications should be noted in the applicable documentation and communicated to appropriate personnel. Significant changes may result in a revision or newly created SOP.

2.0 Limitations

- Level IV data evaluation is not covered in this SOP and should be performed in accordance with NFG or project specific requirements.

3.0 Responsibilities

The laboratory is responsible for generating data from the samples submitted for analysis. In instances where QC criteria are not met for the analysis of samples, the laboratory is responsible for reanalysis of the samples, provided reanalysis is possible (considering matrix interference, holding times and sample volume, etc.), or documenting the impact to the data.

The Data Quality Specialist is responsible for evaluating the data in accordance with this document, in addition to using professional judgment where necessary or appropriate. Project specific requirements, such as those specified in a Quality Assurance Project Plan (QAPP) or Sampling and Analysis Plan (SAP), may differ from these recommendations and professional judgment should be applied before qualifying any data.

4.0 Procedure

The Quality Assurance/Quality Control (QA/QC) data detailed below are the most typical found in a routine level laboratory report. Other QA/QC data may be provided by the laboratory within the laboratory report case narrative, data qualifiers, or cover sheet and should be evaluated using professional judgment (e.g., initial calibration, calibration verification, internal standards, post digestion, serial dilution).

Definitions to common QA/QC terms and terms used within this SOP along with a list of Barr 'Data Qualifiers/Footnotes' that may be applied during review can be found in Barr's "Compendium of Data Quality Assessment Documentation".

4.1 Holding Time and Preservation

The purpose of holding time and preservation evaluation is to ascertain the validity of the analytical results based on the sample condition, preservation, and time elapsed between the date of sample collection and date of analysis.

40 CFR Part 136 and the *Test Methods for Evaluating Solid Waste (SW-846)* are used as guidance for the recommended holding time and preservation acceptance criteria listed in *Table 1*.

Table 1 – Recommended Holding Times and Preservation

Compound	Matrix	Temp.	Preservative	Maximum Holding Time
Mercury	Aqueous	--	HNO_3 < 2 pH	28 days
	Aqueous (low level)	--	Pre-tested hydrochloric acid or bromine chloride	48 hours preserve or analyze if not oxidized in sample bottle/28 days preserve if oxidized in sample bottle 90 days analysis (from collection) if preserved
	Sediment/Soil	Cool, ≤ 6 °C	Ice	28 days
	Wipe/Air	--	NA	28 days

(Table 1 continued on next page)

Table 1 – Recommended Holding Times and Preservation

Compound	Matrix	Temp.	Preservative	Maximum Holding Time
Mercury	TCLP	--	NA	28 days TCLP Extraction/ 28 days analysis
All other metals	Aqueous	--	HNO_3 < 2 pH	180 days
	Sediment/Soil	Cool, ≤ 6 °C	Ice	180 days
	Wipe/Air	--	NA	180 days
	TCLP	--	NA	180 days TCLP Extraction/ 180 days analysis

Note: When analyzing boron or silica, do not collect samples in borosilicate glass bottles.

If samples do not meet holding time, preservation and analysis recommendations in *Table 1*, consider qualification with an "**h**". Other matrices, such as product samples (e.g. oil, waste rock, drill cores) may not be subjected to the same holding time recommendations.

If the sample was stored on ice upon collection and delivered to the laboratory the same day, the sample may exceed recommended temperature at the time of laboratory receipt. Professional judgment should be applied (considering temperature, matrix, magnitude of the exceedance, etc.) when evaluating the application of qualifiers when criteria are not met.

Special considerations for low-level mercury

Low-level mercury must be collected directly into a specially cleaned, pretested, fluoropolymer or glass bottle using sample handling techniques specially designed for collection of mercury at trace levels and preserved with pre-tested hydrochloric acid (required for methyl mercury) or bromine chloride. Samples not collected in the correct type of container may be qualified with an "**h**". These samples may be shipped unpreserved provided:

- Sample is collected in a fluoropolymer or glass bottle.
- Bottle contains no headspace and is capped tightly.
- Sample temperature was maintained at ≤ 6 °C.
- Samples are preserved or analyzed within 48 hours or oxidized in the bottle within 28 days.

4.2 Blank Samples

Blank sample evaluation is conducted to determine the existence and magnitude of target analyte contamination as a result of activities in the field during collection and transport or from inter-laboratory sources.

- For each matrix, at least one method blank should be prepared and analyzed with each sample delivery group (SDG), or each batch digested (whichever is more frequent). Evaluation pertains to the batch of samples analyzed with the method blank.
- Field or equipment blank collection and analysis frequency is project specific. Evaluation pertains to the field samples associated with the field or equipment, blank.

- Blank analyses may not have involved the same weights, volumes, or dilution factors as the associated samples. It may be easier to work with the raw data and/or convert the data to the same units for comparison purposes.
- Low-level mercury method requires *at least* three method blanks per run per analytical batch.

Table 2 – Guidelines for Blank Contamination

Sample Result	Recommended Action for Associated Data
Non-detect	No action required
< 5x blank concentration	Qualify with 'b'
≥ 5x blank concentration	Use professional judgment

b = Reported value may be a potential false positive based on blank data evaluation procedures

Note: Other multipliers of the blank contamination may be used based on professional judgment (reporting to the MDL, common lab contaminant, etc.)

Professional judgment regarding the usability of the data should be used in cases where gross detections of target analytes are found in the blank sample. A number of factors may be considered including historical data, prior knowledge of the site conditions, target analytes involved, type of blank sample, etc. In such cases, it may be appropriate to qualify the affected data with '*****' (estimated value, QA/QC criteria not met) or '******' (unusable value, QA/QC criteria not met).

4.3 Laboratory Control Samples (LCS) and Laboratory Control Sample Duplicate Samples (LCSD)

The laboratory control sample is used to monitor the overall performance of each step during analysis, including sample preparation. The LCS should be analyzed:

- Once every preparation batch (typically 20 or less samples of the same matrix).
- Once for each matrix.
- For low-level mercury, ongoing precision and recovery (OPR) samples are run before and after each analytical batch - quality control samples (QCS) should be from a different source and analyzed once per analytical batch.

Laboratory control samples contain a known amount of each target compound and the percent recoveries are evaluated based on the criteria within the laboratory report or project specific requirements. If criteria are not available, use guidance found in the NFG. Percent recoveries are calculated for accuracy and the relative percent difference (RPD) is calculated for precision (when an LCSD was analyzed). Accuracy and precision equations can be found in 'Definitions' from Barr's "Compendium of Data Quality Assessment Documentation".

Table 3 – Guidelines for Laboratory Control Samples

Criteria	Recommended Action for Associated Data	
	Detect	Non-Detect
%R and RPD > Upper Limit	Qualify with '*'	No qualification
%R < Lower Limit	Qualify with '*' or '**', use professional judgment	
%R and RPD within Limits	No qualification	

* = Reported value is estimated and QA/QC criteria were not met
** = Reported value is unusable and QA/QC criteria were not met

4.4 Laboratory Duplicate Samples

Laboratory duplicate samples are separate aliquots of field samples analyzed to demonstrate acceptable method precision by the laboratory at the time of analysis. Field blanks and proficiency testing (PT) samples should not be used for duplicate analysis. The RPDs are calculated using the equation as provided in 'Definitions' from Barr's "Compendium of Data Quality Assessment Documentation" and are not calculated where data are already qualified with b, U, <, or **. RPD results are dependent on the homogeneity of the samples.

Duplicates should be analyzed (whichever is more frequent):

- One from each matrix (soil or water)
- One from each SDG

The MS/MSD duplicate pairs may be substituted for laboratory duplicates.

Laboratory acceptance criteria or project specific requirement are used to evaluate RPDs. If criteria are not available, use guidance found in NFG or use professional judgment when considering qualification of associated results.

Higher RPDs are expected when results are at or near the reporting limits and are not always indicative of poor precision. RPDs are typically only evaluated for samples where both the native and duplicate sample concentrations are greater than five times (>5x) the RL. In cases where either of the samples (native or duplicate) is non-detect for a parameter and the other corresponding sample has detectable concentrations much greater than five times (>5x) the RL, professional judgment should be used to determine if qualification is appropriate.

Table 4 – Guidelines for Laboratory Duplicates

% RPD	Recommended Action for Associated Data
RPD < Upper Limit	No action is required
RPD > Upper Limit	Both results are ≤ 5x RL, no action is required
RPD > Upper Limit	Both results are > 5x RL, consider qualifying with '*'

* = Reported value is estimated and QA/QC criteria were not met

4.5 Field Duplicate Samples

Field duplicate samples (also known as “masked” or “blind” duplicate samples) are used to demonstrate acceptable precision and reproducibility of the field and laboratory procedures. Frequency of collection is project specific. The RPDs are calculated using the equation as provided under precision in ‘Definitions’ from Barr’s “Compendium of Data Quality Assessment Documentation” and are not calculated where data is already qualified with b, U, <, or **. RPD results are dependent on the homogeneity of the samples.

Acceptance criteria for field duplicate samples are subject to the professional judgment of the Data Quality Specialist but typically RPDs ≤ 30% for aqueous samples and ≤ 40% for soil and sediment samples are considered acceptable unless other project specific requirements are defined.

Higher RPDs are expected when results are at or near the reporting limits and are not always indicative of poor precision. RPDs are typically only evaluated for samples where both the native and duplicate sample concentrations are greater than five times (>5x) the RL. In cases where either of the samples (native or field duplicate) is non-detect for a parameter and the other corresponding sample has detectable concentrations much greater than five times (>5x) the RL, professional judgment should be used to determine if qualification is appropriate.

4.6 Matrix Spikes (MS) and Matrix Spike Duplicate (MSD) Samples

Matrix spike samples contain a known amount of a target compound and provide information about the effect of each samples’ matrix on the sample preparation procedures and analytical results. Matrix spikes are typically analyzed at the following frequencies:

- 1 (MS/MSD pair) in every 20 samples
- 1 per preparation batch per matrix
- 1 per SDG

However, the frequency may be project specific and the documents outlining the needs of the project (SAP, QAPP, etc.) should be reviewed. In some cases, MS/MSD analysis is not required.

The percent recoveries are evaluated based on the criteria within the laboratory report or project specific requirements. If a matrix spike recovery does not meet acceptance criteria and is not associated with a project sample, no further action is required unless other systematic evidence warrants qualification.

If the native concentration of a spiked sample is significantly greater than the spike added (>4x), spike recovery cannot be accurately evaluated, therefore the criteria do not apply. Professional judgment should be used for percent recoveries nominally outside laboratory acceptance criteria prior to qualifying data.

If criteria are not available, use guidance found in the NFG. Percent recoveries of matrix spike (and matrix spike duplicate) samples should be calculated using the equation provided under accuracy in ‘Definitions’ from Barr’s “Compendium of Data Quality Assessment Documentation”.

Solid samples may have highly variable concentrations of target analytes and percent recoveries (%R) may be influenced by the sampling precision and inherent sample homogeneity. Professional judgment should be used for difficult matrices and the acceptance criteria adjusted accordingly.

Table 5 – Guidelines for Matrix Spikes		
Criteria	**Recommended Action for Associated Data**	
	Detect	**Non-Detect**
%R and RPD > Upper Limit	Qualify with '*'	No qualification
%R < Lower Limit	Qualify with '*' or '**', use professional judgment	
%R and RPD within Limits	No qualification	

* = Reported value is estimated and QA/QC criteria were not met
** = Reported value is unusable and QA/QC criteria were not met

While matrix spike duplicates are not required by all methods, if results for MSD analyses are reported, evaluate the RPD for MS and MSD pairs using the equation as provided under precision in 'Definitions' from Barr's "Compendium of Data Quality Assessment Documentation".

4.7 Overall Assessment

The chain-of-custody should be reviewed to determine if the laboratory report matches the requested analyses and that project specific parameters were analyzed as requested. The narrative and other supporting documentation should be evaluated to ensure that sample condition was appropriately documented by the laboratory upon receipt. If available, historical data should be used to assist with data evaluation. Any additional anomalies should be documented and evaluated, if necessary.

4.8 Total vs. Dissolved

Occasionally, the measurements for dissolved metals are equivalent to or greater than the associated results reported for the total metals analysis. When this occurs, the variation between the total and dissolved results may indicate that the majority of the target metals present in the sample were in the dissolved phase and normal analytical variability may account for the difference. Professional judgment should be used to determine if the variation is significant enough to be qualified.

5.0 Quality Control and Quality Assurance (QA/QC)

Depending on the project objectives, the data review may include the completion of a Routine Level Quality Control Report (see Barr's "Compendium of Data Quality Assessment Documentation") as part of the evaluation process. Within each QC data section, the reviewer should include references to whether the QC data met or exceeded the acceptance criteria. The qualifiers, added, removed, or retained, should be documented. Where multiple qualifiers may be applicable to a sample/analyte result, professional judgment should be used to determine if all qualifiers are necessary or if one qualifier would be sufficient to represent the deviations. A statement as to whether the data are acceptable as reported or acceptable with qualification(s) should also be included. If revised reports are required and the revision affects the sample results, notification should be given to the appropriate data management personnel and/or project team members.

The Data Quality Specialist will verify that the qualifiers associated with data tables match the Routine Level Quality Control Report.

6.0 Records

The Routine Level Quality Control Report should be saved to the appropriate internal Barr file and the link uploaded to the tracking system. Periodically, Data Quality staff should check for missing Routine Level Quality Control Reports in the tracking system to help maintain the most current information.

Documentation specific to this SOP are listed below and are available in Barr's "Compendium of Data Quality Assessment Documentation".

- Definitions
- Barr Qualifiers/Footnotes
- Routine Level Quality Control Report

Additional records information can be found in Barr's "Records Management System Manual".

7.0 References

Environmental Protection Agency. *Title 40 of the Code of Federal Regulations, Part 136.3.*

Environmental Protection Agency, *National Functional Guidelines for Inorganic Superfund Data Review.*

Analytical methods listed under the 'Scope and Applicability' section of this SOP.

Attachment 1

Revision History

Revision Number	Date of Revision	Section	Revision Made
3.2	04/2011	Document Wide	Added missing analytical method references.
		Attachments	Updated Attachments to current forms.
3.3	04/2011	References	Update the reference to the current NFG Metals data validation document.
4.0	04/06/12	Document Wide	Major revision
5.0	06/17/13	Cover page	Added Calgary office
		Applicability	Added US to EPA reference
		I	Added waste rock and drill cores to examples of product sample
		III, IV, V, VI	Added 'project specific requirements' as possible criteria source
		V	Added 'field and laboratory procedures' to clarify that it's not only a laboratory item
		V	Clarified field duplicate criteria as < one value and not a range
		VIII	Added statement regarding multiple qualifiers
6.0	01/07/16	Document Wide	SOP restructuring, new format

BARR

Standard Operating Procedure

Routine Level Polychlorinated Biphenyl (PCB), Aroclor, Pesticide, and Herbicide Data Evaluation

Revision 4

January 22, 2016

Approved By:

Michael Dupay		01/22/16
Print	Technical Reviewer Signature	Date
Terri Olson	Terri A. Olson	01/22/16
Print	QA Manager Signature	Date

Review of the SOP has been performed and the SOP still reflects current practice.

Initials: ______________ Date: ______________

Initials: ______________ Date: ______________

Initials: ______________ Date: ______________

Initials: ______________ Date: ______________

Minneapolis, MN ● Hibbing, MN ● Duluth, MN ● Ann Arbor, MI ● Jefferson City, MO ● Bismarck, ND ● Calgary, AB, Canada ● Grand Rapids, MI ● Salt Lake City, UT

Routine Level Polychlorinated Biphenyl (PCB), Aroclor, Pesticide, and Herbicide Data Evaluation

1.0 Scope and Applicability

This SOP is intended as a guidance SOP for the routine level evaluation of polychlorinated biphenyl (PCB), Aroclor, pesticide, and herbicide data provided by laboratories to be used in Barr Engineering Company (Barr) projects.

This SOP is based on quality assurance elements, not the specific criteria, of *USEPA Contract Laboratory Program National Functional Guidelines (NFG) for Organic Data* and applies to routine level PCB, Aroclor, pesticide, and herbicide data evaluation for analyses by the following technologies:

- Gas Chromatography/Electron Capture Detector (GC/ECD)
    - Method examples: EPA 608, EPA 8081, EPA 8082, EPA 8151
- Gas Chromatography/Electrolytic Conductivity Detector (GC/ELCD)
    - Method examples: EPA 8081, EPA 8082
- Gas Chromatography/Flame Photometric Detector (GC/FPD)
    - Method example: EPA 1657, EPA 8141
- Gas Chromatography/Nitrogen Phosphorus Detector (GC/NPD)
    - Method example: EPA 8141
- GC/ECD for Herbicides
    - Method example: EPA 8151
- Methods above with Toxicity Characteristic Leachate Procedure (TCLP), EPA 1311
- Methods above with Synthetic Precipitation Leachate Procedure (SPLP), EPA 1312

In the case of specific technologies and/or methods not listed above, the guidelines within this document will provide the basis upon which to make adequate professional judgment in the evaluation of data submitted for review.

The recommended procedures in this SOP should be followed unless conditions make it impractical or inappropriate to do so. Modifications should be noted in the applicable documentation and communicated to appropriate personnel. Significant changes may result in a revision or newly created SOP.

2.0 Limitations

- Level IV data evaluation is not covered in this SOP and should be performed in accordance with NFG or project specific requirements.

3.0 Responsibilities

The laboratory is responsible for generating data from the samples submitted for analysis. In instances where QC criteria are not met for the analysis of samples, the laboratory is responsible for reanalysis of the samples, provided reanalysis is possible (considering matrix interference, holding times and sample volume, etc.), or documenting the impact to the data.

The Data Quality Specialist is responsible for evaluating the data in accordance with this document, in addition to using professional judgment where necessary or appropriate. Project specific requirements, such as those specified in a Quality Assurance Project Plan (QAPP) or Sampling and Analysis Plan (SAP), may differ from these recommendations and professional judgment should be applied before qualifying any data.

4.0 Procedure

The Quality Assurance/Quality Control (QA/QC) data detailed below are the most typical found in a routine level laboratory report. Other QA/QC data may be provided by the laboratory within the laboratory report case narrative, data qualifiers, or cover sheet and should be evaluated using professional judgment (e.g., initial calibration, calibration verification, internal standards).

Definitions to common QA/QC terms and terms used within this SOP along with a list of Barr 'Data Qualifiers/Footnotes' that may be applied during review can be found in Barr's "Compendium of Data Quality Assessment Documentation".

4.1 Holding Time and Preservation

The purpose of holding time and preservation evaluation is to ascertain the validity of the analytical results based on the sample condition, preservation, and time elapsed between the date of sample collection and date of analysis.

40 CFR Part 136 and the *Test Methods for Evaluating Solid Waste (SW-846)* are used as guidance for the recommended holding time and preservation acceptance criteria listed in *Table 1*.

Table 1 – Recommended Holding Times and Preservation

Compound	Matrix	Temp.	Preservative	Maximum Hold Time
PCBs (EPA 608)	Aqueous	≤ 6° C	Ice	1 year extraction/ addl. 1 year analysis
Organochlorine Pesticides (EPA 608)	Aqueous	≤ 6° C	Ice (if >72 hrs. to extraction, preserve to pH 5-9 with NaOH and/or H_2SO_4)	72 hrs. extraction unpreserved, 7 days extraction preserved/ addl. 40 days analysis
Organochlorine Pesticides (EPA 8081)	Aqueous	≤ 6° C	Ice	7 days extraction/ addl. 40 days analysis
	Sediment/Soil	≤ 6° C	Ice	14 days extraction/ addl. 40 days analysis

(Table 1 continued on next page)

Table 1 – Recommended Holding Times and Preservation				
Compound	**Matrix**	**Temp.**	**Preservative**	**Maximum Hold Time**
Organochlorine Pesticides (EPA 8081)	TCLP	--	NA	14 days TCLP extraction/ 7 days extraction/ addl. 40 days analysis
PCBs/Aroclor (EPA 8082)	Aqueous	≤ 6° C	Ice	None
	Sediment/Soil	≤ 6° C	Ice	None
Organophosphorus Compounds (EPA 8141)	Aqueous and Sediment/Soil	≤ 6° C	Ice	7 days extraction/ addl. 40 days analysis
Herbicides (EPA 8151)	Aqueous	≤ 6° C	Ice	7 days extraction/ addl. 40 days analysis
	Sediment/Soil	≤ 6° C	Ice	14 days extraction/ addl. 40 days analysis

If samples do not meet holding time, preservation and analysis recommendations in *Table 1*, consider qualification with an "**h**". Other matrices, such as product samples (e.g. oil, waste rock, drill cores) may not be subjected to the same holding time recommendations.

If the sample was stored on ice upon collection and delivered to the laboratory the same day, the sample may exceed recommended temperature at the time of laboratory receipt. Professional judgment should be applied (considering temperature, matrix, magnitude of the exceedance, etc.) when evaluating the application of qualifiers when criteria are not met.

4.2 Blank Samples

Blank sample evaluation is conducted to determine the existence and magnitude of target analyte contamination as a result of activities in the field during collection and transport or from inter-laboratory sources.

- For each matrix, at least one method blank should be prepared and analyzed with each sample delivery group (SDG). Evaluation pertains to the batch of samples analyzed with the method blank.
- Field or equipment blank collection and analysis frequency is project specific. Evaluation pertains to the field samples associated with the field or equipment blank.
- Blank analyses may not have involved the same weights, volumes, or dilution factors as the associated samples. It may be easier to work with the raw data and/or convert the data to the same units for comparison purposes.

Table 2 – Guidelines for Blank Contamination	
Sample Result	**Recommended Action for Associated Data**
Non-detect	No action required
< 5x blank concentration	Qualify with ‘b’
≥ 5x blank concentration	Use professional judgment

b = Reported value may be a potential false positive based on blank data evaluation procedures

Note: Other multipliers of the blank contamination may be used based on professional judgment (reporting to the MDL, common lab contaminant, etc.)

Professional judgment regarding the usability of the data should be used in cases where gross detections of target analytes are found in the blank sample. A number of factors may be considered including historical data, prior knowledge of the site conditions, target analytes involved, type of blank sample, etc. In such cases, it may be appropriate to qualify the affected data with ‘*****’ (estimated value, QA/QC criteria not met) or ‘******’ (unusable value, QA/QC criteria not met).

4.3 Surrogates

Surrogates are similar to analytes of interest in chemical composition, extraction, and chromatography but are not typically found in environmental samples. All samples (blanks, spiked samples, project samples, QC samples) should contain surrogates. If a sample does not contain surrogates, professional judgment should be used to determine if the reported results are useable or not. Acceptable evaluation of surrogate spikes may not be applicable if dilution of the sample was required. Percent recoveries are calculated for each surrogate and these are evaluated based on the criteria within the laboratory report or project specific requirements. If criteria are not reported, use guidance found in the NFG, if available. Percent recoveries are calculated using the equation provided under accuracy in ‘Definitions’ from Barr’s “Compendium of Data Quality Assessment Documentation”.

Table 3 includes guidance to evaluate the surrogate recovery where a single surrogate is analyzed.

Table 3 – Guidelines for Single Surrogate		
Criteria	**Recommended Action for Associated Data**	
	Detect	**Non-Detect**
%R > Upper Limit	Qualify with ‘*’	No qualification
%R < Lower Limit	Qualify with ‘*’ or ‘**’, use professional judgment	
%R within Limits	No qualification	

‘*’ = reported value is estimated and QA/QA criteria were not met
‘**’ = reported value is unusable and QA/QC criteria were not met

Table 4 includes guidance where multiple surrogates are analyzed.

Table 4 – Guidelines for Multiple Surrogates		
Criteria	**Recommended Action for Associated Data**	
	Detect	**Non-Detect**
One %R < Lower Limit	No qualification may be necessary, use professional judgment	
Two or more %R < Lower Limit	Qualify with '*' or '**', use professional judgment	
Two or more %R > Upper Limit	Qualify fraction with '*'	No qualification
One %R > Upper Limit	No qualification may be necessary, use professional judgment	No qualification
All %R within Limits	No qualification	

'*' = Reported value is estimated and QA/QA criteria were not met
'**' = Reported value is unusable and QA/QC criteria were not met

4.4 Laboratory Control Samples (LCS) and Laboratory Control Sample Duplicate Samples (LCSD)

The laboratory control sample is used to monitor the overall performance of each step during analysis, including sample preparation. The LCS should be analyzed:

- Once every preparation batch (typically 20 or less samples of the same matrix).
- Once for each matrix.

Laboratory control samples may contain all target compounds or a subset (see *Table 5* for guidance) and the percent recoveries are evaluated based on the criteria within the laboratory report or project specific requirements. If criteria are not available, use guidance found in the NFG. Percent recoveries are calculated for accuracy and the relative percent difference (RPD) is calculated for precision (when an LCSD was analyzed). Accuracy and precision equations can be found in 'Definitions' from Barr's "Compendium of Data Quality Assessment Documentation".

Table 5 – Number of Suggested Target Compounds - LCS/LCSD and MS/MSD	
Number of Target Parameters	**Number of Spiked Compounds**
1-10 analytes	Spike all compounds
11-20 analytes	At least 10 compounds or 80% of all analytes, whichever is greater
More than 20 analytes	Spike at least 16 compounds

Table 6 – Guidelines for Laboratory Control Samples		
Criteria	**Recommended Action for Associated Data**	
	Detect	**Non-Detect**
%R and RPD > Upper Limit	Qualify with ‘*’	No qualification
%R < Lower Limit	Qualify with ‘*’ or ‘**’, use professional judgment	
%R and RPD within Limits	No qualification	

‘*’ = Reported value is estimated and QA/QA criteria were not met
‘**’ = Reported value is unusable and QA/QC criteria were not met

4.5 Laboratory Duplicate Samples

Laboratory duplicate samples are separate aliquots of field samples analyzed to demonstrate acceptable method precision by the laboratory at the time of analysis. Field blanks and proficiency testing (PT) samples should not be used for duplicate analysis. The RPDs are calculated using the equation as provided in ‘Definitions’ from Barr’s “Compendium of Data Quality Assessment Documentation” and are not calculated where data are already qualified with b, U, <, or **. RPD results are dependent on the homogeneity of the samples.

Duplicates should be analyzed (whichever is more frequent):

- One from each matrix (soil or water)
- One from each SDG

The MS/MSD duplicate pairs may be substituted for laboratory duplicates.

Laboratory acceptance criteria or project specific requirement are used to evaluate RPDs. If criteria are not available, use guidance found in NFG or use professional judgment when considering qualification of associated results.

Higher RPDs are expected when results are at or near the reporting limits and are not always indicative of poor precision. RPDs are typically only evaluated for samples where both the native and duplicate sample concentrations are greater than five times (>5x) the RL. In cases where either of the samples (native or duplicate) is non-detect for a parameter and the other corresponding sample has detectable concentrations much greater than five times (>5x) the RL, professional judgment should be used to determine if qualification is appropriate.

Table 7 – Guidelines for Laboratory Duplicates	
% RPD	**Recommended Action for Associated Data**
RPD < Upper Limit	No action is required
RPD > Upper Limit	Both results are ≤ 5x RL, no action is required
RPD > Upper Limit	Both results are > 5x RL, consider qualifying with ‘*’

* = Reported value is estimated and QA/QC criteria were not met

4.6 Field Duplicate Samples

Field duplicate samples (also known as “masked” or “blind” duplicate samples) are used to demonstrate acceptable precision and reproducibility of the field and laboratory procedures. Frequency of collection is project specific. The RPDs are calculated using the equation as provided under precision in ‘Definitions’ from Barr’s “Compendium of Data Quality Assessment Documentation” and are not calculated where data is already qualified with b, U, <, or **. RPD results are dependent on the homogeneity of the samples.

Acceptance criteria for field duplicate samples are subject to the professional judgment of the Data Quality Specialist but typically RPDs ≤ 30% for aqueous samples and ≤ 40% for soil and sediment samples are considered acceptable unless other project specific requirements are defined.

Higher RPDs are expected when results are at or near the reporting limits and are not always indicative of poor precision. RPDs are typically only evaluated for samples where both the native and duplicate sample concentrations are greater than five times (>5x) the RL. In cases where either of the samples (native or field duplicate) is non-detect for a parameter and the other corresponding sample has detectable concentrations much greater than five times (>5x) the RL, professional judgment should be used to determine if qualification is appropriate.

4.7 Matrix Spikes (MS) and Matrix Spike Duplicate (MSD) Samples

Matrix spike samples may contain all target compounds or a subset (see *Table 5*) and provide information about the effect of each samples’ matrix on the sample preparation procedures and analytical results. Matrix spikes are typically analyzed at the following frequencies:

- 1 (MS/MSD pair) in every 20 samples
- 1 per preparation batch per matrix
- 1 per SDG

However, the frequency may be project specific and the documents outlining the needs of the project (SAP, QAPP, etc.) should be reviewed. In some cases, MS/MSD analysis is not required.

The percent recoveries are evaluated based on the criteria within the laboratory report or project specific requirements. If a matrix spike recovery does not meet acceptance criteria and is not associated with a project sample, no further action is required unless other systematic evidence warrants qualification.

If the native concentration of a spiked sample is significantly greater than the spike added (>4x), spike recovery cannot be accurately evaluated, therefore the criteria do not apply. Professional judgment should be used for percent recoveries nominally outside laboratory acceptance criteria prior to qualifying data.

If criteria are not available, use guidance found in the NFG. Percent recoveries of matrix spike (and matrix spike duplicate) samples should be calculated using the equation provided under accuracy in ‘Definitions’ from Barr’s “Compendium of Data Quality Assessment Documentation”.

Solid samples may have highly variable concentrations of target analytes and percent recoveries (%R) may be influenced by the sampling precision and inherent sample homogeneity. Professional judgment should be used for difficult matrices and the acceptance criteria adjusted accordingly.

Table 7 – Guidelines for Matrix Spikes		
Criteria	**Recommended Action for Associated Data**	
	Detect	**Non-Detect**
%R and RPD > Upper Limit	Qualify with '*'	No qualification
%R < Lower Limit	Qualify with '*' or '**', use professional judgment	
%R and RPD within Limits	No qualification	

'*' = Reported value is estimated and QA/QA criteria were not met
'**' = Reported value is unusable and QA/QC criteria were not met

While matrix spike duplicates are not required by all methods, if results for MSD analyses are reported, evaluate the RPD for MS and MSD pairs using the equation as provided under precision in 'Definitions' from Barr's "Compendium of Data Quality Assessment Documentation".

4.8 Overall Assessment

The chain-of-custody should be reviewed to determine if the laboratory report matches the requested analyses and that project specific parameters were analyzed as requested. The narrative and other supporting documentation should be evaluated to ensure that sample condition was appropriately documented by the laboratory upon receipt. If available, historical data should be used to assist with data evaluation. Any additional anomalies should be documented and evaluated, if necessary.

Note: Pesticides, herbicides, PCBs and Aroclors require additional ECD or GC/MS confirmation of tentatively identified compounds (TIC), using a separate column. This may occur at the same time as the initial analysis using a dual-column GC with an additional detector; or a second, separate analysis via EPA 8270 (see Barr SOP for Routine Level SVOC Data Evaluation if positive detections occur). Herbicides are sufficiently identified by a single column if a GC/MS is used for analysis. If there is indication that conformational analysis was not performed for the remaining parameters, professional judgment should be used to critically evaluate the usability of the data as reported.

5.0 Quality Control and Quality Assurance (QA/QC)

Depending on the project objectives, the data review may include the completion of a Routine Level Quality Control Report (see Barr's "Compendium of Data Quality Assessment Documentation") as part of the evaluation process. Within each QC data section, the reviewer should include references to whether the QC data met or exceeded the acceptance criteria. The qualifiers, added, removed, or retained, should be documented also. Where multiple qualifiers may be applicable to a sample/analyte result, professional judgment should be used to determine if all qualifiers are necessary or if one qualifier would be sufficient to represent the deviations. A statement as to whether the data are acceptable as reported or acceptable with qualification(s) should also be included. If revised reports are required and the revision affects the sample results, notification should be given to the appropriate data management personnel and/or project team members.

The Data Quality Specialist will verify that the qualifiers associated with data tables match the Routine Level Quality Control Report.

6.0 Records

The Routine Level Quality Control Report should be saved to the appropriate internal Barr file and the link uploaded to the tracking system. Periodically, Data Quality staff should check for missing Routine Level Quality Control Reports in the tracking system to help maintain the most current information.

Documentation specific to this SOP are listed below and are available in Barr's "Compendium of Data Quality Assessment Documentation".

- Definitions
- Barr Qualifiers/Footnotes
- Routine Level Quality Control Report

Additional records information can be found in Barr's "Records Management System Manual".

7.0 References

Environmental Protection Agency. *Title 40 of the Code of Federal Regulations, Part 136.3.*

Environmental Protection Agency, *National Functional Guidelines for Superfund Organic Methods Data Review.*

Analytical methods listed under the 'Scope and Applicability' section of this SOP.

Attachment 1

Revision History

Revision Number	Date of Revision	Section	Revision Made
1.1	02/2009	Document Wide	Edits to references, formatting; minor language additions and corrections
		Attachments	Added Attachment 3
1.2	04/2011	Attachments	Updated Attachment 1 and 2 to current forms.
2.0	04/06/12	Document Wide	Major revision
3.0	06/17/13	Cover page	Added Calgary office
		I	Added waste rock and drill cores to examples of product sample
		III, IV, V, VI	Added 'project specific requirements' as possible criteria source
		V	Added 'field and laboratory procedures' to clarify that it's not only a laboratory item
		V	Clarified field duplicate criteria as < one value and not a range
		VIII	Added statement regarding multiple qualifiers
4	01/22/16	Document Wide	SOP restructuring, new format

BARR

Standard Operating Procedure

Routine Level Semivolatile Organic Compounds (SVOC), Polycyclic Aromatic Hydrocarbons (PAH), Diesel Range Organics (DRO), and Total Petroleum Hydrocarbons (TPH) Data Evaluation

Revision 6

January 19, 2016

Approved By:

Michael Dupay			01/19/16
Print	Technical Reviewer	Signature	Date
Terri Olson		Terri A. Olson	01/19/16
Print	QA Manager	Signature	Date

Review of the SOP has been performed and the SOP still reflects current practice.

Initials: ____________________ Date: ____________________

Initials: ____________________ Date: ____________________

Initials: ____________________ Date: ____________________

Initials: ____________________ Date: ____________________

Minneapolis, MN ● Hibbing, MN ● Duluth, MN ● Ann Arbor, MI ● Jefferson City, MO ● Bismarck, ND ● Calgary, AB, Canada ● Grand Rapids, MI ● Salt Lake City, UT

Routine Level Semivolatile Organic Compounds (SVOC), Polycyclic Aromatic Hydrocarbons (PAH), Diesel Range Organics (DRO), and Total Petroleum Hydrocarbons (TPH) Data Evaluation

1.0 Scope and Applicability

This SOP is intended as a guidance SOP for the routine level evaluation of semivolatile organic compounds data provided by laboratories to be used in Barr Engineering Company (Barr) projects.

This SOP is based on quality assurance elements, not the specific criteria, of *USEPA Contract Laboratory Program National Functional Guidelines (NFG) for Organic Data* and applies to routine SVOC (including PAHs and phenols), TPH at various carbon ranges (e.g., TPH as fuel oil, TPH as motor oil, TPH as jet fuel), and DRO data evaluation for analyses by the following technologies:

- Gas Chromatography/Flame Ionization Detector (GC/FID)
    - Method examples: EPA 8015, EPA 8100, WI DRO
- Gas Chromatography/Mass Spectrometry (GC/MS)
    - Method example: EPA 625, EPA 8270
- Gas Chromatography/Mass Spectrometry-Selective Ion Monitoring (GC/MS-SIM)
    - Method example: EPA 8270
- High Performance Liquid Chromatography (HPLC)
    - Method example: EPA 610, EPA 8310
- Methods above with Toxicity Characteristic Leachate Procedure (TCLP), EPA 1311
- Methods above with Synthetic Precipitation Leachate Procedure (SPLP), EPA 1312

In the case of specific technologies and/or methods not listed above, the guidelines within this document will provide the basis upon which to make adequate professional judgment in the evaluation of data submitted for review.

The recommended procedures in this SOP should be followed unless conditions make it impractical or inappropriate to do so. Modifications should be noted in the applicable documentation and communicated to appropriate personnel. Significant changes may result in a revision or newly created SOP.

2.0 Limitations

- Level IV data evaluation is not covered in this SOP and should be performed in accordance with NFG or project specific requirements.

3.0 Responsibilities

The laboratory is responsible for generating data from the samples submitted for analysis. In instances where QC criteria are not met for the analysis of samples, the laboratory is responsible for reanalysis of the samples, provided reanalysis is possible (considering matrix interference, holding times and sample volume, etc.), or documenting the impact to the data.

The Data Quality Specialist is responsible for evaluating the data in accordance with this document, in addition to using professional judgment where necessary or appropriate. Project specific requirements, such as those specified in a Quality Assurance Project Plan (QAPP) or Sampling and Analysis Plan (SAP), may differ from these recommendations and professional judgment should be applied before qualifying any data.

4.0 Procedure

The Quality Assurance/Quality Control (QA/QC) data detailed below are the most typical found in a routine level laboratory report. Other QA/QC data may be provided by the laboratory within the laboratory report case narrative, data qualifiers, or cover sheet and should be evaluated using professional judgment (e.g., initial calibration, calibration verification, internal standards).

Definitions to common QA/QC terms and terms used within this SOP along with a list of Barr 'Data Qualifiers/Footnotes' that may be applied during review can be found in Barr's "Compendium of Data Quality Assessment Documentation".

4.1 Holding Time and Preservation

The purpose of holding time and preservation evaluation is to ascertain the validity of the analytical results based on the sample condition, preservation, and time elapsed between the date of sample collection and date of analysis.

40 CFR Part 136, WI GRO method, and the *Test Methods for Evaluating Solid Waste (SW-846)* are used as guidance for the recommended holding time and preservation acceptance criteria listed in *Table 1*.

Table 1 – Recommended Holding Times and Preservation

Compound	Matrix	Temp.	Preservative	Maximum Hold Time
SVOC/PAH/TPH	Aqueous	≤6° C	Ice	7 days extraction/ addl. 40 days analysis
	Sediment/Soil	≤ 6° C	Ice	14 days extraction/ addl. 40 days analysis
DRO	Aqueous	≤ 6° C	Ice, HCl < 2 pH	7 days extraction/ 47 days collection to analysis
	Sediment/Soil	≤ 6° C	Ice	10 days solvent addition/ 47 days collection to extraction and analysis
TCLP SVOC	Various	--	NA	14 days TCLP extraction/ 7 days extraction/ addl. 40 days analysis

If samples do not meet holding time, preservation and analysis recommendations in *Table 1*, consider qualification with an "**h**". Other matrices, such as product samples (e.g. oil, waste rock, drill cores) may not be subjected to the same holding time recommendations.

If the sample was stored on ice upon collection and delivered to the laboratory the same day, the sample may exceed recommended temperature at the time of laboratory receipt. Professional judgment should be applied (considering temperature, matrix, magnitude of the exceedance, etc.) when evaluating the application of qualifiers when criteria are not met.

4.2 Blank Samples

Blank sample evaluation is conducted to determine the existence and magnitude of target analyte contamination as a result of activities in the field during collection and transport or from inter-laboratory sources.

- For each matrix, at least one method blank should be prepared and analyzed with each sample delivery group (SDG). Evaluation pertains to the batch of samples analyzed with the method blank.
- Field or equipment blank collection and analysis frequency is project specific. Evaluation pertains to the field samples associated with the field or equipment blank.
- Blank analyses may not have involved the same weights, volumes, or dilution factors as the associated samples. It may be easier to work with the raw data and/or convert the data to the same units for comparison purposes.

Table 2 – Guidelines for Blank Contamination

Sample Result	Recommended Action for Associated Data
Non-detect	No action required
< 5x blank concentration	Qualify with 'b'
≥ 5x blank concentration	Use professional judgment

b = Reported value may be a potential false positive based on blank data evaluation procedures

Note: Other multipliers of the blank contamination may be used based on professional judgment (reporting to the MDL, common lab contaminant, etc.)

Professional judgment regarding the usability of the data should be used in cases where gross detections of target analytes are found in the blank sample. A number of factors may be considered including historical data, prior knowledge of the site conditions, target analytes involved, type of blank sample, etc. In such cases, it may be appropriate to qualify the affected data with '*****' (estimated value, QA/QC criteria not met) or '******' (unusable value, QA/QC criteria not met).

4.3 Deuterated Monitoring Compounds (DMC) and Surrogates

DMCs are isotopically labeled (deuterated) analogs of native target compounds. DMCs are only used for the SVOC GC/MS analysis. *Table 3* presents the recommended DMCs with their associated target compounds.

Table 3 – DMC and Associated Target Compounds

DMC (alphabetical)	Associated Target Compounds	
2,4-Dichlorophenol-d_3	2,4-Dichlorophenol Hexachlorobutadiene 4-Chloro-3-methylphenol 2,4,6-Trichlorophenol	2,4,5-Trichlorophenol 1,2,4,5-Tetrachlorobenzene Pentachlorophenol 2,3,4,6-Tetrachlorophenol
2-Chlorophenol-d_4	2-Chlorophenol	
2-Nitrophenol-d_4	Isophorone	2-Nitrophenol
4-6-Dinitro-2-methylphenol-d_2	4,6-Ditritro-2-methylphenol	
4-Chloroaniline-d_4	4-Chloroaniline Hexachlorocyclopentadiene	3,3′-Dichlorobenzidine
4-Methylphenol-d_8	2-Methylphenol 4-Methylphenol	2,4-Dimethylphenol
4-Nitrophenol-d_4	2-Nitroaniline 3-Nitroaniline 2,4-Dinitrophenol	4-Nitrophenol 4-Nitroaniline
Acenaphthylene-d_8	Naphthalene 2-Methylnaphthalene 2-Chloronapthalene	Acenaphthylene Acenaphthene
Anthracene-d_{10}	Hexachlorobenzene Atrazine	Phenanthrene Anthracene
Benzo(a)pyrene-d_{12}	Benzo(b)fluoranthene Benzo(k)fluoranthene Benzo(a)pyrene	Indeno(1,2,3-cd)pyrene Dibenzo(a,h)anthracene Benzo(g,h,i)perylene
Bis-(2-chloroethyl) ether-d_8	Bis-(2-chloroethyl) ether 2,2′-oxybis(1-chloropropane)*	bis(2-Choloethoxy) methane
Dimethylphthalate-d_6	Caprolactum 1,1′-Biphenyl Dimethylphthalate Diethylphthalate	Di-n-butylphthalate Butylbenzylphthalate bis(2-ethylhexyl)phthalate Di-n-octylphthalate
Fluorene-d_{10}	Dibenzofuran Fluorene 4-Chlorophenyl-phenylether	4-Bromophenyl-phenylether Carbazole
Nitrobenzene-d_5	Acetophenone N-Nitroso-di-n-propylamine Hexachloroethane Nitrobenzene	2,6-Dinitrotoluene 2,4-Dinitrotoluene N-Nitrosdiphenylamine

(Table 3 continued on next page)

Table 3 – DMC and Associated Target Compounds

DMC (alphabetical)	Associated Target Compounds	
Phenol-d_5	Benzaldehyde	Phenol
Pyrene-d_{10}	Fluoranthrene Pyrene	Benzo(a)anthracene Chrysene
SIM DMC and Associated Target Compounds		
Fluoranthene-d_{10}	Fluoranthene Pyrene Benzo(a)anthracene Chrysene Benzo(b)fluoranthene	Benzo(k)fluoranthene Benzo(a)pyrene Indeno(1,2,3-cd)pyrene Dibenzo(a,h)anthracene Benzo(g,h,i)perylene
2-Methylnaphthalene-d_{10}	Naphthalene 2-Methylnaphthalene Acenaphthylene Acenaphthene	Fluorene Pentachlorophenol Phenanthrene Anthracene

* = Bis(2-chloroisopropyl)ether

Surrogates are similar to analytes of interest in chemical composition, extraction, and chromatography but are not typically found in environmental samples. Other DMC or surrogates may be used by a laboratory based on their experience provided adequate chromatographic separations can be demonstrated. All samples (blanks, spiked samples, project samples, QC samples) should contain DMC or surrogates. If a sample does not contain DMC or surrogates or the method does not require surrogates (WI DRO), professional judgment should be used to determine if the reported results are useable or not. Acceptable evaluation of DMC or surrogate spikes may not be applicable if dilution of the sample was required. Percent recoveries are calculated for each DMC or surrogate and these are evaluated based on the criteria within the laboratory report or project specific requirements. If criteria are not reported, use guidance found in the NFG, if available. Percent recoveries are calculated using the equation provided under accuracy in ‘Definitions’ from Barr’s “Compendium of Data Quality Assessment Documentation”.

For the WI DRO analysis, surrogates are not required by the method. If used, the method requires that the surrogates must not elute within the WI DRO window (C_{10}-C_{28}). If the laboratory report includes a surrogate spike recovery for WI DRO, use professional judgment to assess the data.

Table 4 includes guidance to evaluate the surrogate recovery where a single surrogate is analyzed.

Table 4 – Guidelines for Single DMC or Surrogate

Criteria	Recommended Action for Associated Data	
	Detect	Non-Detect
%R > Upper Limit	Qualify with ‘*’	No qualification
%R < Lower Limit	Qualify with ‘*’ or ‘**’, use professional judgment	
%R within Limits	No qualification	

‘*’ = reported value is estimated and QA/QA criteria were not met
‘**’ = reported value is unusable and QA/QC criteria were not met

Table 5 includes guidance where multiple surrogates are analyzed per analytical fraction.

Table 5 – Guidelines for Multiple DMC or Surrogates

Criteria	Recommended Action for Associated Data	
	Detect	Non-Detect
One %R < Lower Limit	No qualification may be necessary, use professional judgment	
Two or more %R < Lower Limit	Qualify with ‘*’ or ‘**’, use professional judgment	
Two or more %R > Upper Limit	Qualify fraction with ‘*’	No qualification
One %R > Upper Limit	No qualification may be necessary, use professional judgment	No qualification
All %R within Limits	No qualification	

‘*’ = reported value is estimated and QA/QA criteria were not met
‘**’ = reported value is unusable and QA/QC criteria were not met

4.4 Laboratory Control Samples (LCS) and Laboratory Control Sample Duplicate Samples (LCSD)

The laboratory control sample is used to monitor the overall performance of each step during analysis, including sample preparation. The LCS should be analyzed:

- Once every preparation batch (20 or less samples of the same matrix - WI DRO requires an additional LCSD analyzed at the end of 20 samples).
- Once for each matrix.

Laboratory control samples may contain all target compounds or a subset (see *Table 6* for guidance) and the percent recoveries are evaluated based on the criteria within the laboratory report or project specific requirements. If criteria are not available, use guidance found in the NFG. Percent recoveries are calculated for accuracy and the relative percent difference (RPD) is calculated for precision (when an LCSD was analyzed). Accuracy and precision equations can be found in ‘Definitions’ from Barr’s “Compendium of Data Quality Assessment Documentation”.

Table 6 – Number of Suggested Target Compounds - LCS/LCSD and MS/MSD	
Number of Target Parameters	**Number of Spiked Compounds**
1-10 analytes	Spike all compounds
11-20 analytes	At least 10 compounds or 80% of all analytes, whichever is greater
More than 20 analytes	Spike at least 16 compounds

Table 7 – Guidelines for Laboratory Control Samples		
Criteria	**Recommended Action for Associated Data**	
	Detect	**Non-Detect**
%R and RPD > Upper Limit	Qualify with '*'	No qualification
%R < Lower Limit	Qualify with '*' or '**', use professional judgment	
%R and RPD within Limits	No qualification	

* = Reported value is estimated and QA/QC criteria were not met
** = Reported value is unusable and QA/QC criteria were not met

4.5 Laboratory Duplicate Samples

Laboratory duplicate samples are separate aliquots of field samples analyzed to demonstrate acceptable method precision by the laboratory at the time of analysis. Field blanks and proficiency testing (PT) samples should not be used for duplicate analysis. The RPDs are calculated using the equation as provided in 'Definitions' from Barr's "Compendium of Data Quality Assessment Documentation" and are not calculated where data are already qualified with b, U, <, or **. RPD results are dependent on the homogeneity of the samples.

Duplicates should be analyzed (whichever is more frequent):

- One from each matrix (soil or water)
- One from each SDG

The MS/MSD duplicate pairs may be substituted for laboratory duplicates.

Laboratory acceptance criteria or project specific requirement are used to evaluate RPDs. If criteria are not available, use guidance found in NFG or use professional judgment when considering qualification of associated results.

Higher RPDs are expected when results are at or near the reporting limits and are not always indicative of poor precision. RPDs are typically only evaluated for samples where both the native and duplicate sample concentrations are greater than five times (>5x) the RL. In cases where either of the samples (native or duplicate) is non-detect for a parameter and the other corresponding sample has detectable

concentrations much greater than five times (>5x) the RL, professional judgment should be used to determine if qualification is appropriate.

Table 8 – Guidelines for Laboratory Duplicates	
% RPD	**Recommended Action for Associated Data**
RPD < Upper Limit	No action is required
RPD > Upper Limit	Both results are ≤ 5x RL, no action is required
RPD > Upper Limit	Both results are > 5x RL, consider qualifying with '*****'

* = Reported value is estimated and QA/QC criteria were not met

4.6 Field Duplicate Samples

Field duplicate samples (also known as "masked" or "blind" duplicate samples) are used to demonstrate acceptable precision and reproducibility of the field and laboratory procedures. Frequency of collection is project specific. The RPDs are calculated using the equation as provided under precision in 'Definitions' from Barr's "Compendium of Data Quality Assessment Documentation" and are not calculated where data is already qualified with b, U, <, or **. RPD results are dependent on the homogeneity of the samples.

Acceptance criteria for field duplicate samples are subject to the professional judgment of the Data Quality Specialist but typically RPDs ≤ 30% for aqueous samples and ≤ 40% for soil and sediment samples are considered acceptable unless other project specific requirements are defined.

Higher RPDs are expected when results are at or near the reporting limits and are not always indicative of poor precision. RPDs are typically only evaluated for samples where both the native and duplicate sample concentrations are greater than five times (>5x) the RL. In cases where either of the samples (native or field duplicate) is non-detect for a parameter and the other corresponding sample has detectable concentrations much greater than five times (>5x) the RL, professional judgment should be used to determine if qualification is appropriate.

4.7 Matrix Spikes (MS) and Matrix Spike Duplicate (MSD) Samples

Matrix spike samples may contain all target compounds or a subset (see *Table 6*) and provide information about the effect of each samples' matrix on the sample preparation procedures and analytical results. Matrix spikes are typically analyzed at the following frequencies:

- 1 (MS/MSD pair) in every 20 samples (does not apply to DRO in the WI method)
- 1 per preparation batch per matrix
- 1 per SDG

However, the frequency may be project specific and the documents outlining the needs of the project (SAP, QAPP, etc.) should be reviewed. In some cases, MS/MSD analysis is not required.

The percent recoveries are evaluated based on the criteria within the laboratory report or project specific requirements. If a matrix spike recovery does not meet acceptance criteria and is not associated with a project sample, no further action is required unless other systematic evidence warrants qualification.

If the native concentration of a spiked sample is significantly greater than the spike added (>4x), spike recovery cannot be accurately evaluated, therefore the criteria do not apply. Professional judgment should be used for percent recoveries nominally outside laboratory acceptance criteria prior to qualifying data.

If criteria are not available, use guidance found in the NFG. Percent recoveries of matrix spike (and matrix spike duplicate) samples should be calculated using the equation provided under accuracy in 'Definitions' from Barr's "Compendium of Data Quality Assessment Documentation".

Solid samples may have highly variable concentrations of target analytes and percent recoveries (%R) may be influenced by the sampling precision and inherent sample homogeneity. Professional judgment should be used for difficult matrices and the acceptance criteria adjusted accordingly.

Table 9 – Guidelines for Matrix Spikes

Criteria	**Recommended Action for Associated Data**	
	Detect	**Non-Detect**
%R and RPD > Upper Limit	Qualify with '*'	No qualification
%R < Lower Limit	Qualify with '*' or '**', use professional judgment	
%R and RPD within Limits	No qualification	

* = Reported value is estimated and QA/QC criteria were not met
** = Reported value is unusable and QA/QC criteria were not met

While matrix spike duplicates are not required by all methods, if results for MSD analyses are reported, evaluate the RPD for MS and MSD pairs using the equation as provided under precision in 'Definitions' from Barr's "Compendium of Data Quality Assessment Documentation".

4.8 Overall Assessment

The chain-of-custody should be reviewed to determine if the laboratory report matches the requested analyses and that project specific parameters were analyzed as requested. The narrative and other supporting documentation should be evaluated to ensure that sample condition was appropriately documented by the laboratory upon receipt. If available, historical data should be used to assist with data evaluation. Any additional anomalies should be documented and evaluated, if necessary.

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Depending on the project objectives, the data review may include the completion of a Routine Level Quality Control Report (see Barr's "Compendium of Data Quality Assessment Documentation") as part of the evaluation process. Within each QC data section, the reviewer should include references to whether the QC data met or exceeded the acceptance criteria. The qualifiers, added, removed, or retained, should be documented also. Where multiple qualifiers may be applicable to a sample/analyte result, professional judgment should be used to determine if all qualifiers are necessary or if one qualifier would be sufficient to represent the deviations. A statement as to whether the data are acceptable as reported or acceptable with qualification(s) should also be included. If revised reports are required and the revision affects the

sample results, notification should be given to the appropriate data management personnel and/or project team members.

The Data Quality Specialist will verify that the qualifiers associated with data tables match the Routine Level Quality Control Report.

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The Routine Level Quality Control Report should be saved to the appropriate internal Barr file and the link uploaded to the tracking system. Periodically, Data Quality staff should check for missing Routine Level Quality Control Reports in the tracking system to help maintain the most current information.

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- Definitions
- Barr Qualifiers/Footnotes
- Routine Level Quality Control Report

Additional records information can be found in Barr's "Records Management System Manual".

7.0 References

Environmental Protection Agency. *Title 40 of the Code of Federal Regulations, Part 136.3.*

Environmental Protection Agency, *National Functional Guidelines for Superfund Organic Methods Data Review.*

Analytical methods listed under the 'Scope and Applicability' section of this SOP.

Attachment 1

Revision History

Revision Number	Date of Revision	Section	Revision Made
3.1	02/2009	Document Wide	Edits to references, formatting; minor language additions and corrections
		IX	Added Table 10
		Attachments	Added Attachment 3
3.2	04/2011	Document Wide	Added analytical methods to applicability section.
		Attachments	Updated Attachment 1 and 2 to include current forms.
4.0	04/06/12	Document Wide	Major revision
5.0	0601//17/13	Cover page	Added Calgary office
		I	Added waste rock and drill cores to examples of product sample
		III, IV, V, VI, VII	Added 'project specific requirements' as possible criteria source
		VI	Added 'field and laboratory procedures' to clarify that it's not only a laboratory item
		VI	Clarified field duplicate criteria as < one value and not a range
		IX	Added statement regarding multiple qualifiers
6.0	01/19/16	Document Wide	SOP restructuring, new format

Standard Operating Procedure

Routine Level Volatile Organic Compounds (VOC), Gasoline Range Organics (GRO), and Total Petroleum Hydrocarbons (TPH) Data Evaluation

Revision 6

January 15, 2016

Approved By:

Michael Dupay ______ 01/15/16
Print Technical Reviewer Signature Date

Terri Olson ______ Terri A. Olson ______ 01/15/16
Print QA Manager Signature Date

Review of the SOP has been performed and the SOP still reflects current practice.

Initials: ______ Date: ______
Initials: ______ Date: ______
Initials: ______ Date: ______
Initials: ______ Date: ______

Minneapolis, MN ● Hibbing, MN ● Duluth, MN ● Ann Arbor, MI ● Jefferson City, MO ● Bismarck, ND ● Calgary, AB, Canada ● Grand Rapids, MI ● Salt Lake City, UT

Routine Level Volatile Organic Compounds (VOC), Gasoline Range Organics (GRO), and Total Petroleum Hydrocarbons (TPH) Data Evaluation

1.0 Scope and Applicability

This SOP is intended as a guidance SOP for the routine level evaluation of VOC, GRO, and TPH data provided by laboratories to be used in Barr Engineering Company (Barr) projects.

This SOP is based on quality assurance elements, not the specific criteria, of *USEPA Contract Laboratory Program National Functional Guidelines (NFG) for Organic Data* and applies to routine VOC (including BTEX), GRO, and TPH (in the approximate gasoline carbon range, C_6-C_{10}) data evaluation for analyses by the following technologies:

- Gas Chromatography/Flame Ionization Detector (GC/FID)
  - Method examples: EPA 8015, WI GRO (GRO)
- Gas Chromatography/Photoionization Detector (GC/PID)
  - Method example: EPA 8021, WI GRO (PVOC)
- Gas Chromatography/Electrolytic Conductivity Detector (GC/ELCD)
  - Method example: EPA 8021
- Gas Chromatography/Mass Spectrometry (GC/MS)
  - Method example: EPA 624, EPA 8260
- Gas Chromatography/Mass Spectrometry-Selective Ion Monitoring (GC/MS-SIM)
  - Method example: EPA 8260
- Methods above with Toxicity Characteristic Leachate Procedure (TCLP), EPA 1311
- Methods above with Synthetic Precipitation Leachate Procedure (SPLP), EPA 1312

In the case of specific technologies and/or methods not listed above, the guidelines within this document will provide the basis upon which to make adequate professional judgment in the evaluation of data submitted for review.

The recommended procedures in this SOP should be followed unless conditions make it impractical or inappropriate to do so. Modifications should be noted in the applicable documentation and communicated to appropriate personnel. Significant changes may result in a revision or newly created SOP.

2.0 Limitations

- Level IV data evaluation is not covered in this SOP and should be performed in accordance with NFG or project specific requirements.

3.0 Responsibilities

The laboratory is responsible for generating data from the samples submitted for analysis. In instances where QC criteria are not met for the analysis of samples, the laboratory is responsible for reanalysis of the samples, provided reanalysis is possible (considering matrix interference, holding times and sample volume, etc.), or documenting the impact to the data.

The Data Quality Specialist is responsible for evaluating the data in accordance with this document, in addition to using professional judgment where necessary or appropriate. Project specific requirements, such as those specified in a Quality Assurance Project Plan (QAPP) or Sampling and Analysis Plan (SAP), may differ from these recommendations and professional judgment should be applied before qualifying any data.

4.0 Procedure

The Quality Assurance/Quality Control (QA/QC) data detailed below are the most typical found in a routine level laboratory report. Other QA/QC data may be provided by the laboratory within the laboratory report case narrative, data qualifiers, or cover sheet and should be evaluated using professional judgment (e.g., initial calibration, calibration verification, internal standards).

Definitions to common QA/QC terms and terms used within this SOP along with a list of Barr 'Data Qualifiers/Footnotes' that may be applied during review can be found in Barr's "Compendium of Data Quality Assessment Documentation".

4.1 Holding Time and Preservation

The purpose of holding time and preservation evaluation is to ascertain the validity of the analytical results based on the sample condition, preservation, and time elapsed between the date of sample collection and date of analysis.

40 CFR Part 136, WI GRO method, and the *Test Methods for Evaluating Solid Waste (SW-846)* are used as guidance for the recommended holding time and preservation acceptance criteria listed in *Table 1.*

Table 1 – Recommended Holding Times and Preservation

Compound	**Matrix**	**Temp.**	**Preservative**	**Maximum Hold Time**
VOC/PVOC	Aqueous	≤ 6 °C	HCl < 2 pH	14 days
	Aqueous	≤ 6 °C	Unpreserved	7 days
	Sediment/Soil	≤ 6 °C	1:1 soil:solvent (e.g., 10 g soil:10 mL MeOH in lab pre-weighed vial)	14 days
GRO (WI Method)	Aqueous	≤ 6 °C	HCl < 2 pH	14 days
	Sediment/Soil	≤ 6 °C	1:1 soil:solvent (e.g., 10 g soil:10 mL MeOH in lab pre-weighed vial)	21 days

(Table 1 continued on next page)

Table 1 – Recommended Holding Times and Preservation				
Compound	**Matrix**	**Temp.**	**Preservative**	**Maximum Hold Time**
TPH	Aqueous	≤ 6 °C	HCl or H_2SO_4 < 2 pH	7 day extraction/ addl. 40 days analysis
	Sediment/Soil	≤ 6 °C	Zero headspace*	14 days extraction/ addl. 40 days analysis
TCLP	Various	≤ 6 °C	No preservative	14 days TCLP extraction/ addl. 14 days analysis

* = Alternatively, samples may be collected as per the VOC analysis.

If samples do not meet holding time, preservation and analysis recommendations in *Table 1*, consider qualification with an "**h**". Other matrices, such as product samples (e.g. oil, waste rock, drill cores) may not be subjected to the same holding time recommendations.

If the sample was stored on ice upon collection and delivered to the laboratory the same day, the sample may exceed recommended temperature at the time of laboratory receipt. Professional judgment should be applied (considering temperature, matrix, magnitude of the exceedance, etc.) when evaluating the application of qualifiers when criteria are not met.

4.2 Blank Samples

Blank sample evaluation is conducted to determine the existence and magnitude of target analyte contamination as a result of activities in the field during collection and transport or from inter-laboratory sources.

- For each matrix, at least one method blank should be prepared and analyzed with each sample delivery group (SDG) – laboratories should analyze a method blank at least once every 12 hours. Evaluation pertains to the batch of samples analyzed with the method blank.
- Field or equipment blank collection and analysis frequency is project specific. Evaluation pertains to the field samples associated with the field or equipment blank.
- Trip blanks should be placed in each transport cooler containing VOC sample containers prior to shipment into the field and remain with the associated VOC samples submitted to the laboratory for VOC analysis; including sample storage through analysis.
- Blank analyses may not have involved the same weights, volumes, or dilution factors as the associated samples. It may be easier to work with the raw data and/or convert the data to the same units for comparison purposes.

Table 2 – Guidelines for Blank Contamination	
Sample Result	**Recommended Action for Associated Data**
Non-detect	No action required
< 5x blank concentration	Qualify with 'b'
≥ 5x blank concentration	Use professional judgment

b = Reported value may be a potential false positive based on blank data evaluation procedures

Note: Other multipliers of the blank contamination may be used based on professional judgment (reporting to the MDL, common lab contaminant, etc.)

Professional judgment regarding the usability of the data should be used in cases where gross detections of target analytes are found in the blank sample. A number of factors may be considered including historical data, prior knowledge of the site conditions, target analytes involved, type of blank sample, etc. In such cases, it may be appropriate to qualify the affected data with '*****' (estimated value, QA/QC criteria not met) or '******' (unusable value, QA/QC criteria not met).

4.3 Deuterated Monitoring Compounds (DMC) and Surrogates

DMCs are isotopically labeled (deuterated) analogs of native target compounds. DMCs are only used for the VOC GC/MS analysis. *Table 3* presents the recommended DMCs with their associated target compounds.

Table 3 –DMC and Associated Target Compounds

DMC (alphabetical)	**Associated Target Compounds**	
1,1,2,2-Tetrachloroethane-d_2	1,1,2,2-Tetrachloroethane	1,2-Dibromo-3-chloropropane
1,1-Dichloroethane-d_2	trans-1,2-Dichloroethene 1,1-Dichloroethene	cis-1,2-Dichloroethene
1,2-Dichlorobenzene-d_4	Chlorobenzene 1,3-Dichlorobenzene 1,4-Dichlorobenzene	1,2-Dichlorobenzene 1,2,4-Trichlorobenzene 1,2,3-Trichlorobenzene
1,2-Dichloroethane-d_4	Trichlorofluoromethane 1,1,2-Trichloro-1,2,2-trifluoroethane Methyl acetate Methylene chloride Methyl-tert-butyl ether	1,1,1-Trichloroethane Carbon tetrachloride 1,2-Dibromoethane 1,2-Dichloroethane
1,2-Dicloropropane-d_6	Cyclohexane Methylcyclohexane	1,2-Dichloropropane Bromodichloromethane
1,4-Dioxane-d_8	1,4-Dioxane	
2-Butanone-d_5	Acetone	2-Butanone
2-Hexanon-d_5	4-Methyl-2-pentanone	2-Hexanone
Benzene-d_6	Benzene	
Chloroethane-d_5	Dichlorodifluoromethane Chloromethane Bromomethane	Chloroethane Carbon disulfide
Chloroform-d	1,1-Dichloroethane Bromochloromethane Chloroform	Dibromochloromethane Bromoform
Toluene-d_8	Trichloroethene Toluene Tetrachloroethene Ethylbenzene	o-Xylene m,p-Xylene Styrene Isopropylbenzene
trans-1,3-Dichloropropene-d_4	cis-1,3-Dichloropropene trans-1,3-Dichloropropene	1,1,2-Trichloroethane
Vinyl Chloride-d_3	Vinyl chloride	

Surrogates are similar to analytes of interest in chemical composition, extraction, and chromatography but are not typically found in environmental samples. Other DMCs or surrogates may be used by a laboratory based on their experience provided adequate chromatographic separations can be demonstrated. All samples (blanks, spiked samples, project samples, QC samples) should contain DMCs or surrogates. If a sample does not contain DMC or surrogates or the method does not require surrogates (WI GRO), professional judgment should be used to determine if the reported results are useable or not. Acceptable evaluation of the DMC or surrogate spikes may not be applicable if dilution of the sample was required. Percent recoveries are calculated for each DMC or surrogate and these are evaluated based on the criteria within the laboratory report or project specific requirements. If criteria are not reported, use guidance found in the NFG, if available. Percent recoveries are calculated using the equation provided under accuracy in 'Definitions' from Barr's "Compendium of Data Quality Assessment Documentation".

For the WI GRO analysis, surrogates are not required for GRO but are required for PVOC. The method minimum surrogate recovery is 80%; there is no method maximum recovery. Use professional judgment when evaluating surrogates for WI GRO samples.

Table 4 includes guidance to evaluate the surrogate recovery where a single surrogate is analyzed.

Table 4 – Guidelines for Single DMC or Surrogate

Criteria	**Recommended Action for Associated Data**	
	Detect	**Non-Detect**
%R > Upper Limit	Qualify with '*'	No qualification
%R < Lower Limit	Qualify with '*' or '**', use professional judgment	
%R within Limits	No qualification	

'*' = reported value is estimated and QA/QA criteria were not met
'**' = reported value is unusable and QA/QC criteria were not met

Table 5 includes guidance where multiple surrogates are analyzed per analytical fraction.

Table 5 – Guidelines for Multiple DMC or Surrogates

Criteria	**Recommended Action for Associated Data**	
	Detect	**Non-Detect**
One %R < Lower Limit	No qualification may be necessary, use professional judgment	
Two or more %R < Lower Limit	Qualify with '*' or '**', use professional judgment	
Two or more %R > Upper Limit	Qualify fraction with '*'	No qualification
One %R > Upper Limit	No qualification may be necessary, use professional judgment	No qualification
All %R within Limits	No qualification	

'*' = reported value is estimated and QA/QA criteria were not met
'**' = reported value is unusable and QA/QC criteria were not met

4.4 Laboratory Control Samples (LCS) and Laboratory Control Sample Duplicate Samples (LCSD)

The laboratory control sample is used to monitor the overall performance of each step during analysis, including sample preparation. The LCS should be analyzed:

- Once every preparation batch (typically 20 or less samples of the same matrix - WI GRO requires an additional LCSD analyzed at the end of 20 samples)
- Once for each matrix.

Laboratory control samples may contain all target compounds or a subset (see *Table 6* for guidance) and the percent recoveries are evaluated based on the criteria within the laboratory report or project specific requirements. If criteria are not available, use guidance found in the NFG. Percent recoveries are calculated for accuracy and the relative percent difference (RPD) is calculated for precision (when an LCSD was analyzed). Accuracy and precision equations can be found in 'Definitions' from Barr's "Compendium of Data Quality Assessment Documentation".

Table 6 – Number of Suggested Target Compounds - LCS/LCSD and MS/MSD

Number of Target Parameters	Number of Spiked Compounds
1-10 analytes	Spike all compounds
11-20 analytes	At least 10 compounds or 80% of all analytes, whichever is greater
More than 20 analytes	Spike at least 16 compounds

Table 7 – Guidelines for Laboratory Control Samples

Criteria	Recommended Action for Associated Data	
	Detect	Non-Detect
%R and RPD > Upper Limit	Qualify with '*'	No qualification
%R < Lower Limit	Qualify with '*' or '**', use professional judgment	
%R and RPD within Limits	No qualification	

* = Reported value is estimated and QA/QC criteria were not met
** = Reported value is unusable and QA/QC criteria were not met

4.5 Laboratory Duplicate Samples

Laboratory duplicate samples are separate aliquots of field samples analyzed to demonstrate acceptable method precision by the laboratory at the time of analysis. Field blanks and proficiency testing (PT) samples should not be used for duplicate analysis. The RPDs are calculated using the equation as provided in 'Definitions' from Barr's "Compendium of Data Quality Assessment Documentation" and are

not calculated where data are already qualified with b, U, <, or **. RPD results are dependent on the homogeneity of the samples.

Duplicates should be analyzed (whichever is more frequent):

- One from each matrix (soil or water)
- One from each SDG

The MS/MSD duplicate pairs may be substituted for laboratory duplicates.

Laboratory acceptance criteria or project specific requirement are used to evaluate RPDs. If criteria are not available, use guidance found in NFG or use professional judgment when considering qualification of associated results.

Higher RPDs are expected when results are at or near the reporting limits and are not always indicative of poor precision. RPDs are typically only evaluated for samples where both the native and duplicate sample concentrations are greater than five times (>5x) the RL. In cases where either of the samples (native or duplicate) is non-detect for a parameter and the other corresponding sample has detectable concentrations much greater than five times (>5x) the RL, professional judgment should be used to determine if qualification is appropriate.

Table 8 – Guidelines for Laboratory Duplicates

% RPD	**Recommended Action for Associated Data**
RPD < Upper Limit	No action is required
RPD > Upper Limit	Both results are ≤ 5x RL, no action is required
RPD > Upper Limit	Both results are > 5x RL, consider qualifying with '*****'

* = Reported value is estimated and QA/QC criteria were not met

4.6 Field Duplicate Samples

Field duplicate samples (also known as "masked" or "blind" duplicate samples) are used to demonstrate acceptable precision and reproducibility of the field and laboratory procedures. Frequency of collection is project specific. The RPDs are calculated using the equation as provided under precision in 'Definitions' from Barr's "Compendium of Data Quality Assessment Documentation" and are not calculated where data is already qualified with b, U, <, or **. RPD results are dependent on the homogeneity of the samples.

Acceptance criteria for field duplicate samples are subject to the professional judgment of the Data Quality Specialist but typically RPDs ≤ 30% for aqueous samples and ≤ 40% for soil and sediment samples are considered acceptable unless other project specific requirements are defined.

Higher RPDs are expected when results are at or near the reporting limits and are not always indicative of poor precision. RPDs are typically only evaluated for samples where both the native and duplicate sample concentrations are greater than five times (>5x) the RL. In cases where either of the samples (native or field duplicate) is non-detect for a parameter and the other corresponding sample has detectable concentrations much greater than five times (>5x) the RL, professional judgment should be used to determine if qualification is appropriate.

4.7 Matrix Spikes (MS) and Matrix Spike Duplicate (MSD) Samples

Matrix spike samples may contain all target compounds or a subset (see *Table 6*) and provide information about the effect of each samples' matrix on the sample preparation procedures and analytical results. Matrix spikes are typically analyzed at the following frequencies:

- 1 (MS/MSD pair) in every 20 samples (does not apply to GRO in the WI method)
- 1 per preparation batch per matrix
- 1 per SDG

However, the frequency may be project specific and the documents outlining the needs of the project (SAP, QAPP, etc.) should be reviewed. In some cases, MS/MSD analysis is not required.

The percent recoveries are evaluated based on the criteria within the laboratory report or project specific requirements. If a matrix spike recovery does not meet acceptance criteria and is not associated with a project sample, no further action is required unless other systematic evidence warrants qualification.

If the native concentration of a spiked sample is significantly greater than the spike added (>4x), spike recovery cannot be accurately evaluated, therefore the criteria do not apply. Professional judgment should be used for percent recoveries nominally outside laboratory acceptance criteria prior to qualifying data.

If criteria are not available, use guidance found in the NFG. Percent recoveries of matrix spike (and matrix spike duplicate) samples should be calculated using the equation provided under accuracy in 'Definitions' from Barr's "Compendium of Data Quality Assessment Documentation".

Solid samples may have highly variable concentrations of target analytes and percent recoveries (%R) may be influenced by the sampling precision and inherent sample homogeneity. Professional judgment should be used for difficult matrices and the acceptance criteria adjusted accordingly.

Table 9 – Guidelines for Matrix Spikes

Criteria	**Recommended Action for Associated Data**	
	Detect	**Non-Detect**
%R and RPD > Upper Limit	Qualify with '*'	No qualification
%R < Lower Limit	Qualify with '*' or '**', use professional judgment	
%R and RPD within Limits	No qualification	

* = Reported value is estimated and QA/QC criteria were not met
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While matrix spike duplicates are not required by all methods, if results for MSD analyses are reported, evaluate the RPD for MS and MSD pairs using the equation as provided under precision in 'Definitions' from Barr's "Compendium of Data Quality Assessment Documentation".

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The chain-of-custody should be reviewed to determine if the laboratory report matches the requested analyses and that project specific parameters were analyzed as requested. The narrative and other supporting documentation should be evaluated to ensure that sample condition was appropriately documented by the laboratory upon receipt. If available, historical data should be used to assist with data evaluation. Any additional anomalies should be documented and evaluated, if necessary.

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- Routine Level Quality Control Report

Additional records information can be found in Barr's "Records Management System Manual".

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Environmental Protection Agency. *Title 40 of the Code of Federal Regulations, Part 136.3.*

Environmental Protection Agency, *National Functional Guidelines for Superfund Organic Methods Data Review.*

Analytical methods listed under the 'Scope and Applicability' section of this SOP.

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		I	Added waste rock and drill cores to examples of product sample
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6.0	01/15/16	Document Wide	SOP restructuring, new format

Appendix D4

Quality Assurance/Quality Control Review
Landau 2015 Supplemental RI

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Memorandum

To: Mary Monahan – Project Coordinator, Ecology and Chris Wend, Ecology
From: Al Gebhard & Dana Pasi – Barr Engineering
Subject: Quality Assurance / Quality Control Review – Landau Supplemental RI 2015
Date: November 3, 2017
Project: Yakima Mill Site

Landau qualifier (UJ) added to Tables 1 and 2 after date of this memo to conform tables to memo text.

1.0 Introduction

A Supplemental Remedial Investigation (Supplemental RI) was completed at the closed City of Yakima Landfill Site (Landfill Site) by Landau Associates (Landau) in 2014 and 2015 (Landau, 2015). The results of the Supplemental RI are summarized in the report titled Supplemental Remedial Investigation Report for the Landfill Site (Landau, 2015). A portion of the samples collected by Landau during the Supplemental RI at the Landfill Site were from areas that are within the limits of the adjacent Yakima Mill Site (Mill Site). Barr Engineering Co. (Barr) and Fulcrum Environmental Consulting, Inc. (Fulcrum) are in the process of preparing a Remedial Investigation (RI) Work Plan for the Mill Site. Data collected by Barr and Fulcrum under the RI Work Plan will be subject to quality assurance and quality control (QA/QC) review to confirm usability as provided in the Sampling and Analysis Plan (SAP) and Quality Assurance Project Plan (QAPP) for the project.

Barr reviewed Landau's QAPP and Landau's QA/QC review of the Supplemental RI data (Landau, 2015) for the samples collected on the Mill Site and this memorandum summarizes Barr's review. The intent of Barr's review was to verify that Landau's QA/QC review was consistent with the procedures specified in the QAPP for the Supplemental RI and in the U.S. EPA guidance. Once Barr verified that the Landau QA/QC review was consistent with the Landfill Site QAPP and EPA guidance, the results of Landau's QA/QC review could be used to define the data from the Supplemental RI that is usable for development of the RI Work Plan for the Mill Site.

In addition, this memorandum presents a comparison of the practical quantitation limits (PQLs) associated with the 2015 Supplemental RI data set to the standard cleanup levels potentially applicable to the Mill Site (i.e., Washington State Department of Ecology (Ecology) Model Toxics Control Act (MTCA) Method A and B). The PQL, as defined in MTCA Regulation and Statute (Ecology, Rev. 2013), is "the lowest concentration that can be reliably measured within specified limits of precision, accuracy, representativeness, completeness, and comparability during routine laboratory operating conditions, using department approved methods" (WAC 173-340-200). When establishing cleanup levels, the MTCA regulations further provide that "In some cases, cleanup levels calculated using the methods specified in this chapter are less than natural background levels or levels that can be reliably measured. In those situations, the cleanup level shall be established at a concentration equal to the practical quantitation limit or natural background concentration, whichever is higher" (WAC 173-340-700(6)(d)).

The remainder of this memorandum is organized as follows:

- Section 2 – A summary of Landau's QA/QC review of the analytical data sets in the Supplemental RI Report (Landau 2015).
- Section 3 – A comparison of practical quantitation limits (PQLs) against the standard cleanup levels potentially applicable to the Mill Site (i.e., MTCA A and MTCA B).
- Section 4 – An evaluation of the data from the Supplemental RI that can be relied upon to judge conformance with standard MTCA cleanup levels for the Mill Site given the QA/QC review and planned investigation activities in the Mill Site RI Work Plan.

2.0 Data Review

The data set in this report applicable to the Mill Site includes 25 soil samples with approximately 3600 individual analytes and 111 groundwater samples with about 18,300 total analytes. Landau performed a QA/QC review of their Supplemental RI data as specified in their QAPP for the Supplemental RI (Landau, 2015). The Landau QAPP (see Appendix C in Landau, 2015) states that it was prepared using guidance from the Washington State Department of Ecology's Guidelines for Preparing Quality Assurance Project Plans for Environmental Studies (Ecology, 2004), which includes the elements described in U.S. EPA guidance (USEPA, 2002), although in a different format. The following elements are in the Landau QAPP:

- project background and description,
- organization and schedule,
- quality assurance objectives,
- QA/QC requirements,
- corrective actions,
- data verification and validation, and
- data management procedures.

Specifically, the data verification and validation procedures (Appendix C Section 9 in Landau, 2015) are stated to be performed using guidance from applicable portions of The National Functional Guidelines for

Organic and Inorganic Data Review (NFG; USEPA, 2008 and 2010) and are consistent with an EPA Level 2a review. Per USEPA (USEPA, 2009), a Level 2a review is a verification and validation of analytical data based on completeness and compliance checks of sample receipt conditions and sample-related QC results.

Barr's review determined that Landau's QA/QC review of the Supplemental RI data was performed in accordance with the QAPP for the Supplemental RI and USEPA NFG and the data are therefore considered usable as qualified.

The Supplemental RI Report (Landau, 2015) included Data Usability and Validation Reports (Appendix J in Landau, 2015) and a Technical Memorandum (dated September 10, 2015) that describes the Laboratory Analytical Data Usability Determination for the data. The Landau Technical Memorandum stated the following findings:

> *"Based on the data validation and data quality assessment, the analytical data set completeness was calculated as 100 percent. Of the 21,655 data records collected, none of the data records were rejected.*
>
> *A number of analytical and/or sampling biases were applied to the data set. These were the result of imprecision between field duplicates, high matrix spike recoveries, low surrogate recoveries, low BS/BSD [blank spike/blank spike duplicate] recoveries, petroleum hydrocarbon product overlap, and exceeded holding times. Overall, 194 results (0.009%) were qualified as estimated (J, UJ). These data are considered usable and of acceptable quality.*
>
> *Additional biases were applied due to detections in associated method or trip blank results. Fourteen (14) detected results (0.0006%) were U qualified because of potential contamination. The biases are considered to have no adverse impact on the environmental data quality.*
>
> *Overall, the dataset satisfies completeness and quality objectives and data can be used for their intended purposes with confidence."*

The following data were qualified as non-detect with a "U" qualifier by Landau based on blank sample results that are considered as potential false positive values:

- Total arsenic in groundwater with reported detections between 0.63 ug/L and 2.5 ug/L in the following samples:
    - MW-9A-062415,
    - DUP2-062415,
    - MW-16-062415,

  - MW-100-062415,
  - MW-17-062415,
  - TP-MW-1-062415,
  - MW-6-062415,
  - FPP-MW-3-062415,
  - FPP-MW-2-062415,
  - MW-101-062515

- Total lead in groundwater with reported detections between 0.30 ug/L and 0.36 ug/L in the following samples:
  - MW-9A-062415,
  - DUP2-062415,
  - MW-16-062415,
  - MW-100-062415

Although there were no detections in the laboratory blank samples and thus no qualifiers were applied, it was noted that there were sporadic detections of common laboratory contaminants, specifically bis(2-ethylhexyl)phthalate. When evaluating blank sample detections against sample concentrations, additional scrutiny is given to common laboratory contaminants. Bis(2-ethylhexl)phthalate is considered a common laboratory contaminant. Specifically, the Agency for Toxic Substances and Disease Registry (ATSDR) Toxicological Profile discusses this issue in the Analytical Methods section for this compound (ATSDR, 2002).

> Detection and quantification of very low levels of bis(2-ethylhexyl)phthalate (DEHP) are seriously limited by the presence of this compound as a contaminant in almost all laboratory equipment and reagents. Plastics, glassware, aluminum foil, cork, rubber, glass wool, Teflon sheets, and solvents have all been found to be contaminated (EPA 1988a; Giam et al. 1975; Williams 1973). While efforts have been made to reduce laboratory contamination (Giam et al. 1975; Thuren 1986), DEHP is still reported in laboratory blanks, even with thorough cleaning methods (EPA 1988a; Giam et al. 1975). Therefore, practical sample detection limits are often more than an order of magnitude higher than instrument or method detection limits. The EPA (1988a) reports that DEHP, along with other common phthalate and adipate esters, cannot generally be accurately or precisely measured at concentrations below about 2 ppb, due to blank contamination *(see ATSDR, 2002 for references in this paragraph)*.

The QA/QC review indicates that the data are acceptable as qualified except as described above.

3.0 PQLs Compared to MTCA A and B Cleanup Levels

In addition to the data QA/QC evaluation, the soil and groundwater sample PQLs included in the Supplemental RI (Landau, 2015) from the Mill Site were compared to the standard MTCA cleanup levels potentially applicable to the Mill Site (i.e., Method A and Method B). PQLs for soil samples are shown in Table 1 and PQLs for groundwater samples are shown in Table 2. The following parameters have PQLs for some samples above the lowest MTCA Method A and MTCA Method B standard cleanup levels. As noted above, under WAC 173-340-700(6)(d), this does not, in and of itself, mean that the data are not reliable or relevant to investigation and cleanup activities.

For soil:

- SVOCs (Method EPA 8270D)
    - n-nitrosodimethylamine and n-Nitrosodi-n-propylamine had PQLs greater than the lowest MTCA B cleanup levels for all samples with the PQLs approximately 2 times the cleanup values. There were no detections above the PQLs for these compounds.
    - These compounds would likely be detected with other SVOCs associated with wider chemical usage.

For groundwater:

- Metals (Method EPA 200.8) – Groundwater samples were analyzed by EPA method 200.8 (ICP-MS).
    - The PQL for arsenic (0.5 ug/L) was above the lowest MTCA B cleanup level (0.0583 ug/L) for all of the samples. Most samples had arsenic concentrations above the PQL.
    - Typical background concentrations of arsenic (MTCA/SMS Advisory Group, 2010) are greater than both the MTCA B cleanup level and the PQL of method EPA 200.8.
    - Ecology indicates that the MTCA A cleanup level of 5 ug/L is routinely used for arsenic in groundwater.
- SVOCs (Method EPA 8270D)
    - azobenzene, benzo(a)pyrene, bis(2-chloroethyl)ether, 4-chloroaniline, dibenzo(a,h)anthracene, 3,3'-dichlorobenzidine, 2,4-dinitrotoluene, 2,6-dinitrotoluene, hexachlorobenzene, hexachlorobutadiene, hexachloroethane, n-nitrosodimethylamine, n-

  nitrosodi-n-propylamine, 2,2-oxybis (1-chloropropane), and 1,2,4-trichlorobenzene had PQLs above the lowest MTCA B cleanup levels.

  - The analytical method used in the Supplemental RI is the industry standard; however, selected ion monitoring (SIM) could have been used to increase the precision and decrease the PQLs. SIM is proposed to be used for SVOCs in the Mill Site RI Work Plan to ensure that the PQLs are either below, or as close as possible to the lowest standard cleanup level.

- VOCs (Method 8260C)
  - acrylonitrile, benzene, 1,2-dibromo 3-chloropropane, 1,2-dichloroethane, cis-1,3-dichloropropene, trans-1,3-dichloropropene-trans, hexachlorobutadiene, 1,2,4-trichlorobenzene, and 1,2,3-trichloropropane had PQLs greater than MTCA B cleanup levels for at least one of the compounds above for all of the samples with the majority having PQLs about 10 times the lowest cleanup level.. There were no detections above PQLs for these compounds.
  - Method 8260 (SIM) was used during some of the sampling events to provide greater precision and lower PQLs.
- Pesticides (Method EPA 8081)
  - aldrin, dieldrin, heptachlor epoxide, and toxaphene had PQLs above the lowest MTCA B cleanup levels in all of the samples with the majority of the compounds having PQLs about 10 times the lowest cleanup level.
  - Fourteen other pesticides had PQLs below the standard MTCA cleanup levels; two pesticides analyzed do not have MTCA cleanup levels.
  - Pesticides were analyzed by EPA method 8081, which is the industry standard for pesticide analysis.

All of the data is acceptable to judge conformance with MTCA cleanup levels with the exceptions noted above. This data will not be relied upon to judge conformance with MTCA cleanup levels but it does inform Site conditions within the constraints of the analytical methods that were used.

4.0 Conclusions

Barr evaluated Landau's QA/QC review of the soil and groundwater analytical data collected by Landau in the Supplemental RI (Landau, 2015) to assess the usability of the data for the purposes of the Mill Site RI Work Plan. In general, the QA/QC review showed that the data are considered acceptable as qualified.

With the following exceptions, all data collected from the Mill Site in the Supplemental RI can be used for judging conformance with MTCA cleanup levels during investigation and cleanup activities based on the results of the QA/QC review and the comparison of PQLs to cleanup levels:

For soil:

- All soil data are considered acceptable for use in the development of the Mill Site RI Work Plan.

For groundwater:

- SVOCs (Method EPA 8270D) – The standard PQLs for the specific SVOCs listed in Section 3 of this memo are above the lowest standard MTCA cleanup levels. This data will not be used for judging conformance with MTCA cleanup levels in the development of the Mill Site RI Work Plan. The data are useful however in judging that the SVOC concentrations do not exceed the PQLs reported in the analysis. Site-wide groundwater sampling for SVOCs is included in the Mill Site RI Work Plan. Groundwater samples will be analyzed by Method EPA 8270 SIM for assessment of SVOCs. The PQLs for the SVOCs are less than the standard cleanup levels with analysis using Method EPA 8270 (SIM) as described in the Draft QAPP for the Mill Site that was previously submitted to Ecology.

  Also there was a handful of detections of bis(2-ethylhexyl)phthalate, a known laboratory contaminant, that exceeded standard cleanup values with the majority included in the same sampling and analytical batch in December 2014. Although there were no detections in the corresponding laboratory blank samples, there is concern that these are false positive values. Additional steps, including sampling and analysis of field blank samples in addition to laboratory blank samples, will be included in the Mill Site RI Work Plan to track potential sources of laboratory contamination.

- VOCs (Method EPA 8260C) – the standard PQLs for the select VOCs listed in Section 3 of this memo are above the lowest standard MTCA cleanup level. This data will not be used for judging conformance with MTCA cleanup levels in the development of the Mill Site RI Work Plan. The data are useful however in judging that the VOC concentrations do not exceed the PQLs reported in the analysis. Site-wide groundwater sampling for VOCs is included in the Mill Site RI Work Plan. Groundwater samples will be analyzed for VOCs by EPA method 8260 (SIM). The PQLs for VOCs are less than the standard cleanup levels with EPA method 8260 (SIM) with the exception of 1,2,3-trichloropropane, 1,3-dichloropropene-cis, and 1,3,-dichloropropene-trans as described in the Draft QAPP for the Mill Site that was previously submitted to Ecology. No Ecology approved analytical methods are available with PQLs below the lowest MTCA cleanup levels for these three compounds.

Samples not specifically discussed above will be considered useable to judge conformance with MTCA cleanup levels.

5.0 References

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MTCA/SMS Advisory Group, 2010. Draft Revisions to MTCA Method A Groundwater Cleanup Levels, Discussion Materials prepared for MTCA/SMS Advisory Group, June 2010.

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6.0 Attachments

Table 1	Historical Soil Data Review – 2015 Landau PQLs vs MTCA Cleanup Levels
Table 2	Historical Groundwater Data Review – 2015 Landau PQLs vs MTCA Cleanup Levels

Table 1
Historical Soil Data Review - 2015 Landau PQLs vs. MTCA Cleanup Levels
Yakima Mill Site

Location					GP-23		GP-24		GP-26		GP-27		GP-28		GP-29		GP-30		GP-31		MW-100	
Date					10/30/2014		10/30/2014		10/29/2014		4/23/2015		4/23/2015		4/23/2015		4/24/2015		4/22/2015		9/11/2014	
Depth					15 - 15.5 ft		12.5 - 13 ft		7.5 - 8.5 ft		5.5 - 6.5 ft		6.5 - 7.5 ft		8 - 9 ft		8 - 8.5 ft		6.5 - 7.5 ft		13.5 - 14 ft	
Sample Type					N		N		N		N		N		N		N		N		N	
Result Type					PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result
Data Status					SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource
Parameter	Units	Washington Method A Unrestricted Land Use	Washington Method B Cancer Direct Contact	Washington Method B Noncancer Direct Contact																		
Effective Date		07/01/2015	07/01/2015	07/01/2015																		
Exceedance Key		No Exceedances	Shade	No Exceedances																		
General Parameters																						
Fluoride	mg/kg			3200	1.0	3.7	1.0	2.2	1.0	ND	0.16	ND	0.16	ND	0.16	ND	0.16	ND	0.16	ND	1.6	ND
Nitrogen, nitrate, as N	mg/kg			128000	4.0	ND	4.0	ND	4.0	ND	3.4	67	0.34	8.9	0.34	17	0.34	1.7	0.34	1.7	0.50	0.87
Nitrogen, nitrite, as N	mg/kg			8000	4.0	ND	4.0	ND	4.0	ND	0.43	ND	0.43	ND	0.43	ND	0.43	ND	0.43	ND	0.50	ND
pH	pH units				1.0	6.95	1.0	6.07	1.0	6.29	1.0	6.27	1.0	6.8	1.0	7.82	1.0	7.6	1.0	7.58	1.0	8.62
Metals																						
Arsenic	mg/kg	20.0	0.667	24.0	1.3	2.3	1.0	2.0	1.2	2.3	0.84	2.5	0.85	2.3	0.78	3.1	0.82	1.6	0.88	2	1.0	1.4
Barium	mg/kg			16000	0.50	110	0.50	140	0.50	170	0.16	130	0.16	100	0.15	130	0.16	60	0.17	74	0.50	58
Cadmium	mg/kg	2.00		80.0	0.50	ND	0.50	ND	0.50	ND	0.26	ND	0.26	ND	0.24	ND	0.25	ND	0.27	ND	0.50	ND
Chromium	mg/kg				0.64	17	0.50	17	0.61	24	0.43	17	0.43	17	0.4	19	0.41	14	0.45	14	0.50	23
Chromium, hexavalent	mg/kg	19.0		240	5.0	ND	5.0	ND	5.0	ND	--	--	--	--	--	--	--	--	--	--	5.0	ND
Iron	mg/kg			56000	58	24000	50	25000	55	30000	50	28000	50	24000	50	29000	50	22000	50	22000	50	25000
Lead	mg/kg	250			0.50	23	0.50	9.1	0.50	17	0.27	25	0.27	14	0.25	8.7	0.26	3.5	0.28	5.1	0.50	2.9
Manganese	mg/kg			11200	0.50	240	0.50	280	0.50	340	0.33	430	0.34	320	0.31	510	0.32	320	0.35	270	0.50	380
Mercury	mg/kg	2.00			0.02	0.13	0.02	0.077	0.02	0.12	0.0041	0.14	0.0041	0.12	0.0041	0.089	0.0041	0.044	0.0041	0.058	0.020	ND
Selenium	mg/kg			400	5.6	ND	5.0	ND	5.3	ND	5.0	ND	5.0	ND	5.0	ND	5.0	ND	5.0	ND	5.0	ND
Silver	mg/kg			400	0.50	ND	0.50	ND	0.50	ND	0.26	ND	0.27	ND	0.25	ND	0.26	ND	0.28	ND	0.50	ND
Sodium	mg/kg				50	570	50	530	50	610	50	590	50	570	50	700	50	440	50	540	50	750
SVOCs																						
1,2,4-Trichlorobenzene	ug/kg		34500	800000	150	ND	100	ND	110	ND	100	ND	100	ND	100	ND	100	ND	100	ND	100	ND
1,2-Dichlorobenzene	ug/kg			7200000	100	ND	100	ND	100	ND	--	--	--	--	--	--	--	--	--	--	100	ND
1,3-Dichlorobenzene	ug/kg				100	ND	100	ND	100	ND	--	--	--	--	--	--	--	--	--	--	100	ND
1,4-Dichlorobenzene	ug/kg		185000	5600000	100	ND	100	ND	100	ND	--	--	--	--	--	--	--	--	--	--	100	ND
1-Methylnaphthalene	ug/kg		34500	5600000	20	22	20	ND	20	ND	20	ND	20	ND	20	ND	20	ND	20	ND	20	ND
2,2'-oxybis (1-chloropropane)	ug/kg		14300	3200000	260	ND	250	ND	250	ND	250	ND	250	ND	250	ND	250	ND	250	ND	250	ND
2,3,4,6-Tetrachlorophenol	ug/kg			2400000	100	ND	100	ND	100	ND	100	ND	100	ND	100	ND	100	ND	100	ND	100	ND
2,4,5-Trichlorophenol	ug/kg			8000000	100	ND	100	ND	100	ND	100	ND	100	ND	100	ND	100	ND	100	ND	100	ND
2,4,6-Trichlorophenol	ug/kg		90900	80000	82	ND	50	ND	62	ND	45	ND	45	ND	42	ND	44	ND	47	ND	38	ND
2,4-Dichlorophenol	ug/kg			240000	510	ND	310	ND	380	ND	280	ND	280	ND	260	ND	270	ND	290	ND	240	ND
2,4-Dimethylphenol	ug/kg			1600000	130	ND	100	ND	100	ND	100	ND	100	ND	100	ND	100	ND	100	ND	100	ND
2,4-Dinitrophenol	ug/kg			160000	110	ND	100	ND	100	ND	100	ND	100	ND	100	ND	100	ND	100	ND	100	ND
2,4-Dinitrotoluene	ug/kg		3230	160000	45	ND	27	ND	34	ND	100	ND	100	ND	100	ND	100	ND	100	ND	21	ND
2,6-Dichlorophenol	ug/kg				380	ND	250	ND	290	ND	250	ND	250	ND	250	ND	250	ND	250	ND	250	ND
2,6-Dinitrotoluene	ug/kg		667	24000	77	ND	47	ND	58	ND	42	ND	42	ND	39	ND	41	ND	44	ND	36	ND
2-Chloronaphthalene	ug/kg			6400000	100	ND	100	ND	100	ND	100	ND	100	ND	100	ND	100	ND	100	ND	100	ND
2-Chlorophenol	ug/kg			400000	250	ND	250	ND	250	ND	250	ND UJ	250	ND UJ	250	ND UJ	250	ND UJ	250	ND UJ	250	ND
2-Methyl-4,6-dinitrophenol	ug/kg				100	ND	100	ND	100	ND	100	ND	100	ND	100	ND	100	ND	100	ND	100	ND
2-Methylnaphthalene	ug/kg			320000	20	32	20	ND	20	22	20	ND	20	ND	20	ND	20	ND	20	ND	20	ND
2-Methylphenol (o-cresol)	ug/kg			4000000	100	ND	100	ND	100	ND	100	ND	100	ND	100	ND	100	ND	100	ND	100	ND
2-Nitroaniline	ug/kg			800000	100	ND	100	ND	100	ND	100	ND	100	ND	100	ND	100	ND	100	ND	100	ND
2-Nitrophenol	ug/kg				100	ND	100	ND	100	ND	100	ND	100	ND	100	ND	100	ND	100	ND	100	ND
3,3`-Dichlorobenzidine	ug/kg		2220		360	ND	220	ND	270	ND	190	ND	200	ND	180	ND	190	ND	200	ND	170	ND
3,4-Methylphenol (m,p cresols)	ug/kg				100	ND	100	ND	100	170	100	ND	100	ND	100	ND	100	ND	100	ND	100	ND
3-Nitroaniline	ug/kg				1200	ND	1000	ND	1000	ND	1000	ND	1000	ND	1000	ND	1000	ND	1000	ND	1000	ND
4-Bromophenyl phenyl ether	ug/kg				100	ND	100	ND	100	ND	100	ND	100	ND	100	ND	100	ND	100	ND	100	ND
4-Chloro-3-methylphenol	ug/kg				670	ND	500	ND	500	ND	500	ND	500	ND	500	ND	500	ND	500	ND	500	ND
4-Chloroaniline	ug/kg		5000	320000	1200	ND	1000	ND	1000	ND	1000	ND	1000	ND	1000	ND	1000	ND	1000	ND	1000	ND
4-Chlorophenyl phenyl ether	ug/kg				100	ND	100	ND	100	ND	100	ND	100	ND	100	ND	100	ND	100	ND	100	ND
4-Nitroaniline	ug/kg				260	ND	250	ND	250	ND	250	ND	250	ND	250	ND	250	ND	250	ND	250	ND
4-Nitrophenol	ug/kg				110	ND	100	ND	100	ND	100	ND	100	ND	100	ND	100	ND	100	ND	100	ND
Acenaphthene	ug/kg			4800000	20	22	20	ND	20	ND	20	ND	20	ND	20	ND	20	ND	20	ND	20	ND
Acenaphthylene	ug/kg				20	81	20	ND	20	ND	20	ND	20	ND	20	ND	20	ND	20	ND	20	ND
Aniline	ug/kg		175000	560000	96	ND	59	ND	72	ND	52	ND	53	ND	48	ND	51	ND	55	ND	45	ND
Anthracene	ug/kg			24000000	20	28	20	ND	20	ND	20	ND	20	ND	20	ND	20	ND	20	ND	20	ND
Azobenzene	ug/kg		9090		100	ND	100	ND	100	ND	100	ND	100	ND	100	ND	100	ND	100	ND	100	ND
Benz(a)anthracene	ug/kg		1370		20	44	20	ND	20	29	20	ND	20	ND	20	ND	20	ND	20	ND	20	ND
Benzo(a)pyrene	ug/kg	100	137		20	35	20	ND	20	ND	20	ND	20	ND	20	ND	20	ND	20	ND	20	ND
Benzo(b)fluoranthene	ug/kg		1370		20	88	20	ND	20	37	20	ND	20	ND	20	ND	20	ND	20	ND	20	ND
Benzo(g,h,i)perylene	ug/kg				20	58	20	ND	20	43	20	ND	20	ND	20	ND	20	ND	20	ND	20	ND
Benzo(k)fluoranthene	ug/kg		13700		20	ND	20	ND	20	ND	20	ND	20	ND	20	ND	20	ND	20	ND	20	ND

Table 1
Historical Soil Data Review - 2015 Landau PQLs vs. MTCA Cleanup Levels
Yakima Mill Site

				Location	GP-23		GP-24		GP-26		GP-27		GP-28		GP-29		GP-30		GP-31		MW-100	
				Date	10/30/2014		10/30/2014		10/29/2014		4/23/2015		4/23/2015		4/23/2015		4/24/2015		4/22/2015		9/11/2014	
				Depth	15 - 15.5 ft		12.5 - 13 ft		7.5 - 8.5 ft		5.5 - 6.5 ft		6.5 - 7.5 ft		8 - 9 ft		8 - 8.5 ft		6.5 - 7.5 ft		13.5 - 14 ft	
				Sample Type	N		N		N		N		N		N		N		N		N	
				Result Type	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result
				Data Status	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource
Parameter	Units	Washington Method A Unrestricted Land Use	Washington Method B Cancer Direct Contact	Washington Method B Noncancer Direct Contact																		
Effective Date		07/01/2015	07/01/2015	07/01/2015																		
Exceedance Key		No Exceedances	Shade	No Exceedances																		
Benzoic acid	ug/kg			320000000	1500	ND	1000	ND	1100	ND	1000	ND	1000	ND	1000	ND	1000	ND	1000	ND	1000	ND
Benzyl alcohol	ug/kg			8000000	110	ND	100	ND	100	ND	100	ND	100	ND	100	ND	100	ND	100	ND	100	ND
Bis(2-chloroethoxy)methane	ug/kg				250	ND	250	ND	250	ND	250	ND	250	ND	250	ND	250	ND	250	ND	250	ND
Bis(2-chloroethyl)ether	ug/kg		909		200	ND	120	ND	150	ND	110	ND	110	ND	100	ND	110	ND	110	ND	93	ND
Bis(2-ethylhexyl)phthalate	ug/kg		71400	1600000	100	ND	100	ND	100	ND	100	ND	100	ND	100	ND	100	ND	100	ND	100	110
Butyl benzyl phthalate	ug/kg		526000	16000000	100	ND	100	ND	100	ND	100	ND	100	ND	100	ND	100	ND	100	ND	100	ND
Carbazole	ug/kg				250	ND	250	ND	250	ND	250	ND	250	ND	250	ND	250	ND	250	ND	250	ND
Chrysene	ug/kg		137000		20	45	20	ND	20	ND	20	ND	20	ND	20	ND	20	ND	20	ND	20	ND
Dibenz(a,h)anthracene	ug/kg		137		20	ND	20	ND	20	ND	20	ND	20	ND	20	ND	20	ND	20	ND	20	ND
Dibenzofuran	ug/kg			80000	100	ND	100	ND	100	ND	100	ND	100	ND	100	ND	100	ND	100	ND	100	ND
Diethyl phthalate	ug/kg			64000000	100	ND	100	ND	100	ND	100	ND	100	ND	100	ND	100	ND	100	ND	100	ND
Dimethyl phthalate	ug/kg				100	ND	100	ND	100	ND	100	ND	100	ND	100	ND	100	ND	100	ND	100	ND
Di-n-butyl phthalate	ug/kg			8000000	100	ND	100	ND	100	ND	100	ND	100	ND	100	ND	100	ND	100	ND	100	ND
Di-n-octyl phthalate	ug/kg			800000	100	ND	100	ND	100	ND	100	ND	100	ND	100	ND	100	ND	100	ND	100	ND
Fluoranthene	ug/kg			3200000	20	250	20	ND	20	120	20	ND	20	ND	20	ND	20	ND	20	ND	20	ND
Fluorene	ug/kg			3200000	20	ND	20	ND	20	ND	20	ND	20	ND	20	ND	20	ND	20	ND	20	ND
Hexachlorobenzene	ug/kg		625	64000	100	ND	100	ND	100	ND	--	--	--	--	--	--	--	--	--	--	100	ND
Hexachlorobutadiene	ug/kg		12800	80000	500	ND	500	ND	500	ND	--	--	--	--	--	--	--	--	--	--	500	ND
Hexachlorocyclopentadiene	ug/kg			480000	100	ND	100	ND	100	ND	100	ND	100	ND	100	ND	100	ND	100	ND	100	ND
Hexachloroethane	ug/kg		25000	56000	100	ND	100	ND	100	ND	100	ND	100	ND	100	ND	100	ND	100	ND	100	ND
Indeno(1,2,3-cd)pyrene	ug/kg		1370		20	27	20	ND	20	ND	20	ND	20	ND	20	ND	20	ND	20	ND	20	ND
Isophorone	ug/kg		1053000	16000000	150	ND	100	ND	110	ND	100	ND	100	ND	100	ND	100	ND	100	ND	100	ND
Naphthalene	ug/kg	5000		1600000	20	250	20	ND	20	120	20	ND	20	ND	20	ND	20	ND	20	ND	20	ND
Nitrobenzene	ug/kg			160000	100	ND	100	ND	100	ND	100	ND	100	ND	100	ND	100	ND	100	ND	100	ND
n-Nitrosodimethylamine	ug/kg		19.6	640	56	ND	34	ND	42	ND	30	ND	31	ND	28	ND	29	ND	32	ND	26	ND
n-Nitrosodi-n-propylamine	ug/kg		143		190	ND	120	ND	150	ND	250	ND	250	ND	250	ND	250	ND	250	ND	90	ND
n-Nitrosodiphenylamine	ug/kg		204000		100	ND	100	ND	100	ND	100	ND	100	ND	100	ND	100	ND	100	ND	100	ND
Pentachlorophenol	ug/kg		2500	400000	110	ND	67	ND	79	ND	47	ND	47	ND	43	ND	45	ND	49	ND	48	ND
Phenanthrene	ug/kg				20	170	20	ND	20	100	20	ND	20	ND	20	ND	20	ND	20	ND	20	ND
Phenol	ug/kg			24000000	100	ND	100	ND	100	ND	100	ND	100	ND	100	ND	100	ND	100	ND	100	ND
Pyrene	ug/kg			2400000	20	170	20	ND	20	93	20	ND	20	ND	20	ND	20	ND	20	ND	20	ND
Pyridine	ug/kg			80000	200	ND	200	ND	200	ND	200	ND	200	ND	200	ND	200	ND	200	ND	200	ND
VOCs																						
1,1,1,2-Tetrachloroethane	ug/kg		38500	2400000	10	ND	10	ND	10	ND	10	ND	10	ND	10	ND	--	--	10	ND	10	ND
1,1,1-Trichloroethane	ug/kg	2000		160000000	10	ND	10	ND	10	ND	10	ND	10	ND	10	ND	--	--	10	ND	10	ND
1,1,2,2-Tetrachloroethane	ug/kg		5000	1600000	1.4	ND	1.1	ND	1.6	ND	1.3	ND	1.3	ND	1.1	ND	--	--	1.0	ND	0.89	ND
1,1,2-Trichloroethane	ug/kg		17500	320000	1.4	ND	1.0	ND	1.5	ND	1.2	ND	1.2	ND	1.1	ND	--	--	0.97	ND	0.86	ND
1,1-Dichloroethane	ug/kg		175000	16000000	10	ND	10	ND	10	ND	10	ND	10	ND	10	ND	--	--	10	ND	10	ND
1,1-Dichloroethylene	ug/kg			4000000	10	ND	10	ND	10	ND	10	ND	10	ND	10	ND	--	--	10	ND	10	ND
1,1-Dichloropropene	ug/kg				10	ND	10	ND	10	ND	10	ND	10	ND	10	ND	--	--	10	ND	10	ND
1,2,3-Trichlorobenzene	ug/kg				10	ND	10	ND	10	ND	10	ND	10	ND	10	ND	--	--	10	ND	10	ND
1,2,3-Trichloropropane	ug/kg		33.3	320000	1.5	ND	1.1	ND	1.6	ND	1.3	ND	1.3	ND	1.2	ND	--	--	1.1	ND	0.94	ND
1,2,4-Trichlorobenzene	ug/kg		34500	800000	10	ND	10	ND	10	ND	10	ND	10	ND	10	ND	--	--	10	ND	10	ND
1,2,4-Trimethylbenzene	ug/kg				10	ND	10	ND	10	ND	10	ND	10	ND	10	ND	--	--	10	ND	10	ND
1,2-Dibromo-3-chloropropane (DBCP)	ug/kg		1250	16000	50	ND	50	ND	50	ND	50	ND	50	ND	50	ND	--	--	50	ND	50	ND
1,2-Dibromoethane (EDB)	ug/kg	5.00	500	720000	5.0	ND	5.0	ND	5.0	ND	5.0	ND	5.0	ND	5.0	ND	--	--	5.0	ND	5.0	ND
1,2-Dichlorobenzene	ug/kg			7200000	10	ND	10	ND	10	ND	10	ND	10	ND	10	ND	--	--	10	ND	10	ND
1,2-Dichloroethane	ug/kg		11000	480000	10	ND	10	ND	10	ND	10	ND	10	ND	10	ND	--	--	10	ND	10	ND
1,2-Dichloroethylene, cis	ug/kg			160000	10	ND	10	ND	10	ND	10	ND	10	ND	10	ND	--	--	10	ND	10	ND
1,2-Dichloroethylene, trans	ug/kg			1600000	10	ND	10	ND	10	ND	10	ND	10	ND	10	ND	--	--	10	ND	10	ND
1,2-Dichloropropane	ug/kg		27800	7200000	10	ND	10	ND	10	ND	10	ND	10	ND	10	ND	--	--	10	ND	10	ND
1,3,5-Trimethylbenzene	ug/kg			800000	10	ND	10	ND	10	ND	10	ND	10	ND	10	ND	--	--	10	ND	10	ND
1,3-Dichlorobenzene	ug/kg				10	ND	10	ND	10	ND	--	--	--	--	--	--	--	--	--	--	10	ND
1,3-Dichloropropane	ug/kg				10	ND	10	ND	10	ND	10	ND	10	ND	10	ND	--	--	10	ND	10	ND
1,3-Dichloropropene, cis	ug/kg		10000	2400000	10	ND	10	ND	10	ND	10	ND	10	ND	10	ND	--	--	10	ND	10	ND
1,3-Dichloropropene, trans	ug/kg		10000	2400000	10	ND	10	ND	10	ND	10	ND	10	ND	10	ND	--	--	10	ND	10	ND
1,4-Dichlorobenzene	ug/kg		185000	5600000	10	ND	10	ND	10	ND	10	ND	10	ND	10	ND	--	--	10	ND	10	ND
2,2-Dichloropropane	ug/kg				10	ND	10	ND	10	ND	10	ND	10	ND	10	ND	--	--	10	ND	10	ND
2-Hexanone	ug/kg				50	ND	50	ND	50	ND	50	ND	50	ND	50	ND	--	--	50	ND	50	ND
Acetone	ug/kg			72000000	50	ND	130	ND	230	250	120	280	120	280	100	190	--	--	50	52	50	ND

Table 1
Historical Soil Data Review - 2015 Landau PQLs vs. MTCA Cleanup Levels
Yakima Mill Site

Location					GP-23		GP-24		GP-26		GP-27		GP-28		GP-29		GP-30		GP-31		MW-100	
Date					10/30/2014		10/30/2014		10/29/2014		4/23/2015		4/23/2015		4/23/2015		4/24/2015		4/22/2015		9/11/2014	
Depth					15 - 15.5 ft		12.5 - 13 ft		7.5 - 8.5 ft		5.5 - 6.5 ft		6.5 - 7.5 ft		8 - 9 ft		8 - 8.5 ft		6.5 - 7.5 ft		13.5 - 14 ft	
Sample Type					N		N		N		N		N		N		N		N		N	
Result Type					PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result
Data Status					SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource
Parameter	Units	Washington Method A Unrestricted Land Use	Washington Method B Cancer Direct Contact	Washington Method B Noncancer Direct Contact																		
Effective Date		07/01/2015	07/01/2015	07/01/2015																		
Exceedance Key		No Exceedances	Shade	No Exceedances																		
Acrylonitrile	ug/kg		1850	3200000	50	ND	50	ND	50	ND	50	ND	50	ND	50	ND	--	--	50	ND	50	ND
Benzene	ug/kg	30.0	18200	320000	5.0	ND	5.0	ND	5.0	ND	5.0	ND	5.0	ND	5.0	ND	--	--	5.0	ND	5.0	ND
Bromobenzene	ug/kg				10	ND	10	ND	10	ND	10	ND	10	ND	10	ND	--	--	10	ND	10	ND
Bromochloromethane	ug/kg				10	ND	10	ND	10	ND	10	ND	10	ND	10	ND	--	--	10	ND	10	ND
Bromodichloromethane	ug/kg		16100	1600000	1.3	ND	0.96	ND	1.4	ND	1.2	ND	1.1	ND	1.0	ND	--	--	0.91	ND	0.81	ND
Bromoform	ug/kg		127000	1600000	10	ND	10	ND	10	ND	10	ND	10	ND	10	ND	--	--	10	ND	10	ND
Bromomethane	ug/kg			112000	10	ND	10	ND	10	ND	10	ND	10	ND	10	ND	--	--	10	ND	10	ND
Butylbenzene	ug/kg			4000000	10	ND	10	ND	10	ND	10	ND	10	ND	10	ND	--	--	10	ND	10	ND
Butylbenzene, sec	ug/kg			8000000	10	ND	10	ND	10	ND	10	ND	10	ND	10	ND	--	--	10	ND	10	ND
Butylbenzene, tert	ug/kg			8000000	10	ND	10	ND	10	ND	10	ND	10	ND	10	ND	--	--	10	ND	10	ND
Carbon disulfide	ug/kg			8000000	10	ND	10	ND	10	ND	10	ND	10	ND	10	ND	--	--	10	ND	10	ND
Carbon tetrachloride	ug/kg		14300	320000	10	ND	10	ND	10	ND	10	ND	10	ND	10	ND	--	--	10	ND	10	ND
Chlorobenzene	ug/kg			1600000	10	ND	10	ND	10	ND	10	ND	10	ND	10	ND	--	--	10	ND	10	ND
Chlorodibromomethane	ug/kg		11900	1600000	10	ND	10	ND	10	ND	10	ND	10	ND	10	ND	--	--	10	ND	10	ND
Chloroethane	ug/kg				10	ND	10	ND	10	ND	10	ND	10	ND	10	ND	--	--	10	ND	10	ND
Chloroform	ug/kg		32300	800000	8	ND	8	ND	8	ND	8.0	ND	8.0	ND	8.0	ND	--	--	8.0	ND	8.0	ND
Chloromethane	ug/kg				10	ND	10	ND	10	ND	10	ND	10	ND	10	ND	--	--	10	ND	10	ND
Chlorotoluene, o	ug/kg			1600000	10	ND	10	ND	10	ND	10	ND	10	ND	10	ND	--	--	10	ND	10	ND
Chlorotoluene, p	ug/kg				10	ND	10	ND	10	ND	10	ND	10	ND	10	ND	--	--	10	ND	10	ND
Cumene (isopropyl benzene)	ug/kg			8000000	10	ND	10	ND	10	ND	10	ND	10	ND	10	ND	--	--	10	ND	10	ND
Cymene p- (toluene isopropyl p-)	ug/kg				10	ND	10	ND	10	ND	10	ND	10	ND	10	ND	--	--	10	ND	10	ND
Dibromomethane (methylene bromide)	ug/kg			800000	10	ND	10	ND	10	ND	10	ND	10	ND	10	ND	--	--	10	ND	10	ND
Dichlorodifluoromethane (Freon-12)	ug/kg			16000000	10	ND	10	ND	10	ND	10	ND	10	ND	10	ND	--	--	10	ND	10	ND
Ethyl benzene	ug/kg	6000		8000000	10	ND	10	ND	10	ND	10	ND	10	ND	10	ND	--	--	10	ND	10	ND
Hexachlorobutadiene	ug/kg		12800	80000	10	ND	10	ND	10	ND	10	ND	10	ND	10	ND	--	--	10	ND	10	ND
Methyl ethyl ketone (2-butanone)	ug/kg			48000000	50	ND	50	ND	50	ND	50	ND	50	ND	50	ND	--	--	50	ND	50	ND
Methyl isobutyl ketone (MIBK)	ug/kg			6400000	50	ND	50	ND	50	ND	50	ND	50	ND	50	ND	--	--	50	ND	50	ND
Methyl tertiary butyl ether (MTBE)	ug/kg	100	556000		10	ND	10	ND	10	ND	10	ND	10	ND	10	ND	--	--	10	ND	10	ND
Methylene chloride	ug/kg	20.0	500000	480000	20	ND	20	ND	20	ND	20	ND	20	ND	20	ND	--	--	20	ND	20	ND
Naphthalene	ug/kg	5000		1600000	10	ND	10	ND	10	ND	--	--	--	--	--	--	--	--	--	--	10	ND
Propylbenzene	ug/kg			8000000	10	ND	10	ND	10	ND	10	ND	10	ND	10	ND	--	--	10	ND	10	ND
Styrene	ug/kg			16000000	10	ND	10	ND	10	ND	10	ND	10	ND	10	ND	--	--	10	ND	10	ND
Tetrachloroethylene	ug/kg	50.0	476000	480000	10	ND	10	ND	10	ND	10	ND	10	ND	10	ND	--	--	10	ND	10	ND
Toluene	ug/kg	7000		6400000	10	ND	10	ND	10	ND	10	ND	10	ND	10	ND	--	--	10	ND	10	ND
Trichloroethylene (TCE)	ug/kg	30.0	12000	40000	10	ND	10	ND	10	ND	10	ND	10	ND	10	ND	--	--	10	ND	10	ND
Trichlorofluoromethane (Freon-11)	ug/kg			24000000	10	ND	10	ND	10	ND	10	ND	10	ND	10	ND	--	--	10	ND	10	ND
Vinyl chloride	ug/kg			240000	0.053	ND	0.040	ND	0.058	ND	0.048	ND	0.047	ND	0.043	ND	--	--	0.038	ND	0.033	ND
Xylene, m & p	ug/kg			16000000	20	ND	20	ND	20	ND	20	ND	20	ND	20	ND	--	--	20	ND	20	ND
Xylene, o	ug/kg			16000000	10	ND	10	ND	10	ND	10	ND	10	ND	10	ND	--	--	10	ND	10	ND
Pesticides																						
4,4'-DDD	mg/kg		4.17		0.0045	0.0060	0.0032	ND	0.004	0.045	0.0010	ND	0.001	0.0012	0.0010	ND	0.0010	ND	0.0010	ND	0.0026	ND
4,4'-DDE	mg/kg		2.94		0.0045	ND	0.0032	ND	0.004	0.0059	0.0016	0.003	0.0016	0.0024	0.0016	ND	0.0016	ND	0.0016	ND	0.0026	ND
4,4'-DDT	mg/kg	3.00	2.94	40.0	0.0045	ND	0.0032	ND	0.0040	ND	0.00085	0.0019	0.00085	ND	0.00085	0.0011	0.00085	ND	0.00085	ND	0.0026	ND
a-BHC	mg/kg		0.159	640	0.0045	ND	0.0032	ND	0.0040	ND	0.00054	ND	0.00058	ND	0.00054	ND	0.00056	ND	0.00060	ND	0.0026	ND
Aldrin	mg/kg		0.0588	2.40	0.0045	ND	0.0032	ND	0.0040	ND	0.00054	ND	0.00058	ND	0.00054	ND	0.00056	ND	0.00060	ND	0.0026	ND
b-BHC	mg/kg		0.556		0.0045	ND	0.0032	ND	0.0040	ND	0.00054	ND	0.00058	ND	0.00054	ND	0.00056	ND	0.00060	ND	0.0026	ND
Chlordane, alpha & gamma	mg/kg		2.86	40.0	0.0045	ND	0.0032	ND	0.0040	ND	0.00060	ND	0.00060	ND	0.00060	ND	0.00060	ND	0.00060	ND	0.0026	ND
d-BHC	mg/kg				0.0045	ND	0.0032	ND	0.0040	ND	0.00054	ND	0.00058	ND	0.00054	ND	0.00056	ND	0.00060	ND	0.0026	ND
Dieldrin	mg/kg		0.0625	4.00	0.0045	ND	0.0032	ND	0.0058	ND	0.00054	ND	0.00058	ND	0.00054	ND	0.00056	ND	0.00060	ND	0.0026	ND
Endosulfan I	mg/kg			480	0.0045	ND	0.0032	ND	0.0040	ND	0.0017	ND	0.0017	ND	0.0017	ND	0.0017	ND	0.0017	ND	0.0026	ND
Endosulfan II	mg/kg			480	0.0045	ND	0.0032	ND	0.0040	ND	0.00086	ND	0.00086	ND	0.00086	ND	0.00086	ND	0.00086	ND	0.0026	ND
Endosulfan sulfate	mg/kg			480	0.0045	ND	0.0032	ND	0.004	0.0053	0.00057	ND	0.00058	ND	0.00057	ND	0.00057	ND	0.00060	ND	0.0026	ND
Endrin	mg/kg			24.0	0.0045	ND	0.0032	ND	0.0040	ND	0.00054	ND	0.00058	ND	0.00054	ND	0.00056	ND	0.00060	ND	0.0026	ND
Endrin aldehyde	mg/kg				0.0045	ND	0.0032	ND	0.0040	ND	0.0014	ND	0.0014	ND	0.0014	ND	0.0014	ND	0.0014	ND	0.0026	ND
g-BHC (Lindane)	mg/kg	0.0100	0.909	24.0	0.0045	ND	0.0032	ND	0.0040	ND	0.00054	ND	0.00058	ND	0.00054	ND	0.00056	ND	0.00060	ND	0.0026	ND
Heptachlor	mg/kg		0.222	40.0	0.0045	ND	0.0032	ND	0.0040	ND	0.00083	ND	0.00083	ND	0.00083	ND	0.00083	ND	0.00083	ND	0.0026	ND
Heptachlor epoxide	mg/kg		0.110	1.04	0.0045	ND	0.0032	ND	0.0040	ND	0.00054	ND	0.00058	ND	0.00054	ND	0.00056	ND	0.00060	ND	0.0026	ND
Hexachlorobenzene	mg/kg		0.625	64.0	--	--	--	--	--	--	0.00054	ND	0.00058	ND	0.00054	ND	0.00056	ND	0.00060	ND	--	--
Methoxychlor	mg/kg			400	0.0045	ND	0.0032	ND	0.0040	ND	0.00061	ND	0.00061	ND	0.00061	ND	0.00061	ND	0.00061	ND	0.0026	ND
Toxaphene	mg/kg		0.909		0.23	ND	0.16	ND	0.20	ND	0.037	ND	0.037	ND	0.037	ND	0.037	ND	0.037	ND	0.13	ND

Table 1
Historical Soil Data Review - 2015 Landau PQLs vs. MTCA Cleanup Levels
Yakima Mill Site

Location					GP-23		GP-24		GP-26		GP-27		GP-28		GP-29		GP-30		GP-31		MW-100	
Date					10/30/2014		10/30/2014		10/29/2014		4/23/2015		4/23/2015		4/23/2015		4/24/2015		4/22/2015		9/11/2014	
Depth					15 - 15.5 ft		12.5 - 13 ft		7.5 - 8.5 ft		5.5 - 6.5 ft		6.5 - 7.5 ft		8 - 9 ft		8 - 8.5 ft		6.5 - 7.5 ft		13.5 - 14 ft	
Sample Type					N		N		N		N		N		N		N		N		N	
Result Type					PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result
Data Status					SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource
Parameter	Units	Washington Method A Unrestricted Land Use	Washington Method B Cancer Direct Contact	Washington Method B Noncancer Direct Contact																		
Effective Date		07/01/2015	07/01/2015	07/01/2015																		
Exceedance Key		No Exceedances	Shade	No Exceedances																		
PCBs																						
Aroclor 1016	mg/kg		14.3	5.60	0.018	ND	0.013	ND	0.016	ND	0.0054	ND	0.0058	ND	0.0054	ND	0.0056	ND	0.0060	ND	0.0052	ND
Aroclor 1221	mg/kg				0.036	ND	0.025	ND	0.032	ND	0.011	ND	0.012	ND	0.011	ND	0.012	ND	0.012	ND	0.011	ND
Aroclor 1232	mg/kg				0.018	ND	0.013	ND	0.016	ND	0.0054	ND	0.0058	ND	0.0054	ND	0.0056	ND	0.0060	ND	0.0052	ND
Aroclor 1242	mg/kg				0.018	ND	0.013	ND	0.016	ND	0.0054	ND	0.0058	ND	0.0054	ND	0.0056	ND	0.0060	ND	0.0052	ND
Aroclor 1248	mg/kg				0.018	ND	0.013	ND	0.016	ND	0.0054	ND	0.0058	ND	0.0054	ND	0.0056	ND	0.0060	ND	0.0052	ND
Aroclor 1254	mg/kg		0.500	1.60	0.018	ND	0.013	ND	0.016	ND	0.0054	0.0099	0.0058	ND	0.0054	ND	0.0056	ND	0.0060	ND	0.0052	ND
Aroclor 1260	mg/kg		0.500		0.018	ND	0.013	ND	0.016	ND	0.0054	0.0057	0.0058	ND	0.0054	ND	0.0056	ND	0.0060	ND	0.0052	ND
Total Petroleum Hydrocarbons																						
Total Petroleum Hydrocarbons (as diesel)	mg/kg	2000			50	ND	25 50	160 ND	50	ND	25 50	ND	25 50	ND	50	ND	50	ND	50	ND	50	ND
Total Petroleum Hydrocarbons (as diesel), silica gel	mg/kg	2000			--	--	25	140	--	--	25	ND	25	ND	--	--	--	--	--	--	--	--
Total Petroleum Hydrocarbons (as gasoline)	mg/kg	30.0			20	ND	20	ND	20	ND	20	ND	20	ND	20	ND	20	ND	20	ND	20	ND
Total Petroleum Hydrocarbons (as motor oil)	mg/kg	2000			100	ND	50 100	300 100	100	ND	50 100	280 100	50 100	150 100	100	ND	100	ND	100	ND	100	ND
Total Petroleum Hydrocarbons (as motor oil), silica gel	mg/kg	2000			--	--	50	280	--	--	50	150	50	78	--	--	--	--	--	--	--	--

Landau qualifier - J: Indicates the analyte was positively identified; the associated numerical value is the approximate concentration of the analyte in the sample.

Landau qualifier - UJ: The analyte was not detected in the sample; the reported sample reporting limit is an estimate.
N: Normal Sample.
FD: Field Duplicate Sample.
ND: Not detected.
PQL: Practical Quantitation Limit.
SSource: Laboratory and/or field data obtained from a secondary source external to Barr. Second source QA/QC evaluation procedures may or may not have been performed beyond the original data generator.

Table was updated (items in red) after original submittal to add Landau qualifiers to be consistent with the memo.

Table 1
Historical Soil Data Review - 2015 Landau PQLs vs. MTCA Cleanup Levels
Yakima Mill Site

				Location	MW-101		MW-102		MW-102		MW-103		MW-104		MW-104		MW-105		MW-105		MW-106	
				Date	9/05/2014		9/08/2014		9/08/2014		9/05/2014		9/03/2014		9/03/2014		9/02/2014		9/02/2014		9/09/2014	
				Depth	17.5 - 18.5 ft		4 - 5 ft		15 - 15.5 ft		20.5 - 21.5 ft		2.5 - 3 ft		19 - 20 ft		2.5 - 3.5 ft		17.5 - 19 ft		2.5 - 3.5 ft	
				Sample Type	N		N		N		N		N		N		N		N		N	
				Result Type	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result
				Data Status	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource
Parameter	Units	Washington Method A Unrestricted Land Use	Washington Method B Cancer Direct Contact	Washington Method B Noncancer Direct Contact																		
Effective Date		07/01/2015	07/01/2015	07/01/2015																		
Exceedance Key		No Exceedances	Shade	No Exceedances																		
General Parameters																						
Fluoride	mg/kg			3200	1.6	ND	1.6	ND	1.6	ND	1.6	ND	1.6	ND	1.6	ND	1.6	1.7	1.6	ND	1.6	3.3
Nitrogen, nitrate, as N	mg/kg			128000	0.50	ND UJ	0.50	ND UJ	0.50	ND UJ	0.50	ND UJ	0.50	ND UJ	0.50	0.91 J	5	63 J	0.50	ND UJ	0.50	15 J
Nitrogen, nitrite, as N	mg/kg			8000	0.50	ND UJ	0.50	ND UJ	0.50	ND UJ	0.50	ND UJ	0.50	ND UJ	0.50	ND UJ	0.50	ND UJ	0.50	ND UJ	0.50	1.7 J
pH	pH units				1.0	6.71	--	--	1.0	7.43	1.0	7.53	--	--	1.0	7.51	--	--	1.0	7.87	--	--
Metals																						
Arsenic	mg/kg	20.0	0.667	24.0	1.0	1.4	1.0	1.9	1.0	2.2	1.0	1.8	0.82	2.2	0.83	1.5	0.89	3.6	0.86	2.7	1.0	2.6
Barium	mg/kg			16000	0.50	70	0.50	82	0.50	84	0.50	56	0.16	91	0.16	76	0.17	140	0.17	79	0.50	100
Cadmium	mg/kg	2.00		80.0	0.50	ND	0.50	ND	0.50	ND	0.50	ND	0.25	ND	0.26	ND	0.27	1.3	0.27	ND	0.50	ND
Chromium	mg/kg				0.50	14	0.50	7.9	0.50	15	0.50	14	0.41	12	0.42	19	0.45	24	0.44	18	0.50	13
Chromium, hexavalent	mg/kg	19.0		240	5.0	ND	--	--	5.0	ND	5.0	ND	--	--	5.0	ND	--	--	5.0	ND	--	--
Iron	mg/kg			56000	50	22000	50	17000	50	24000	50	23000	50	20000	50	22000	50	35000	50	21000	50	25000
Lead	mg/kg	250			0.50	3.7	0.50	39	0.50	6	0.50	3.1	0.26	56	0.27	3.3	0.29	190	0.28	4.7	0.50	51
Manganese	mg/kg			11200	0.50	240	0.50	200	0.50	250	0.50	250	0.32	330	0.33	240	0.35	330	0.34	350	0.50	520
Mercury	mg/kg	2.00			0.02	0.036	0.02	0.06	0.02	0.049	0.02	0.028	0.0041	0.09	0.0041	0.23	0.0041	0.18	0.0041	0.023	0.02	0.11
Selenium	mg/kg			400	5.0	ND	5.0	ND	5.0	ND	5.0	ND	5.0	ND	5.0	ND	5.0	ND	5.0	ND	5.0	ND
Silver	mg/kg			400	0.50	ND	0.50	ND	0.50	ND	0.50	ND	0.26	3.5	0.26	ND	0.28	ND	0.27	ND	0.50	ND
Sodium	mg/kg				50	380	50	340	50	440	50	530	50	540	50	540	50	490	50	1200	50	560
SVOCs																						
1,2,4-Trichlorobenzene	ug/kg		34500	800000	100	ND	--	--	100	ND	100	ND	--	--	100	ND	--	--	100	ND	--	--
1,2-Dichlorobenzene	ug/kg			7200000	100	ND	--	--	100	ND	100	ND	--	--	100	ND	--	--	100	ND	--	--
1,3-Dichlorobenzene	ug/kg				100	ND	--	--	100	ND	100	ND	--	--	100	ND	--	--	100	ND	--	--
1,4-Dichlorobenzene	ug/kg		185000	5600000	100	ND	--	--	100	ND	100	ND	--	--	100	ND	--	--	100	ND	--	--
1-Methylnaphthalene	ug/kg		34500	5600000	20	ND	20	ND	20	ND	20	ND	20	ND	20	ND	20	ND	20	ND	20	ND
2,2'-oxybis (1-chloropropane)	ug/kg		14300	3200000	250	ND	--	--	250	ND	250	ND	--	--	250	ND	--	--	250	ND	--	--
2,3,4,6-Tetrachlorophenol	ug/kg			2400000	100	ND	--	--	100	ND	100	ND	--	--	100	ND	--	--	100	ND	--	--
2,4,5-Trichlorophenol	ug/kg			8000000	100	ND	--	--	100	ND	100	ND	--	--	100	ND	--	--	100	ND	--	--
2,4,6-Trichlorophenol	ug/kg		90900	80000	36	ND	--	--	43	ND	34	ND	--	--	43	ND	--	--	46	ND	--	--
2,4-Dichlorophenol	ug/kg			240000	230	ND	--	--	270	ND	210	ND	--	--	270	ND	--	--	280	ND	--	--
2,4-Dimethylphenol	ug/kg			1600000	100	ND	--	--	100	ND	100	ND	--	--	100	ND	--	--	100	ND	--	--
2,4-Dinitrophenol	ug/kg			160000	100	ND	--	--	100	ND	100	ND	--	--	100	ND	--	--	100	ND	--	--
2,4-Dinitrotoluene	ug/kg		3230	160000	20	ND	--	--	24	ND	19	ND	--	--	23	ND	--	--	25	ND	--	--
2,6-Dichlorophenol	ug/kg				250	ND	--	--	250	ND	250	ND	--	--	250	ND	--	--	250	ND	--	--
2,6-Dinitrotoluene	ug/kg		667	24000	34	ND	--	--	41	ND	32	ND	--	--	40	ND	--	--	43	ND	--	--
2-Chloronaphthalene	ug/kg			6400000	100	ND	--	--	100	ND	100	ND	--	--	100	ND	--	--	100	ND	--	--
2-Chlorophenol	ug/kg			400000	250	ND	--	--	250	ND	250	ND	--	--	250	ND	--	--	250	ND	--	--
2-Methyl-4,6-dinitrophenol	ug/kg				100	ND	--	--	100	ND	100	ND	--	--	100	ND	--	--	100	ND	--	--
2-Methylnaphthalene	ug/kg			320000	20	ND	20	26	20	ND	20	ND	20	ND	20	ND	20	ND	20	ND	20	ND
2-Methylphenol (o-cresol)	ug/kg			4000000	100	ND	--	--	100	ND	100	ND	--	--	100	ND	--	--	100	ND	--	--
2-Nitroaniline	ug/kg			800000	100	ND	--	--	100	ND	100	ND	--	--	100	ND	--	--	100	ND	--	--
2-Nitrophenol	ug/kg				100	ND	--	--	100	ND	100	ND	--	--	100	ND	--	--	100	ND	--	--
3,3`-Dichlorobenzidine	ug/kg		2220		160	ND	--	--	190	ND	150	ND	--	--	180	ND	--	--	200	ND	--	--
3,4-Methylphenol (m,p cresols)	ug/kg				100	400	--	--	100	ND	100	ND	--	--	100	ND	--	--	100	ND	--	--
3-Nitroaniline	ug/kg				1000	ND	--	--	1000	ND	1000	ND	--	--	1000	ND	--	--	1000	ND	--	--
4-Bromophenyl phenyl ether	ug/kg				100	ND	--	--	100	ND	100	ND	--	--	100	ND	--	--	100	ND	--	--
4-Chloro-3-methylphenol	ug/kg				500	ND	--	--	500	ND	500	ND	--	--	500	ND	--	--	500	ND	--	--
4-Chloroaniline	ug/kg		5000	320000	1000	ND	--	--	1000	ND	1000	ND	--	--	1000	ND	--	--	1000	ND	--	--
4-Chlorophenyl phenyl ether	ug/kg				100	ND	--	--	100	ND	100	ND	--	--	100	ND	--	--	100	ND	--	--
4-Nitroaniline	ug/kg				250	ND	--	--	250	ND	250	ND	--	--	250	ND	--	--	250	ND	--	--
4-Nitrophenol	ug/kg				100	ND	--	--	100	ND	100	ND	--	--	100	ND	--	--	100	ND	--	--
Acenaphthene	ug/kg			4800000	20	ND	20	ND	20	ND	20	ND	20	ND	20	ND	20	ND	20	ND	20	ND
Acenaphthylene	ug/kg				20	ND	20	ND	20	ND	20	ND	20	ND	20	ND	20	ND	20	ND	20	ND
Aniline	ug/kg		175000	560000	42	ND	--	--	51	ND	40	ND	--	--	50	ND	--	--	53	ND	--	--
Anthracene	ug/kg			24000000	20	ND	20	ND	20	ND	20	ND	20	ND	20	ND	20	ND	20	ND	20	ND
Azobenzene	ug/kg		9090		100	ND	--	--	100	ND	100	ND	--	--	100	ND	--	--	100	ND	--	--
Benz(a)anthracene	ug/kg		1370		20	ND	20	ND	20	ND	20	ND	20	21	20	ND	20	99	20	ND	20	ND
Benzo(a)pyrene	ug/kg	100	137		20	ND	20	ND	20	ND	20	ND	20	22	20	ND	20	71	20	ND	20	ND
Benzo(b)fluoranthene	ug/kg		1370		20	ND	20	ND	20	ND	20	ND	20	30	20	ND	20	110	20	ND	20	21
Benzo(g,h,i)perylene	ug/kg				20	ND	20	ND	20	ND	20	ND	20	25	20	ND	20	64	20	ND	20	ND
Benzo(k)fluoranthene	ug/kg		13700		20	ND	20	ND	20	ND	20	ND	20	ND	20	ND	20	31	20	ND	20	ND

Table 1
Historical Soil Data Review - 2015 Landau PQLs vs. MTCA Cleanup Levels
Yakima Mill Site

				Location	MW-101		MW-102		MW-102		MW-103		MW-104		MW-104		MW-105		MW-105		MW-106	
				Date	9/05/2014		9/08/2014		9/08/2014		9/05/2014		9/03/2014		9/03/2014		9/02/2014		9/02/2014		9/09/2014	
				Depth	17.5 - 18.5 ft		4 - 5 ft		15 - 15.5 ft		20.5 - 21.5 ft		2.5 - 3 ft		19 - 20 ft		2.5 - 3.5 ft		17.5 - 19 ft		2.5 - 3.5 ft	
				Sample Type	N		N		N		N		N		N		N		N		N	
				Result Type	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result
				Data Status	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource
Parameter	Units	Washington Method A Unrestricted Land Use	Washington Method B Cancer Direct Contact	Washington Method B Noncancer Direct Contact																		
Effective Date		07/01/2015	07/01/2015	07/01/2015																		
Exceedance Key		No Exceedances	Shade	No Exceedances																		
Benzoic acid	ug/kg			320000000	1000	ND	--	--	1000	ND	1000	ND	--	--	1000	ND	--	--	1000	ND	--	--
Benzyl alcohol	ug/kg			8000000	100	ND	--	--	100	ND	100	ND	--	--	100	ND	--	--	100	ND	--	--
Bis(2-chloroethoxy)methane	ug/kg				250	ND	--	--	250	ND	250	ND	--	--	250	ND	--	--	250	ND	--	--
Bis(2-chloroethyl)ether	ug/kg		909		89	ND	--	--	110	ND	83	ND	--	--	100	ND	--	--	110	ND	--	--
Bis(2-ethylhexyl)phthalate	ug/kg		71400	1600000	100	140	--	--	100	110	100	ND	--	--	100	120	--	--	100	ND	--	--
Butyl benzyl phthalate	ug/kg		526000	16000000	100	ND	--	--	100	ND	100	ND	--	--	100	ND	--	--	100	ND	--	--
Carbazole	ug/kg				250	ND	--	--	250	ND	250	ND	--	--	250	ND	--	--	250	ND	--	--
Chrysene	ug/kg		137000		20	ND	20	ND	20	ND	20	ND	20	ND	20	ND	20	63	20	ND	20	ND
Dibenz(a,h)anthracene	ug/kg		137		20	ND	20	ND	20	ND	20	ND	20	ND	20	ND	20	ND	20	ND	20	ND
Dibenzofuran	ug/kg			80000	100	ND	--	--	100	ND	100	ND	--	--	100	ND	--	--	100	ND	--	--
Diethyl phthalate	ug/kg			64000000	100	ND	--	--	100	ND	100	ND	--	--	100	ND	--	--	100	ND	--	--
Dimethyl phthalate	ug/kg				100	ND	--	--	100	ND	100	ND	--	--	100	ND	--	--	100	ND	--	--
Di-n-butyl phthalate	ug/kg			8000000	100	ND	--	--	100	ND	100	ND	--	--	100	ND	--	--	100	ND	--	--
Di-n-octyl phthalate	ug/kg			800000	100	ND	--	--	100	ND	100	ND	--	--	100	ND	--	--	100	ND	--	--
Fluoranthene	ug/kg			3200000	20	ND	20	31	20	ND	20	ND	20	170	20	ND	20	240	20	ND	20	ND
Fluorene	ug/kg			3200000	20	ND	20	ND	20	ND	20	ND	20	ND	20	ND	20	ND	20	ND	20	ND
Hexachlorobenzene	ug/kg		625	64000	100	ND	--	--	100	ND	100	ND	--	--	100	ND	--	--	100	ND	--	--
Hexachlorobutadiene	ug/kg		12800	80000	500	ND	--	--	500	ND	500	ND	--	--	500	ND	--	--	500	ND	--	--
Hexachlorocyclopentadiene	ug/kg			480000	100	ND	--	--	100	ND	100	ND	--	--	100	ND	--	--	100	ND	--	--
Hexachloroethane	ug/kg		25000	56000	100	ND	--	--	100	ND	100	ND	--	--	100	ND	--	--	100	ND	--	--
Indeno(1,2,3-cd)pyrene	ug/kg		1370		20	ND	20	ND	20	ND	20	ND	20	ND	20	ND	20	38	20	ND	20	ND
Isophorone	ug/kg		1053000	16000000	100	ND	--	--	100	ND	100	ND	--	--	100	ND	--	--	100	ND	--	--
Naphthalene	ug/kg	5000		1600000	20	ND	20	36	20	ND	20	ND	20	ND	20	ND	20	ND	20	ND	20	ND
Nitrobenzene	ug/kg			160000	100	ND	--	--	100	ND	100	ND	--	--	100	ND	--	--	100	ND	--	--
n-Nitrosodimethylamine	ug/kg		19.6	640	25	ND	--	--	29	ND	23	ND	--	--	29	ND	--	--	31	ND	--	--
n-Nitrosodi-n-propylamine	ug/kg		143		86	ND	--	--	100	ND	80	ND	--	--	100	ND	--	--	110	ND	--	--
n-Nitrosodiphenylamine	ug/kg		204000		100	ND	--	--	100	ND	100	ND	--	--	100	ND	--	--	100	ND	--	--
Pentachlorophenol	ug/kg		2500	400000	58	ND	54	ND	61	ND	61	ND	63	ND	62	ND	69	ND	59	ND	53	ND
Phenanthrene	ug/kg				20	ND	20	23	20	ND	20	ND	20	28	20	ND	20	78	20	ND	20	21
Phenol	ug/kg			24000000	100	ND	--	--	100	ND	100	ND	--	--	100	ND	--	--	100	ND	--	--
Pyrene	ug/kg			2400000	20	ND	20	33	20	ND	20	ND	20	45	20	ND	20	120	20	ND	20	ND
Pyridine	ug/kg			80000	200	ND	--	--	200	ND	200	ND	--	--	200	ND	--	--	200	ND	--	--
VOCs																						
1,1,1,2-Tetrachloroethane	ug/kg		38500	2400000	10	ND	--	--	10	ND	10	ND	--	--	10	ND	--	--	10	ND	--	--
1,1,1-Trichloroethane	ug/kg	2000		160000000	10	ND	--	--	10	ND	10	ND	--	--	10	ND	--	--	10	ND	--	--
1,1,2,2-Tetrachloroethane	ug/kg		5000	1600000	1.1	ND	--	--	1.0	ND	0.87	ND	--	--	0.93	ND	--	--	0.91	ND	--	--
1,1,2-Trichloroethane	ug/kg		17500	320000	1.1	ND	--	--	0.96	ND	0.84	ND	--	--	0.90	ND	--	--	0.87	ND	--	--
1,1-Dichloroethane	ug/kg		175000	16000000	10	ND	--	--	10	ND	10	ND	--	--	10	ND	--	--	10	ND	--	--
1,1-Dichloroethylene	ug/kg			4000000	10	ND	--	--	10	ND	10	ND	--	--	10	ND	--	--	10	ND	--	--
1,1-Dichloropropene	ug/kg				10	ND	--	--	10	ND	10	ND	--	--	10	ND	--	--	10	ND	--	--
1,2,3-Trichlorobenzene	ug/kg				10	ND	--	--	10	ND	10	ND	--	--	10	ND	--	--	10	ND	--	--
1,2,3-Trichloropropane	ug/kg		33.3	320000	1.2	ND	--	--	1.0	ND	0.92	ND	--	--	0.98	ND	--	--	0.95	ND	--	--
1,2,4-Trichlorobenzene	ug/kg		34500	800000	10	ND	--	--	10	ND	10	ND	--	--	10	ND	--	--	10	ND	--	--
1,2,4-Trimethylbenzene	ug/kg				10	ND	--	--	10	ND	10	ND	--	--	10	ND	--	--	10	ND	--	--
1,2-Dibromo-3-chloropropane (DBCP)	ug/kg		1250	16000	50	ND	--	--	50	ND	50	ND	--	--	50	ND	--	--	50	ND	--	--
1,2-Dibromoethane (EDB)	ug/kg	5.00	500	720000	5.0	ND	--	--	5.0	ND	5.0	ND	--	--	5.0	ND	--	--	5.0	ND	--	--
1,2-Dichlorobenzene	ug/kg			7200000	10	ND	--	--	10	ND	10	ND	--	--	10	ND	--	--	10	ND	--	--
1,2-Dichloroethane	ug/kg		11000	480000	10	ND	--	--	10	ND	10	ND	--	--	10	ND	--	--	10	ND	--	--
1,2-Dichloroethylene, cis	ug/kg			160000	10	ND	--	--	10	ND	10	ND	--	--	10	ND	--	--	10	ND	--	--
1,2-Dichloroethylene, trans	ug/kg			1600000	10	ND	--	--	10	ND	10	ND	--	--	10	ND	--	--	10	ND	--	--
1,2-Dichloropropane	ug/kg		27800	7200000	10	ND	--	--	10	ND	10	ND	--	--	10	ND	--	--	10	ND	--	--
1,3,5-Trimethylbenzene	ug/kg			800000	10	ND	--	--	10	ND	10	ND	--	--	10	ND	--	--	10	ND	--	--
1,3-Dichlorobenzene	ug/kg				10	ND	--	--	10	ND	10	ND	--	--	10	ND	--	--	10	ND	--	--
1,3-Dichloropropane	ug/kg				10	ND	--	--	10	ND	10	ND	--	--	10	ND	--	--	10	ND	--	--
1,3-Dichloropropene, cis	ug/kg		10000	2400000	10	ND	--	--	10	ND	10	ND	--	--	10	ND	--	--	10	ND	--	--
1,3-Dichloropropene, trans	ug/kg		10000	2400000	10	ND	--	--	10	ND	10	ND	--	--	10	ND	--	--	10	ND	--	--
1,4-Dichlorobenzene	ug/kg		185000	5600000	10	ND	--	--	10	ND	10	ND	--	--	10	ND	--	--	10	ND	--	--
2,2-Dichloropropane	ug/kg				10	ND	--	--	10	ND	10	ND	--	--	10	ND	--	--	10	ND	--	--
2-Hexanone	ug/kg				50	ND	--	--	50	ND	50	ND	--	--	50	ND	--	--	50	ND	--	--
Acetone	ug/kg			72000000	50	ND	--	--	50	ND	50	ND	--	--	50	ND	--	--	50	ND	--	--

Table 1
Historical Soil Data Review - 2015 Landau PQLs vs. MTCA Cleanup Levels
Yakima Mill Site

				Location	MW-101		MW-102		MW-102		MW-103		MW-104		MW-104		MW-105		MW-105		MW-106	
				Date	9/05/2014		9/08/2014		9/08/2014		9/05/2014		9/03/2014		9/03/2014		9/02/2014		9/02/2014		9/09/2014	
				Depth	17.5 - 18.5 ft		4 - 5 ft		15 - 15.5 ft		20.5 - 21.5 ft		2.5 - 3 ft		19 - 20 ft		2.5 - 3.5 ft		17.5 - 19 ft		2.5 - 3.5 ft	
				Sample Type	N		N		N		N		N		N		N		N		N	
				Result Type	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result
				Data Status	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource
Parameter	Units	Washington Method A Unrestricted Land Use	Washington Method B Cancer Direct Contact	Washington Method B Noncancer Direct Contact																		
Effective Date		07/01/2015	07/01/2015	07/01/2015																		
Exceedance Key		No Exceedances	Shade	No Exceedances																		
Acrylonitrile	ug/kg		1850	3200000	50	ND	--	--	50	ND	50	ND	--	--	50	ND	--	--	50	ND	--	--
Benzene	ug/kg	30.0	18200	320000	5.0	ND	--	--	5.0	ND	5.0	ND	--	--	5.0	ND	--	--	5.0	ND	--	--
Bromobenzene	ug/kg				10	ND	--	--	10	ND	10	ND	--	--	10	ND	--	--	10	ND	--	--
Bromochloromethane	ug/kg				10	ND	--	--	10	ND	10	ND	--	--	10	ND	--	--	10	ND	--	--
Bromodichloromethane	ug/kg		16100	1600000	1.0	ND	--	--	0.91	ND	0.79	ND	--	--	0.84	ND	--	--	0.82	ND	--	--
Bromoform	ug/kg		127000	1600000	10	ND	--	--	10	ND	10	ND	--	--	10	ND	--	--	10	ND	--	--
Bromomethane	ug/kg			112000	10	ND	--	--	10	ND	10	ND	--	--	10	ND	--	--	10	ND	--	--
Butylbenzene	ug/kg			4000000	10	ND	--	--	10	ND	10	ND	--	--	10	ND	--	--	10	ND	--	--
Butylbenzene, sec	ug/kg			8000000	10	ND	--	--	10	ND	10	ND	--	--	10	ND	--	--	10	ND	--	--
Butylbenzene, tert	ug/kg			8000000	10	ND	--	--	10	ND	10	ND	--	--	10	ND	--	--	10	ND	--	--
Carbon disulfide	ug/kg			8000000	10	ND	--	--	10	ND	10	ND	--	--	10	ND	--	--	10	ND	--	--
Carbon tetrachloride	ug/kg		14300	320000	10	ND	--	--	10	ND	10	ND	--	--	10	ND	--	--	10	ND	--	--
Chlorobenzene	ug/kg			1600000	10	ND	--	--	10	ND	10	ND	--	--	10	ND	--	--	10	ND	--	--
Chlorodibromomethane	ug/kg		11900	1600000	10	ND	--	--	10	ND	10	ND	--	--	10	ND	--	--	10	ND	--	--
Chloroethane	ug/kg				10	ND	--	--	10	ND	10	ND	--	--	10	ND	--	--	10	ND	--	--
Chloroform	ug/kg		32300	800000	8.0	ND	--	--	8.0	ND	8.0	ND	--	--	8.0	ND	--	--	8.0	ND	--	--
Chloromethane	ug/kg				10	ND	--	--	10	ND	10	ND	--	--	10	ND	--	--	10	ND	--	--
Chlorotoluene, o	ug/kg			1600000	10	ND	--	--	10	ND	10	ND	--	--	10	ND	--	--	10	ND	--	--
Chlorotoluene, p	ug/kg				10	ND	--	--	10	ND	10	ND	--	--	10	ND	--	--	10	ND	--	--
Cumene (isopropyl benzene)	ug/kg			8000000	10	ND	--	--	10	ND	10	ND	--	--	10	ND	--	--	10	ND	--	--
Cymene p- (toluene isopropyl p-)	ug/kg				10	ND	--	--	10	ND	10	ND	--	--	10	ND	--	--	10	ND	--	--
Dibromomethane (methylene bromide)	ug/kg			800000	10	ND	--	--	10	ND	10	ND	--	--	10	ND	--	--	10	ND	--	--
Dichlorodifluoromethane (Freon-12)	ug/kg			16000000	10	ND	--	--	10	ND	10	ND	--	--	10	ND	--	--	10	ND	--	--
Ethyl benzene	ug/kg	6000		8000000	10	ND	--	--	10	ND	10	ND	--	--	10	ND	--	--	10	ND	--	--
Hexachlorobutadiene	ug/kg		12800	80000	10	ND	--	--	10	ND	10	ND	--	--	10	ND	--	--	10	ND	--	--
Methyl ethyl ketone (2-butanone)	ug/kg			48000000	50	ND	--	--	50	ND	50	ND	--	--	50	ND	--	--	50	ND	--	--
Methyl isobutyl ketone (MIBK)	ug/kg			6400000	50	ND	--	--	50	ND	50	ND	--	--	50	ND	--	--	50	ND	--	--
Methyl tertiary butyl ether (MTBE)	ug/kg	100	556000		10	ND	--	--	10	ND	10	ND	--	--	10	ND	--	--	10	ND	--	--
Methylene chloride	ug/kg	20.0	500000	480000	20	ND	--	--	20	ND	20	ND	--	--	20	ND	--	--	20	ND	--	--
Naphthalene	ug/kg	5000		1600000	10	ND	--	--	10	ND	10	ND	--	--	10	ND	--	--	10	ND	--	--
Propylbenzene	ug/kg			8000000	10	ND	--	--	10	ND	10	ND	--	--	10	ND	--	--	10	ND	--	--
Styrene	ug/kg			16000000	10	ND	--	--	10	ND	10	ND	--	--	10	ND	--	--	10	ND	--	--
Tetrachloroethylene	ug/kg	50.0	476000	480000	10	ND	--	--	10	ND	10	ND	--	--	10	ND	--	--	10	ND	--	--
Toluene	ug/kg	7000		6400000	10	ND	--	--	10	ND	10	ND	--	--	10	ND	--	--	10	ND	--	--
Trichloroethylene (TCE)	ug/kg	30.0	12000	40000	10	ND	--	--	10	ND	10	ND	--	--	10	ND	--	--	10	ND	--	--
Trichlorofluoromethane (Freon-11)	ug/kg			24000000	10	ND	--	--	10	ND	10	ND	--	--	10	ND	--	--	10	ND	--	--
Vinyl chloride	ug/kg			240000	0.042	ND	--	--	0.037	ND	0.033	ND	--	--	0.035	ND	--	--	0.034	ND	--	--
Xylene, m & p	ug/kg			16000000	20	ND	--	--	20	ND	20	ND	--	--	20	ND	--	--	20	ND	--	--
Xylene, o	ug/kg			16000000	10	ND	--	--	10	ND	10	ND	--	--	10	ND	--	--	10	ND	--	--
Pesticides																						
4,4'-DDD	mg/kg		4.17		0.0029	ND	--	--	0.0031	ND	0.0028	0.012	--	--	0.0031	ND	--	--	0.0029	ND	--	--
4,4'-DDE	mg/kg		2.94		0.0029	ND	--	--	0.0031	ND	0.0028	ND	--	--	0.0031	ND	--	--	0.0029	ND	--	--
4,4'-DDT	mg/kg	3.00	2.94	40.0	0.0029	ND	--	--	0.0031	ND	0.0028	0.0069	--	--	0.0031	ND	--	--	0.0029	ND	--	--
a-BHC	mg/kg		0.159	640	0.0029	ND	--	--	0.0031	ND	0.0028	ND	--	--	0.0031	ND	--	--	0.0029	ND	--	--
Aldrin	mg/kg		0.0588	2.40	0.0029	ND	--	--	0.0031	ND	0.0028	ND	--	--	0.0031	ND	--	--	0.0029	ND	--	--
b-BHC	mg/kg		0.556		0.0029	ND	--	--	0.0031	ND	0.0028	ND	--	--	0.0031	ND	--	--	0.0029	ND	--	--
Chlordane, alpha & gamma	mg/kg		2.86	40.0	0.0029	ND	--	--	0.0031	ND	0.0028	ND	--	--	0.0031	ND	--	--	0.0029	ND	--	--
d-BHC	mg/kg				0.0029	ND	--	--	0.0031	ND	0.0028	ND	--	--	0.0031	ND	--	--	0.0029	ND	--	--
Dieldrin	mg/kg		0.0625	4.00	0.0029	ND	--	--	0.0031	ND	0.0028	ND	--	--	0.0031	ND	--	--	0.0029	ND	--	--
Endosulfan I	mg/kg			480	0.0029	ND	--	--	0.0031	ND	0.0028	ND	--	--	0.0031	ND	--	--	0.0029	ND	--	--
Endosulfan II	mg/kg			480	0.0029	ND	--	--	0.0031	ND	0.0028	ND	--	--	0.0031	ND	--	--	0.0029	ND	--	--
Endosulfan sulfate	mg/kg			480	0.0029	ND	--	--	0.0031	ND	0.0028	ND	--	--	0.0031	ND	--	--	0.0029	ND	--	--
Endrin	mg/kg			24.0	0.0029	ND	--	--	0.0031	ND	0.0028	ND	--	--	0.0031	ND	--	--	0.0029	ND	--	--
Endrin aldehyde	mg/kg				0.0029	ND	--	--	0.0031	ND	0.0028	ND	--	--	0.0031	ND	--	--	0.0029	ND	--	--
g-BHC (Lindane)	mg/kg	0.0100	0.909	24.0	0.0029	ND	--	--	0.0031	ND	0.0028	ND	--	--	0.0031	ND	--	--	0.0029	ND	--	--
Heptachlor	mg/kg		0.222	40.0	0.0029	ND	--	--	0.0031	ND	0.0028	ND	--	--	0.0031	ND	--	--	0.0029	ND	--	--
Heptachlor epoxide	mg/kg		0.110	1.04	0.0029	ND	--	--	0.0031	ND	0.0028	ND	--	--	0.0031	ND	--	--	0.0029	ND	--	--
Hexachlorobenzene	mg/kg		0.625	64.0	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Methoxychlor	mg/kg			400	0.0029	ND	--	--	0.0031	ND	0.0028	ND	--	--	0.0031	ND	--	--	0.0029	ND	--	--
Toxaphene	mg/kg		0.909		0.15	ND	--	--	0.16	ND	0.14	ND	--	--	0.16	ND	--	--	0.15	ND	--	--

Table 1
Historical Soil Data Review - 2015 Landau PQLs vs. MTCA Cleanup Levels
Yakima Mill Site

				Location	MW-101		MW-102		MW-102		MW-103		MW-104		MW-104		MW-105		MW-105		MW-106	
				Date	9/05/2014		9/08/2014		9/08/2014		9/05/2014		9/03/2014		9/03/2014		9/02/2014		9/02/2014		9/09/2014	
				Depth	17.5 - 18.5 ft		4 - 5 ft		15 - 15.5 ft		20.5 - 21.5 ft		2.5 - 3 ft		19 - 20 ft		2.5 - 3.5 ft		17.5 - 19 ft		2.5 - 3.5 ft	
				Sample Type	N		N		N		N		N		N		N		N		N	
				Result Type	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result
				Data Status	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource
Parameter	Units	Washington Method A Unrestricted Land Use	Washington Method B Cancer Direct Contact	Washington Method B Noncancer Direct Contact																		
Effective Date		07/01/2015	07/01/2015	07/01/2015																		
Exceedance Key		No Exceedances	▨ Shade	No Exceedances																		
PCBs																						
Aroclor 1016	mg/kg		14.3	5.60	0.0059	ND	--	--	0.0061	ND	0.0056	ND	--	--	0.0061	ND	--	--	0.0057	ND	--	--
Aroclor 1221	mg/kg				0.012	ND	--	--	0.013	ND	0.012	ND	--	--	0.013	ND	--	--	0.012	ND	--	--
Aroclor 1232	mg/kg				0.0059	ND	--	--	0.0061	ND	0.0056	ND	--	--	0.0061	ND	--	--	0.0057	ND	--	--
Aroclor 1242	mg/kg				0.0059	ND	--	--	0.0061	ND	0.0056	ND	--	--	0.0061	ND	--	--	0.0057	0.0059	--	--
Aroclor 1248	mg/kg				0.0059	ND	--	--	0.0061	ND	0.0056	ND	--	--	0.0061	ND	--	--	0.0057	ND	--	--
Aroclor 1254	mg/kg		0.500	1.60	0.0059	ND	--	--	0.0061	ND	0.0056	ND	--	--	0.0061	ND	--	--	0.0057	ND	--	--
Aroclor 1260	mg/kg		0.500		0.0059	ND	--	--	0.0061	ND	0.0056	ND	--	--	0.0061	ND	--	--	0.0057	ND	--	--
Total Petroleum Hydrocarbons																						
Total Petroleum Hydrocarbons (as diesel)	mg/kg	2000			50	ND	25 50	ND	61	ND	50	ND	46 50	ND	50	ND	25 50	ND	50	ND	25 50	150 J 50
Total Petroleum Hydrocarbons (as diesel), silica gel	mg/kg	2000			--	--	25	ND	--	--	--	--	25	ND	--	--	25	ND	--	--	25	87 J
Total Petroleum Hydrocarbons (as gasoline)	mg/kg	30.0			20	ND	20	ND	25	ND	20	ND	20	ND	20	ND	20	ND	20	ND	3.0 20	35 20
Total Petroleum Hydrocarbons (as motor oil)	mg/kg	2000			100	ND	50 100	330 100	120	ND	100	ND	50 100	450 100	100	ND	50 100	510 100	100	ND	50 100	560 100
Total Petroleum Hydrocarbons (as motor oil), silica gel	mg/kg	2000			--	--	50	260	--	--	--	--	50	300	--	--	50	380	--	--	50	380

Landau qualifier - J: Indicates the analyte was positively identified; the associated numerical value is the approximate concentration of the analyte in the sample.

Landau qualifier - UJ: The analyte was not detected in the sample; the reported sample reporting limit is an estimate.
N: Normal Sample.
FD: Field Duplicate Sample.
ND: Not detected.
PQL: Practical Quantitation Limit.
SSource: Laboratory and/or field data obtained from a secondary source external to Barr. Second source QA/QC evaluation procedures may or may not have been performed beyond the original data generator.

Table was updated (items in red) after original submittal to add Landau qualifiers to be consistent with the memo.

Table 1
Historical Soil Data Review - 2015 Landau PQLs vs. MTCA Cleanup Levels
Yakima Mill Site

Location					MW-106		MW-107		MW-107		MW-108		MW-108		MW-109		MW-109	
Date					9/10/2014		9/09/2014		9/09/2014		9/04/2014		9/04/2014		9/11/2014		9/11/2014	
Depth					13.5 - 14.5 ft		2.5 - 3.5 ft		16 - 17 ft		2.5 - 3.5 ft		21.5 - 22.5 ft		5 - 5.5 ft		12.5 - 13 ft	
Sample Type					N		N		N		N		N		N		N	
Result Type					PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result
Data Status					SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource
Parameter	Units	Washington Method A Unrestricted Land Use	Washington Method B Cancer Direct Contact	Washington Method B Noncancer Direct Contact														
Effective Date		07/01/2015	07/01/2015	07/01/2015														
Exceedance Key		No Exceedances	Shade	No Exceedances														
General Parameters																		
Fluoride	mg/kg			3200	1.6	ND	1.6	2	1.6	ND	1.6	ND	1.6	ND	1.6	ND	1.6	ND
Nitrogen, nitrate, as N	mg/kg			128000	0.50	26	0.50	ND UJ	0.50	ND UJ	0.50	ND UJ	0.50	ND UJ	0.50	21	0.50	1.2
Nitrogen, nitrite, as N	mg/kg			8000	0.50	ND	0.50	ND UJ	0.50	ND UJ	0.50	ND UJ	0.50	ND UJ	0.50	ND	0.50	ND
pH	pH units				1.0	7.17	--	--	1.0	7.23	--	--	1.0	7.98	1.0	7.64	1.0	8.42
Metals																		
Arsenic	mg/kg	20.0	0.667	24.0	1.0	2.1	1.0	1.7	1.1	2.6	1.0	3.5	1.0	4.1	1.0	5.4	1.0	1.7
Barium	mg/kg			16000	0.50	94	0.50	88	0.50	190	0.50	140	0.50	73	0.50	150	0.50	63
Cadmium	mg/kg	2.00		80.0	0.50	1.1	0.50	ND	0.50	ND	0.50	ND	0.50	ND	0.50	ND	0.50	ND
Chromium	mg/kg				0.50	16	0.50	8.9	0.55	21	0.50	17	0.50	41	0.50	16	0.50	14
Chromium, hexavalent	mg/kg	19.0		240	5.0	ND	--	--	5.0	ND	--	--	5.0	ND	5.0	ND	5.0	ND
Iron	mg/kg			56000	50	24000	50	27000	50	40000	50	28000	50	23000	50	31000	50	23000
Lead	mg/kg	250			0.50	11	0.50	68	0.50	9.6	0.50	26	0.50	3.5	0.50	39	0.50	3.4
Manganese	mg/kg			11200	0.50	210	0.50	470	0.50	320	0.50	570	0.50	240	0.50	680	0.50	360
Mercury	mg/kg	2.00			0.02	0.035	0.02	0.038	0.02	0.073	0.02	0.12	0.020	ND	0.02	0.061	0.020	ND
Selenium	mg/kg			400	5.0	ND	5.0	ND	5.0	ND	5.0	ND	5.0	ND	5.0	ND	5.0	ND
Silver	mg/kg			400	0.50	ND	0.50	ND	0.50	ND	0.50	ND	0.50	ND	0.50	ND	0.50	ND
Sodium	mg/kg				50	490	50	520	50	1200	50	650	50	990	50	670	50	680
SVOCs																		
1,2,4-Trichlorobenzene	ug/kg		34500	800000	100	ND	--	--	100	ND	--	--	100	ND	100	ND	100	ND
1,2-Dichlorobenzene	ug/kg			7200000	100	ND	--	--	100	ND	--	--	100	ND	100	ND	100	ND
1,3-Dichlorobenzene	ug/kg				100	ND	--	--	100	ND	--	--	100	ND	100	ND	100	ND
1,4-Dichlorobenzene	ug/kg		185000	5600000	100	ND	--	--	100	ND	--	--	100	ND	100	ND	100	ND
1-Methylnaphthalene	ug/kg		34500	5600000	20	61	20	ND	20	ND	20	ND	20	ND	20	ND	20	ND
2,2'-oxybis (1-chloropropane)	ug/kg		14300	3200000	250	ND	--	--	250	ND	--	--	250	ND	250	ND	250	ND
2,3,4,6-Tetrachlorophenol	ug/kg			2400000	100	ND	--	--	100	ND	--	--	100	ND	100	ND	100	ND
2,4,5-Trichlorophenol	ug/kg			8000000	100	ND	--	--	100	ND	--	--	100	ND	100	ND	100	ND
2,4,6-Trichlorophenol	ug/kg		90900	80000	43	ND	--	--	52	ND	--	--	40	ND	38	ND	36	ND
2,4-Dichlorophenol	ug/kg			240000	260	ND	--	--	320	ND	--	--	250	ND	240	ND	220	ND
2,4-Dimethylphenol	ug/kg			1600000	100	ND	--	--	100	ND	--	--	100	ND	100	ND	100	ND
2,4-Dinitrophenol	ug/kg			160000	100	ND	--	--	100	ND	--	--	100	ND	100	ND	100	ND
2,4-Dinitrotoluene	ug/kg		3230	160000	23	ND	--	--	28	ND	--	--	22	ND	21	ND	19	ND
2,6-Dichlorophenol	ug/kg				250	ND	--	--	250	ND	--	--	250	ND	250	ND	250	ND
2,6-Dinitrotoluene	ug/kg		667	24000	40	ND	--	--	49	ND	--	--	38	ND	36	ND	33	ND
2-Chloronaphthalene	ug/kg			6400000	100	ND	--	--	100	ND	--	--	100	ND	100	ND	100	ND
2-Chlorophenol	ug/kg			400000	250	ND	--	--	250	ND	--	--	250	ND	250	ND	250	ND
2-Methyl-4,6-dinitrophenol	ug/kg				100	ND	--	--	100	ND	--	--	100	ND	100	ND	100	ND
2-Methylnaphthalene	ug/kg			320000	20	95	20	ND	20	ND	20	ND	20	ND	20	ND	20	ND
2-Methylphenol (o-cresol)	ug/kg			4000000	100	ND	--	--	100	ND	--	--	100	ND	100	ND	100	ND
2-Nitroaniline	ug/kg			800000	100	ND	--	--	100	ND	--	--	100	ND	100	ND	100	ND
2-Nitrophenol	ug/kg				100	ND	--	--	100	ND	--	--	100	ND	100	ND	100	ND
3,3`-Dichlorobenzidine	ug/kg		2220		180	ND	--	--	230	ND	--	--	170	ND	170	ND	150	ND
3,4-Methylphenol (m,p cresols)	ug/kg				100	ND	--	--	100	ND	--	--	100	ND	100	ND	100	ND
3-Nitroaniline	ug/kg				1000	ND	--	--	1000	ND	--	--	1000	ND	1000	ND	1000	ND
4-Bromophenyl phenyl ether	ug/kg				100	ND	--	--	100	ND	--	--	100	ND	100	ND	100	ND
4-Chloro-3-methylphenol	ug/kg				500	ND	--	--	500	ND	--	--	500	ND	500	ND	500	ND
4-Chloroaniline	ug/kg		5000	320000	1000	ND	--	--	1000	ND	--	--	1000	ND	1000	ND	1000	ND
4-Chlorophenyl phenyl ether	ug/kg				100	ND	--	--	100	ND	--	--	100	ND	100	ND	100	ND
4-Nitroaniline	ug/kg				250	ND	--	--	250	ND	--	--	250	ND	250	ND	250	ND
4-Nitrophenol	ug/kg				100	ND	--	--	100	ND	--	--	100	ND	100	ND	100	ND
Acenaphthene	ug/kg			4800000	20	ND	20	ND	20	ND	20	ND	20	ND	20	ND	20	ND
Acenaphthylene	ug/kg				20	ND	20	ND	20	ND	20	ND	20	ND	20	ND	20	ND
Aniline	ug/kg		175000	560000	50	ND	--	--	61	ND	--	--	47	ND	45	ND	42	ND
Anthracene	ug/kg			24000000	20	ND	20	ND	20	ND	20	ND	20	ND	20	ND	20	ND
Azobenzene	ug/kg		9090		100	ND	--	--	100	ND	--	--	100	ND	100	ND	100	ND
Benz(a)anthracene	ug/kg		1370		20	ND	20	ND	20	ND	20	52	20	ND	20	ND	20	ND
Benzo(a)pyrene	ug/kg	100	137		20	ND	20	ND	20	ND	20	ND	20	ND	20	ND	20	ND
Benzo(b)fluoranthene	ug/kg		1370		20	ND	20	ND	20	ND	20	ND	20	ND	20	ND	20	ND
Benzo(g,h,i)perylene	ug/kg				20	ND	20	ND	20	ND	20	ND	20	ND	20	ND	20	ND
Benzo(k)fluoranthene	ug/kg		13700		20	ND	20	ND	20	ND	20	ND	20	ND	20	21	20	ND

Table 1
Historical Soil Data Review - 2015 Landau PQLs vs. MTCA Cleanup Levels
Yakima Mill Site

				Location	MW-106		MW-107		MW-107		MW-108		MW-108		MW-109		MW-109	
				Date	9/10/2014		9/09/2014		9/09/2014		9/04/2014		9/04/2014		9/11/2014		9/11/2014	
				Depth	13.5 - 14.5 ft		2.5 - 3.5 ft		16 - 17 ft		2.5 - 3.5 ft		21.5 - 22.5 ft		5 - 5.5 ft		12.5 - 13 ft	
				Sample Type	N		N		N		N		N		N		N	
				Result Type	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result
				Data Status	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource
Parameter	Units	Washington Method A Unrestricted Land Use	Washington Method B Cancer Direct Contact	Washington Method B Noncancer Direct Contact														
Effective Date		07/01/2015	07/01/2015	07/01/2015														
Exceedance Key		No Exceedances	Shade	No Exceedances														
Benzoic acid	ug/kg			320000000	1000	ND	--	--	1000	ND	--	--	1000	ND	1000	ND	1000	ND
Benzyl alcohol	ug/kg			8000000	100	ND	--	--	100	ND	--	--	100	ND	100	ND	100	ND
Bis(2-chloroethoxy)methane	ug/kg				250	ND	--	--	250	ND	--	--	250	ND	250	ND	250	ND
Bis(2-chloroethyl)ether	ug/kg		909		100	ND	--	--	130	ND	--	--	98	ND	93	ND	87	ND
Bis(2-ethylhexyl)phthalate	ug/kg		71400	1600000	100	820	--	--	100	540	--	--	100	ND	100	100	100	190
Butyl benzyl phthalate	ug/kg		526000	16000000	100	ND	--	--	100	ND	--	--	100	ND	100	ND	100	ND
Carbazole	ug/kg				250	ND	--	--	250	ND	--	--	250	ND	250	ND	250	ND
Chrysene	ug/kg		137000		20	ND	20	ND	20	ND	20	ND	20	ND	20	24	20	ND
Dibenz(a,h)anthracene	ug/kg		137		20	ND	20	ND	20	ND	20	ND	20	ND	20	ND	20	ND
Dibenzofuran	ug/kg			80000	100	ND	--	--	100	ND	--	--	100	ND	100	ND	100	ND
Diethyl phthalate	ug/kg			64000000	100	ND	--	--	100	ND	--	--	100	ND	100	ND	100	ND
Dimethyl phthalate	ug/kg				100	ND	--	--	100	ND	--	--	100	ND	100	ND	100	ND
Di-n-butyl phthalate	ug/kg			8000000	100	ND	--	--	100	ND	--	--	100	ND	100	ND	100	ND
Di-n-octyl phthalate	ug/kg			800000	100	ND	--	--	100	ND	--	--	100	ND	100	ND	100	ND
Fluoranthene	ug/kg			3200000	20	28	20	ND	20	ND	20	23	20	ND	20	61	20	ND
Fluorene	ug/kg			3200000	20	ND	20	ND	20	ND	20	ND	20	ND	20	ND	20	ND
Hexachlorobenzene	ug/kg		625	64000	100	ND	--	--	100	ND	--	--	100	ND	100	ND	100	ND
Hexachlorobutadiene	ug/kg		12800	80000	500	ND	--	--	500	ND	--	--	500	ND	500	ND	500	ND
Hexachlorocyclopentadiene	ug/kg			480000	100	ND	--	--	100	ND	--	--	100	ND	100	ND	100	ND
Hexachloroethane	ug/kg		25000	56000	100	ND	--	--	100	ND	--	--	100	ND	100	ND	100	ND
Indeno(1,2,3-cd)pyrene	ug/kg		1370		20	ND	20	ND	20	ND	20	ND	20	ND	20	ND	20	ND
Isophorone	ug/kg		1053000	16000000	100	ND	--	--	100	ND	--	--	100	ND	100	ND	100	ND
Naphthalene	ug/kg	5000		1600000	20	ND	20	ND	20	ND	20	ND	20	ND	20	28	20	ND
Nitrobenzene	ug/kg			160000	100	ND	--	--	100	ND	--	--	100	ND	100	ND	100	ND
n-Nitrosodimethylamine	ug/kg		19.6	640	29	ND	--	--	35	ND	--	--	27	ND	26	ND	24	ND
n-Nitrosodi-n-propylamine	ug/kg		143		100	ND	--	--	120	ND	--	--	95	ND	90	ND	84	ND
n-Nitrosodiphenylamine	ug/kg		204000		100	110	--	--	100	ND	--	--	100	ND	100	ND	100	ND
Pentachlorophenol	ug/kg		2500	400000	55	ND	57	ND	76	ND	65	ND	55	ND	48	ND	51	ND
Phenanthrene	ug/kg				20	29	20	ND	20	ND	20	ND	20	ND	20	35	20	ND
Phenol	ug/kg			24000000	100	ND	--	--	100	ND	--	--	100	ND	100	ND	100	ND
Pyrene	ug/kg			2400000	20	24	20	ND	20	ND	20	ND	20	ND	20	47	20	ND
Pyridine	ug/kg			80000	200	ND	--	--	200	ND	--	--	200	ND	200	ND	200	ND
VOCs																		
1,1,1,2-Tetrachloroethane	ug/kg		38500	2400000	10	ND	--	--	10	ND	--	--	10	ND	10	ND	10	ND
1,1,1-Trichloroethane	ug/kg	2000		160000000	10	ND	--	--	10	ND	--	--	10	ND	10	ND	10	ND
1,1,2,2-Tetrachloroethane	ug/kg		5000	1600000	0.92	ND	--	--	1.4	ND	--	--	0.86	ND	1.1	ND	0.88	ND
1,1,2-Trichloroethane	ug/kg		17500	320000	0.89	ND	--	--	1.3	ND	--	--	0.83	ND	1.0	ND	0.85	ND
1,1-Dichloroethane	ug/kg		175000	16000000	10	ND	--	--	10	ND	--	--	10	ND	10	ND	10	ND
1,1-Dichloroethylene	ug/kg			4000000	10	ND	--	--	10	ND	--	--	10	ND	10	ND	10	ND
1,1-Dichloropropene	ug/kg				10	ND	--	--	10	ND	--	--	10	ND	10	ND	10	ND
1,2,3-Trichlorobenzene	ug/kg				10	ND	--	--	10	ND	--	--	10	ND	10	ND	10	ND
1,2,3-Trichloropropane	ug/kg		33.3	320000	0.97	ND	--	--	1.4	ND	--	--	0.90	ND	1.1	ND	0.92	ND
1,2,4-Trichlorobenzene	ug/kg		34500	800000	10	ND	--	--	10	ND	--	--	10	ND	10	ND	10	ND
1,2,4-Trimethylbenzene	ug/kg				10	ND	--	--	10	ND	--	--	10	ND	10	ND	10	ND
1,2-Dibromo-3-chloropropane (DBCP)	ug/kg		1250	16000	50	ND	--	--	50	ND	--	--	50	ND	50	ND	50	ND
1,2-Dibromoethane (EDB)	ug/kg	5.00	500	720000	5.0	ND	--	--	5.0	ND	--	--	5.0	ND	5.0	ND	5.0	ND
1,2-Dichlorobenzene	ug/kg			7200000	10	ND	--	--	10	ND	--	--	10	ND	10	ND	10	ND
1,2-Dichloroethane	ug/kg		11000	480000	10	ND	--	--	10	ND	--	--	10	ND	10	ND	10	ND
1,2-Dichloroethylene, cis	ug/kg			160000	10	ND	--	--	10	ND	--	--	10	ND	10	ND	10	ND
1,2-Dichloroethylene, trans	ug/kg			1600000	10	ND	--	--	10	ND	--	--	10	ND	10	ND	10	ND
1,2-Dichloropropane	ug/kg		27800	7200000	10	ND	--	--	10	ND	--	--	10	ND	10	ND	10	ND
1,3,5-Trimethylbenzene	ug/kg			800000	10	ND	--	--	10	ND	--	--	10	ND	10	ND	10	ND
1,3-Dichlorobenzene	ug/kg				10	ND	--	--	10	ND	--	--	10	ND	10	ND	10	ND
1,3-Dichloropropane	ug/kg				10	ND	--	--	10	ND	--	--	10	ND	10	ND	10	ND
1,3-Dichloropropene, cis	ug/kg		10000	2400000	10	ND	--	--	10	ND	--	--	10	ND	10	ND	10	ND
1,3-Dichloropropene, trans	ug/kg		10000	2400000	10	ND	--	--	10	ND	--	--	10	ND	10	ND	10	ND
1,4-Dichlorobenzene	ug/kg		185000	5600000	10	ND	--	--	10	ND	--	--	10	ND	10	ND	10	ND
2,2-Dichloropropane	ug/kg				10	ND	--	--	10	ND	--	--	10	ND	10	ND	10	ND
2-Hexanone	ug/kg				50	ND	--	--	50	ND	--	--	50	ND	50	ND	50	ND
Acetone	ug/kg			72000000	50	ND	--	--	50	ND	--	--	50	ND	50	ND	50	ND

Table 1
Historical Soil Data Review - 2015 Landau PQLs vs. MTCA Cleanup Levels
Yakima Mill Site

				Location	MW-106		MW-107		MW-107		MW-108		MW-108		MW-109		MW-109	
				Date	9/10/2014		9/09/2014		9/09/2014		9/04/2014		9/04/2014		9/11/2014		9/11/2014	
				Depth	13.5 - 14.5 ft		2.5 - 3.5 ft		16 - 17 ft		2.5 - 3.5 ft		21.5 - 22.5 ft		5 - 5.5 ft		12.5 - 13 ft	
				Sample Type	N		N		N		N		N		N		N	
				Result Type	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result
				Data Status	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource
Parameter	Units	Washington Method A Unrestricted Land Use	Washington Method B Cancer Direct Contact	Washington Method B Noncancer Direct Contact														
Effective Date		07/01/2015	07/01/2015	07/01/2015														
Exceedance Key		No Exceedances	Shade	No Exceedances														
Acrylonitrile	ug/kg		1850	3200000	50	ND	--	--	50	ND	--	--	50	ND	50	ND	50	ND
Benzene	ug/kg	30.0	18200	320000	5.0	ND	--	--	5.0	ND	--	--	5.0	ND	5.0	ND	5.0	ND
Bromobenzene	ug/kg				10	ND	--	--	10	ND	--	--	10	ND	10	ND	10	ND
Bromochloromethane	ug/kg				10	ND	--	--	10	ND	--	--	10	ND	10	ND	10	ND
Bromodichloromethane	ug/kg		16100	1600000	0.84	ND	--	--	1.2	ND	--	--	0.78	ND	0.99	ND	0.80	ND
Bromoform	ug/kg		127000	1600000	10	ND	--	--	10	ND	--	--	10	ND	10	ND	10	ND
Bromomethane	ug/kg			112000	10	ND	--	--	10	ND	--	--	10	ND	10	ND	10	ND
Butylbenzene	ug/kg			4000000	10	ND	--	--	10	ND	--	--	10	ND	10	ND	10	ND
Butylbenzene, sec	ug/kg			8000000	10	ND	--	--	10	ND	--	--	10	ND	10	ND	10	ND
Butylbenzene, tert	ug/kg			8000000	10	ND	--	--	10	ND	--	--	10	ND	10	ND	10	ND
Carbon disulfide	ug/kg			8000000	10	ND	--	--	10	ND	--	--	10	ND	10	ND	10	ND
Carbon tetrachloride	ug/kg		14300	320000	10	ND	--	--	10	ND	--	--	10	ND	10	ND	10	ND
Chlorobenzene	ug/kg			1600000	10	ND	--	--	10	ND	--	--	10	ND	10	ND	10	ND
Chlorodibromomethane	ug/kg		11900	1600000	10	ND	--	--	10	ND	--	--	10	ND	10	ND	10	ND
Chloroethane	ug/kg				10	ND	--	--	10	ND	--	--	10	ND	10	ND	10	ND
Chloroform	ug/kg		32300	800000	8.0	ND	--	--	8.0	ND	--	--	8.0	ND	8.0	ND	8.0	ND
Chloromethane	ug/kg				10	ND	--	--	10	ND	--	--	10	ND	10	ND	10	ND
Chlorotoluene, o	ug/kg			1600000	10	ND	--	--	10	ND	--	--	10	ND	10	ND	10	ND
Chlorotoluene, p	ug/kg				10	ND	--	--	10	ND	--	--	10	ND	10	ND	10	ND
Cumene (isopropyl benzene)	ug/kg			8000000	10	ND	--	--	10	ND	--	--	10	ND	10	ND	10	ND
Cymene p- (toluene isopropyl p-)	ug/kg				10	ND	--	--	10	ND	--	--	10	ND	10	ND	10	ND
Dibromomethane (methylene bromide)	ug/kg			800000	10	ND	--	--	10	ND	--	--	10	ND	10	ND	10	ND
Dichlorodifluoromethane (Freon-12)	ug/kg			16000000	10	ND	--	--	10	ND	--	--	10	ND	10	ND	10	ND
Ethyl benzene	ug/kg	6000		8000000	10	ND	--	--	10	ND	--	--	10	ND	10	ND	10	ND
Hexachlorobutadiene	ug/kg		12800	80000	10	ND	--	--	10	ND	--	--	10	ND	10	ND	10	ND
Methyl ethyl ketone (2-butanone)	ug/kg			48000000	50	ND	--	--	50	ND	--	--	50	ND	50	ND	50	ND
Methyl isobutyl ketone (MIBK)	ug/kg			6400000	50	ND	--	--	50	ND	--	--	50	ND	50	ND	50	ND
Methyl tertiary butyl ether (MTBE)	ug/kg	100	556000		10	ND	--	--	10	ND	--	--	10	ND	10	ND	10	ND
Methylene chloride	ug/kg	20.0	500000	480000	20	ND	--	--	20	ND	--	--	20	ND	20	ND	20	ND
Naphthalene	ug/kg	5000		1600000	10	ND	--	--	10	ND	--	--	10	ND	10	ND	10	ND
Propylbenzene	ug/kg			8000000	10	ND	--	--	10	ND	--	--	10	ND	10	ND	10	ND
Styrene	ug/kg			16000000	10	ND	--	--	10	ND	--	--	10	ND	10	ND	10	ND
Tetrachloroethylene	ug/kg	50.0	476000	480000	10	ND	--	--	10	ND	--	--	10	ND	10	ND	10	ND
Toluene	ug/kg	7000		6400000	10	ND	--	--	10	ND	--	--	10	ND	10	ND	10	ND
Trichloroethylene (TCE)	ug/kg	30.0	12000	40000	10	ND	--	--	10	ND	--	--	10	ND	10	ND	10	ND
Trichlorofluoromethane (Freon-11)	ug/kg			24000000	10	ND	--	--	10	ND	--	--	10	ND	10	ND	10	ND
Vinyl chloride	ug/kg			240000	0.034	ND	--	--	0.051	ND	--	--	0.032	ND	0.041	ND	0.033	ND
Xylene, m & p	ug/kg			16000000	20	ND	--	--	20	ND	--	--	20	ND	20	ND	20	ND
Xylene, o	ug/kg			16000000	10	ND	--	--	10	ND	--	--	10	ND	10	ND	10	ND
Pesticides																		
4,4'-DDD	mg/kg		4.17		0.0032	ND	--	--	0.0036	ND	--	--	0.0031	ND	0.0026	ND	0.0026	ND
4,4'-DDE	mg/kg		2.94		0.0032	ND	--	--	0.0036	ND	--	--	0.0031	ND	0.0026	0.022	0.0026	ND
4,4'-DDT	mg/kg	3.00	2.94	40.0	0.0032	ND	--	--	0.0036	ND	--	--	0.0031	ND	0.0026	0.032	0.0026	ND
a-BHC	mg/kg		0.159	640	0.0032	ND	--	--	0.0036	ND	--	--	0.0031	ND	0.0026	ND	0.0026	ND
Aldrin	mg/kg		0.0588	2.40	0.0032	0.0094	--	--	0.0036	ND	--	--	0.0031	ND	0.0026	ND	0.0026	ND
b-BHC	mg/kg		0.556		0.0032	ND	--	--	0.0036	ND	--	--	0.0031	ND	0.0026	ND	0.0026	ND
Chlordane, alpha & gamma	mg/kg		2.86	40.0	0.0032	ND	--	--	0.0036	ND	--	--	0.0031	ND	0.0026	ND	0.0026	ND
d-BHC	mg/kg				0.0032	ND	--	--	0.0036	ND	--	--	0.0031	ND	0.0026	ND	0.0026	ND
Dieldrin	mg/kg		0.0625	4.00	0.0032	ND	--	--	0.0036	ND	--	--	0.0031	ND	0.0026	ND	0.0026	ND
Endosulfan I	mg/kg			480	0.0032	ND	--	--	0.0036	ND	--	--	0.0031	ND	0.0026	ND	0.0026	ND
Endosulfan II	mg/kg			480	0.0032	ND	--	--	0.0036	ND	--	--	0.0031	ND	0.0026	ND	0.0026	ND
Endosulfan sulfate	mg/kg			480	0.0032	ND	--	--	0.0036	ND	--	--	0.0031	ND	0.0026	ND	0.0026	ND
Endrin	mg/kg			24.0	0.0032	ND	--	--	0.0036	ND	--	--	0.0031	ND	0.0026	ND	0.0026	ND
Endrin aldehyde	mg/kg				0.0032	ND	--	--	0.0036	ND	--	--	0.0031	ND	0.0026	ND	0.0026	ND
g-BHC (Lindane)	mg/kg	0.0100	0.909	24.0	0.0032	ND	--	--	0.0036	ND	--	--	0.0031	ND	0.0026	ND	0.0026	ND
Heptachlor	mg/kg		0.222	40.0	0.0032	ND	--	--	0.0036	ND	--	--	0.0031	ND	0.0026	ND	0.0026	ND
Heptachlor epoxide	mg/kg		0.110	1.04	0.0032	ND	--	--	0.0036	ND	--	--	0.0031	ND	0.0026	ND	0.0026	ND
Hexachlorobenzene	mg/kg		0.625	64.0	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Methoxychlor	mg/kg			400	0.0032	ND	--	--	0.0036	ND	--	--	0.0031	ND	0.0026	ND	0.0026	ND
Toxaphene	mg/kg		0.909		0.16	ND	--	--	0.18	ND	--	--	0.16	ND	0.13	ND	0.13	ND

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Table 1
Historical Soil Data Review - 2015 Landau PQLs vs. MTCA Cleanup Levels
Yakima Mill Site

				Location	**MW-106**		**MW-107**		**MW-107**		**MW-108**		**MW-108**		**MW-109**		**MW-109**	
				Date	**9/10/2014**		**9/09/2014**		**9/09/2014**		**9/04/2014**		**9/04/2014**		**9/11/2014**		**9/11/2014**	
				Depth	**13.5 - 14.5 ft**		**2.5 - 3.5 ft**		**16 - 17 ft**		**2.5 - 3.5 ft**		**21.5 - 22.5 ft**		**5 - 5.5 ft**		**12.5 - 13 ft**	
				Sample Type	**N**		**N**		**N**		**N**		**N**		**N**		**N**	
				Result Type	**PQL**	**Result**	**PQL**	**Result**	**PQL**	**Result**	**PQL**	**Result**	**PQL**	**Result**	**PQL**	**Result**	**PQL**	**Result**
				Data Status	**SSource**	**SSource**	**SSource**	**SSource**	**SSource**	**SSource**	**SSource**	**SSource**	**SSource**	**SSource**	**SSource**	**SSource**	**SSource**	**SSource**
Parameter	Units	Washington Method A Unrestricted Land Use	Washington Method B Cancer Direct Contact	Washington Method B Noncancer Direct Contact														
Effective Date		07/01/2015	07/01/2015	07/01/2015														
Exceedance Key		No Exceedances	Shade	No Exceedances														
PCBs																		
Aroclor 1016	mg/kg		14.3	5.60	0.0064	ND	--	--	0.0074	ND	--	--	0.0062	ND	0.0052	ND	0.0052	ND
Aroclor 1221	mg/kg				0.013	ND	--	--	0.015	ND	--	--	0.013	ND	0.011	ND	0.011	ND
Aroclor 1232	mg/kg				0.0064	ND	--	--	0.0074	ND	--	--	0.0062	ND	0.0052	ND	0.0052	ND
Aroclor 1242	mg/kg				0.0064	0.028	--	--	0.0074	ND	--	--	0.0062	ND	0.0052	ND	0.0052	ND
Aroclor 1248	mg/kg				0.0064	ND	--	--	0.0074	ND	--	--	0.0062	ND	0.0052	ND	0.0052	ND
Aroclor 1254	mg/kg		0.500	1.60	0.0064	ND	--	--	0.0074	ND	--	--	0.0062	ND	0.0052	ND	0.0052	ND
Aroclor 1260	mg/kg		0.500		0.0064	ND	--	--	0.0074	ND	--	--	0.0062	ND	0.0052	ND	0.0052	ND
Total Petroleum Hydrocarbons																		
Total Petroleum Hydrocarbons (as diesel)	mg/kg	2000			50	ND	120 50	300 ND	50	ND	25 50	ND	50	ND	50	ND	50	ND
Total Petroleum Hydrocarbons (as diesel), silica gel	mg/kg	2000			--	--	25	250	--	--	25	ND	--	--	--	--	--	--
Total Petroleum Hydrocarbons (as gasoline)	mg/kg	30.0			20	ND	20	ND	20	ND	20	ND	20	ND	20	ND	20	ND
Total Petroleum Hydrocarbons (as motor oil)	mg/kg	2000			100	ND	250 100	990 100	100	ND	50 100	160 100	100	ND	100	ND	100	ND
Total Petroleum Hydrocarbons (as motor oil), silica gel	mg/kg	2000			--	--	50	820	--	--	50	130	--	--	--	--	--	--

Landau qualifier - J: Indicates the analyte was positively identified; the associated numerical value is the approximate concentration of the analyte in the sample.

Landau qualifier - UJ: The analyte was not detected in the sample; the reported sample reporting limit is an estimate.
N: Normal Sample.
FD: Field Duplicate Sample.
ND: Not detected.
PQL: Practical Quantitation Limit.
SSource: Laboratory and/or field data obtained from a secondary source external to Barr. Second source QA/QC evaluation procedures may or may not have been performed beyond the original data generator.

Table was updated (items in red) after original submittal to add Landau qualifiers to be consistent with the memo.

Table 2
Historical Groundwater Data - 2015 Landau PQLs vs. MTCA Cleanup Levels
Yakima Mill Site

					Location	FPP-MW-01		FPP-MW-01		FPP-MW-01		FPP-MW-02		FPP-MW-02		FPP-MW-02		FPP-MW-03		FPP-MW-03		FPP-MW-03	
					Date	12/19/2014		3/24/2015		6/25/2015		12/18/2014		3/26/2015		6/24/2015		9/16/2014		9/16/2014		12/18/2014	
					Sample Type	N		N		N		N		N		N		N		FD		N	
					Result Type	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result
					Data Status	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource
Parameter	Total or Dissolved	Units	Washington GW Method A	Washington Groundwater Method B Cancer	Washington Groundwater Method B Noncancer																		
Effective Date			07/01/2015	07/01/2015	07/01/2015																		
Exceedance Key			No Exceedances	Shade	Border																		
General Parameters																							
Alkalinity, bicarbonate, as CaCO3	NA	mg/l				15	320	0.0	260	15	440	0.0	240	0.0	260	15	200	15	120	15	120	0.0	120
Alkalinity, total, as CaCO3	NA	mg/l				15	320	0.0	260	15	440	0.0	240	0.0	260	15	200	15	120	15	120	0.0	120
Carbon, total organic	NA	mg/l				5.0	21	10	15	10	28	0.50	6.2	1.0	9.8	0.50	5.8	0.50	1.8	0.50	1.8	0.50	1.4
Chloride	NA	mg/l				0.92	44	0.92	30	0.92	90	0.092	18	0.092	15	0.92	14	0.092	9.7	0.092	9.2	0.092	8.7
Fluoride	NA	mg/l			0.64	0.16	0.29	0.16	0.27	0.16	ND	0.16	0.49	0.16	0.26	0.16	0.19	0.16	0.33 J	0.16	ND UJ	0.16	0.50
Nitrogen, ammonia, as N	NA	mg/l				0.050	3.6	0.050	3.1	0.050	3.6	0.050	2.1	0.050	4.8	0.050	1.0	0.050	0.43	0.050	0.52	0.050	0.27
Nitrogen, nitrate, as N	NA	mg/l			25.6	0.034	0.038	0.034	ND	0.034	ND	0.034	0.063	0.034	ND	0.034	ND	0.034	ND	0.034	ND	0.034	ND
Nitrogen, nitrite, as N	NA	mg/l			1.6	0.043	ND	0.043	ND	0.043	ND	0.043	ND	0.043	ND	0.043	ND	0.043	ND	0.043	ND	0.043	ND
Solids, total dissolved	NA	mg/l				5.0	490	5.0	320	5.0	590	5.0	240	5.0	280	5.0	220	5.0	170	5.0	180	5.0	140
Sulfate, as SO4	NA	mg/l				0.26	ND	0.26	ND	0.26	2.7	0.26	ND	0.26	19	2.6	4.3	0.26	9.7	0.26	9.5	0.26	10
Metals																							
Arsenic	Dissolved	ug/l	5.00	0.0583	4.80	0.45	2.3	0.45	2	0.45	4.1	0.45	4.2	0.45	5.9	0.45	2.5	1.0	1.4	1.0	1.4	0.45	0.58
Arsenic	Total	ug/l	5.00	0.0583	4.80	0.45	2.3	0.45	2.6	0.45	2.8	0.45	4.2	0.45	7.6	2.5	ND	1.0	1.2	1.0	1.7	0.45	ND
Barium	Dissolved	ug/l			3200	1.0	99	1.0	63	1.0	120	1.0	33	1.0	40	1.0	27	1.0	15	1.0	15	1.0	20
Barium	Total	ug/l			3200	1.0	100	1.0	73	1.0	130	1.0	36	1.0	44	1.0	29	1.0	15	1.0	15	1.0	20
Cadmium	Dissolved	ug/l	5.00		8.00	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND
Cadmium	Total	ug/l	5.00		8.00	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND
Calcium	Dissolved	ug/l				100	64000	100	50000	100	81000	100	36000	100	39000	100	31000	100	22000	100	22000	100	25000
Calcium	Total	ug/l				100	65000	100	53000	100	89000	100	38000	100	40000	100	33000	100	22000	100	22000	100	25000
Chromium	Dissolved	ug/l	50.0			2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
Chromium	Total	ug/l	50.0			2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
Chromium, hexavalent	Dissolved	ug/l			48.0	--	--	--	--	--	--	--	--	--	--	--	--	10	ND UJ	10	ND UJ	--	--
Chromium, hexavalent	Total	ug/l			48.0	--	--	--	--	--	--	--	--	--	--	--	--	10	ND UJ	10	ND UJ	--	--
Iron	Dissolved	ug/l			11200	50	43000	50	32000	50	53000	50	17000	50	15000	50	14000	50	7600	50	7500	50	7900
Iron	Total	ug/l			11200	50	43000	50	35000	50	57000	50	18000	50	17000	50	15000	50	7700	50	7500	50	7600
Lead	Dissolved	ug/l	15.0			0.28	ND	0.28	ND	0.28	ND	0.28	ND	0.28	ND	0.28	ND	1.0	ND	1.0	ND	0.28	ND
Lead	Total	ug/l	15.0			0.28	ND	0.28	ND	0.28	ND	0.28	ND	0.28	ND	0.28	ND	1.0	ND	1.0	ND	0.28	ND
Magnesium	Dissolved	ug/l				50	19000	50	14000	50	25000	50	13000	50	14000	50	11000	50	8500	50	8500	50	9700
Magnesium	Total	ug/l				50	19000	50	15000	50	27000	50	13000	50	14000	50	12000	50	8700	50	8600	50	9600
Manganese	Dissolved	ug/l			2240	2.0	3700	2.0	2700	10	5300	2.0	1500	2.0	1400	2.0	1500	2.0	440	2.0	440	2.0	390
Manganese	Total	ug/l			2240	2.0	3800	2.0	2900	10	5800	2.0	1600	2.0	1500	2.0	1600	2.0	450	2.0	440	2.0	390
Mercury	Dissolved	ug/l	2.00			0.11	ND	0.11	ND	0.11	ND	0.11	ND	0.20	ND	0.11	ND	0.20	ND	0.20	ND	0.11	ND
Mercury	Total	ug/l	2.00			0.11	ND	0.11	ND	0.11	ND	0.11	ND	0.11	ND	0.11	ND	0.20	ND	0.20	ND	0.11	ND
Potassium	Dissolved	ug/l				--	--	50	6400	50	7900	--	--	50	5600	50	4200	--	--	--	--	--	--
Potassium	Total	ug/l				--	--	50	6700	50	8700	--	--	50	5800	50	4400	--	--	--	--	--	--
Selenium	Dissolved	ug/l			80.0	4.0	ND	4.0	ND	4.0	ND	4.0	ND	4.0	ND	4.0	ND	4.0	ND	4.0	ND	4.0	ND
Selenium	Total	ug/l			80.0	4.0	ND	4.0	ND	4.0	ND	4.0	ND	4.0	ND	4.0	ND	4.0	ND	4.0	ND	4.0	ND
Silver	Dissolved	ug/l			80.0	0.20	ND	0.20	ND	0.20	ND	0.20	ND	0.20	ND	0.20	ND	1.0	ND	1.0	ND	0.20	ND
Silver	Total	ug/l			80.0	0.20	ND	0.20	ND	0.20	ND	0.20	ND	0.20	ND	0.20	ND	1.0	ND	1.0	ND	0.20	ND
Sodium	Dissolved	ug/l				50	53000	50	42000	50	62000	50	36000	50	42000	50	32000	50	16000	50	16000	50	15000
Sodium	Total	ug/l				50	53000	50	45000	50	68000	50	38000	50	42000	50	34000	50	16000	50	16000	50	15000
SVOCs																							
1,2,4-Trichlorobenzene	NA	ug/l		1.51	80.0	--	--	--	--	--	--	--	--	--	--	--	--	2.0	ND	2.0	ND	2.0	ND
1,2-Dichlorobenzene	NA	ug/l			720	--	--	--	--	--	--	--	--	--	--	--	--	2.0	ND	2.0	ND	2.0	ND
1,3-Dichlorobenzene	NA	ug/l				--	--	--	--	--	--	--	--	--	--	--	--	2.0	ND	2.0	ND	2.0	ND
1,4-Dichlorobenzene	NA	ug/l		8.10	560	--	--	--	--	--	--	--	--	--	--	--	--	2.0	ND	2.0	ND	2.0	ND
1-Methylnaphthalene	NA	ug/l		1.51	560	0.020	ND	0.020	ND	0.020	ND	0.020	ND	0.020	ND	0.020	ND	0.020	ND	0.020	ND	0.020	ND
2,2'-oxybis (1-chloropropane)	NA	ug/l		0.625	320	--	--	--	--	--	--	--	--	--	--	--	--	2.0	ND	2.0	ND	2.0	ND
2,3,4,6-Tetrachlorophenol	NA	ug/l			480	--	--	--	--	--	--	--	--	--	--	--	--	2.0	ND	2.0	ND	2.0	ND
2,4,5-Trichlorophenol	NA	ug/l			800	--	--	--	--	--	--	--	--	--	--	--	--	2.0	ND	2.0	ND	2.0	ND
2,4,6-Trichlorophenol	NA	ug/l		3.98	8.00	--	--	--	--	--	--	--	--	--	--	--	--	2.0	ND	2.0	ND	0.83	ND
2,4-Dichlorophenol	NA	ug/l			24.0	--	--	--	--	--	--	--	--	--	--	--	--	2.0	ND	2.0	ND	2.0	ND
2,4-Dimethylphenol	NA	ug/l			160	--	--	--	--	--	--	--	--	--	--	--	--	2.0	ND	2.0	ND	2.0	ND
2,4-Dinitrophenol	NA	ug/l			32.0	--	--	--	--	--	--	--	--	--	--	--	--	10	ND	10	ND	10	ND
2,4-Dinitrotoluene	NA	ug/l		0.282	32.0	--	--	--	--	--	--	--	--	--	--	--	--	0.78	ND	0.78	ND	0.72	ND
2,6-Dichlorophenol	NA	ug/l				--	--	--	--	--	--	--	--	--	--	--	--	2.0	ND	2.0	ND	2.0	ND

Table 2
Historical Groundwater Data - 2015 Landau PQLs vs. MTCA Cleanup Levels
Yakima Mill Site

					Location	FPP-MW-01		FPP-MW-01		FPP-MW-01		FPP-MW-02		FPP-MW-02		FPP-MW-02		FPP-MW-03		FPP-MW-03		FPP-MW-03	
					Date	12/19/2014		3/24/2015		6/25/2015		12/18/2014		3/26/2015		6/24/2015		9/16/2014		9/16/2014		12/18/2014	
					Sample Type	N		N		N		N		N		N		N		FD		N	
					Result Type	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result
					Data Status	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource
Parameter	Total or Dissolved	Units	Washington GW Method A	Washington Groundwater Method B Cancer	Washington Groundwater Method B Noncancer																		
Effective Date			07/01/2015	07/01/2015	07/01/2015																		
Exceedance Key			No Exceedances	Shade	Border																		
2,6-Dinitrotoluene	NA	ug/l		0.0583	4.80	--	--	--	--	--	--	--	--	--	--	--	--	1.8	ND	1.8	ND	1.7	ND
2-Chloronaphthalene	NA	ug/l			640	--	--	--	--	--	--	--	--	--	--	--	--	2.0	ND	2.0	ND	2.0	ND
2-Chlorophenol	NA	ug/l			40.0	--	--	--	--	--	--	--	--	--	--	--	--	2.0	ND	2.0	ND	2.0	ND
2-Methyl-4,6-dinitrophenol	NA	ug/l				--	--	--	--	--	--	--	--	--	--	--	--	2.0	ND	2.0	ND	2.0	ND
2-Methylnaphthalene	NA	ug/l			32.0	0.020	ND	0.020	ND	0.020	ND	0.020	ND	0.020	ND	0.020	ND	0.020	ND	0.020	ND	0.020	ND
2-Methylphenol (o-cresol)	NA	ug/l			400	--	--	--	--	--	--	--	--	--	--	--	--	2.0	ND	2.0	ND	2.0	ND
2-Nitroaniline	NA	ug/l			160	--	--	--	--	--	--	--	--	--	--	--	--	2.0	ND	2.0	ND	2.0	ND
2-Nitrophenol	NA	ug/l				--	--	--	--	--	--	--	--	--	--	--	--	2.0	ND	2.0	ND	2.0	ND
3,3`-Dichlorobenzidine	NA	ug/l		0.194		--	--	--	--	--	--	--	--	--	--	--	--	2.0	ND	2.0	ND	1.9	ND
3,4-Methylphenol (m,p cresols)	NA	ug/l				--	--	--	--	--	--	--	--	--	--	--	--	2.0	ND	2.0	ND	2.0	ND
3-Nitroaniline	NA	ug/l				--	--	--	--	--	--	--	--	--	--	--	--	5.0	ND	5.0	ND	5.0	ND
4-Bromophenyl phenyl ether	NA	ug/l				--	--	--	--	--	--	--	--	--	--	--	--	2.0	ND	2.0	ND	2.0	ND
4-Chloro-3-methylphenol	NA	ug/l				--	--	--	--	--	--	--	--	--	--	--	--	2.0	ND	2.0	ND	2.0	ND
4-Chloroaniline	NA	ug/l		0.219	32.0	--	--	--	--	--	--	--	--	--	--	--	--	2.0	ND	2.0	ND	1.8	ND
4-Chlorophenyl phenyl ether	NA	ug/l				--	--	--	--	--	--	--	--	--	--	--	--	2.0	ND	2.0	ND	2.0	ND
4-Nitroaniline	NA	ug/l				--	--	--	--	--	--	--	--	--	--	--	--	2.0	ND	2.0	ND	2.0	ND
4-Nitrophenol	NA	ug/l				--	--	--	--	--	--	--	--	--	--	--	--	2.0	ND	2.0	ND	2.0	ND
Acenaphthene	NA	ug/l			960	0.014	ND	0.014	ND	0.014	ND	0.014	ND	0.014	ND	0.014	ND	0.020	ND	0.020	ND	0.014	ND
Acenaphthylene	NA	ug/l				0.020	ND	0.020	ND	0.020	ND	0.020	ND	0.020	ND	0.020	ND	0.020	ND	0.020	ND	0.020	ND
Aniline	NA	ug/l		7.68	56.0	--	--	--	--	--	--	--	--	--	--	--	--	2.0	ND	2.0	ND	2.0	ND
Anthracene	NA	ug/l			4800	0.010	ND	0.010	ND	0.010	ND	0.010	ND	0.010	0.012	0.010	ND	0.020	ND	0.020	ND	0.010	ND
Azobenzene	NA	ug/l		0.795		--	--	--	--	--	--	--	--	--	--	--	--	2.0	ND	2.0	ND	1.5	ND
Benz(a)anthracene	NA	ug/l		0.120		0.017	ND	0.017	ND	0.017	ND	0.017	ND	0.017	ND	0.017	ND	0.020	ND	0.020	ND	0.017	ND
Benzo(a)pyrene	NA	ug/l	0.100	0.0120		0.027	ND	0.027	ND	0.027	ND	0.027	ND	0.027	ND	0.027	ND	0.029	ND	0.029	ND	0.027	ND
Benzo(b)fluoranthene	NA	ug/l		0.120		0.0068	ND	0.0068	0.02	0.0068	ND	0.0068	ND	0.0068	0.011	0.0068	ND	0.020	ND	0.020	ND	0.0068	ND
Benzo(g,h,i)perylene	NA	ug/l				0.019	ND	0.019	0.019	0.019	ND	0.019	ND	0.019	ND	0.019	ND	0.020	ND	0.020	ND	0.019	ND
Benzo(k)fluoranthene	NA	ug/l		1.20		0.013	ND	0.013	0.019	0.013	ND	0.013	ND	0.013	ND	0.013	ND	0.020	ND	0.020	ND	0.013	ND
Benzoic acid	NA	ug/l			64000	--	--	--	--	--	--	--	--	--	--	--	--	10	ND	10	ND	10	ND
Benzyl alcohol	NA	ug/l			800	--	--	--	--	--	--	--	--	--	--	--	--	2.0	ND	2.0	ND	2.0	ND
Bis(2-chloroethoxy)methane	NA	ug/l				--	--	--	--	--	--	--	--	--	--	--	--	2.0	ND	2.0	ND	2.0	ND
Bis(2-chloroethyl)ether	NA	ug/l		0.0398		--	--	--	--	--	--	--	--	--	--	--	--	0.94	ND	0.94	ND	0.87	ND
Bis(2-ethylhexyl)phthalate	NA	ug/l		6.25	320	--	--	--	--	--	--	--	--	--	--	--	--	2.0	2.1	2.0	ND	0.75	ND
Butyl benzyl phthalate	NA	ug/l		46.1	3200	--	--	--	--	--	--	--	--	--	--	--	--	2.0	ND	2.0	ND	2.0	ND
Carbazole	NA	ug/l				--	--	--	--	--	--	--	--	--	--	--	--	2.0	ND	2.0	ND	2.0	ND
Chrysene	NA	ug/l		12.0		0.018	ND	0.018	ND	0.018	ND	0.018	ND	0.018	ND	0.018	ND	0.020	ND	0.020	ND	0.018	ND
Dibenz(a,h)anthracene	NA	ug/l		0.0120		0.011	ND	0.011	ND	0.011	ND	0.011	ND	0.011	ND	0.011	ND	0.012	ND	0.012	ND	0.011	ND
Dibenzofuran	NA	ug/l			16.0	--	--	--	--	--	--	--	--	--	--	--	--	2.0	ND	2.0	ND	2.0	ND
Diethyl phthalate	NA	ug/l			12800	--	--	--	--	--	--	--	--	--	--	--	--	2.0	ND	2.0	ND	2.0	ND
Dimethyl phthalate	NA	ug/l				--	--	--	--	--	--	--	--	--	--	--	--	2.0	ND	2.0	ND	2.0	ND
Di-n-butyl phthalate	NA	ug/l			1600	--	--	--	--	--	--	--	--	--	--	--	--	2.0	ND	2.0	ND	2.0	ND
Di-n-octyl phthalate	NA	ug/l			160	--	--	--	--	--	--	--	--	--	--	--	--	2.0	ND	2.0	ND	2.0	ND
Fluoranthene	NA	ug/l			640	0.0093	ND	0.0092	ND	0.0093	ND	0.0093	ND	0.0092	ND	0.0092	ND	0.020	ND	0.020	ND	0.0092	ND
Fluorene	NA	ug/l			640	0.0092	0.013	0.0090	ND	0.0092	ND	0.0092	ND	0.0090	ND	0.009	0.010	0.020	ND	0.020	ND	0.0090	ND
Hexachlorobenzene	NA	ug/l		0.0547	12.8	--	--	--	--	--	--	--	--	--	--	--	--	2.0	ND	2.0	ND	0.59	ND
Hexachlorobutadiene	NA	ug/l		0.561	8.00	--	--	--	--	--	--	--	--	--	--	--	--	2.0	ND	2.0	ND	--	--
Hexachlorocyclopentadiene	NA	ug/l			48.0	--	--	--	--	--	--	--	--	--	--	--	--	2.0	ND	2.0	ND	2.0	ND
Hexachloroethane	NA	ug/l		1.09	5.60	--	--	--	--	--	--	--	--	--	--	--	--	2.0	ND	2.0	ND	1.9	ND
Indeno(1,2,3-cd)pyrene	NA	ug/l		0.120		0.014	ND	0.014	ND	0.014	ND	0.014	ND	0.014	ND	0.014	ND	0.020	ND	0.020	ND	0.014	ND
Isophorone	NA	ug/l		46.1	1600	--	--	--	--	--	--	--	--	--	--	--	--	2.0	ND	2.0	ND	2.0	ND
Naphthalene	NA	ug/l	160		160	0.014	ND	0.013	0.052	0.014	ND	0.014	ND	0.013	ND	0.013	ND	0.020	ND	0.020	0.031	0.013	ND
Nitrobenzene	NA	ug/l			16.0	--	--	--	--	--	--	--	--	--	--	--	--	2.0	ND	2.0	ND	2.0	ND
n-Nitrosodimethylamine	NA	ug/l		0.000858	0.0640	--	--	--	--	--	--	--	--	--	--	--	--	1.5	ND	1.5	ND	1.4	ND
n-Nitrosodi-n-propylamine	NA	ug/l		0.0125		--	--	--	--	--	--	--	--	--	--	--	--	2.0	ND	2.0	ND	1.9	ND
n-Nitrosodiphenylamine	NA	ug/l		17.9		--	--	--	--	--	--	--	--	--	--	--	--	2.0	ND	2.0	ND	2.0	ND
Pentachlorophenol	NA	ug/l		0.219	80.0	0.12	ND	0.12	0.22	0.12	ND	0.12	ND	0.12	ND	0.12	ND	0.13	ND	0.13	ND	0.12	ND
Phenanthrene	NA	ug/l				0.014	0.018	0.013	ND	0.014	ND	0.014	ND	0.013	ND	0.013	ND	0.020	ND	0.020	ND	0.013	ND
Phenol	NA	ug/l			2400	--	--	--	--	--	--	--	--	--	--	--	--	2.0	ND	2.0	ND	2.0	ND
Pyrene	NA	ug/l			480	0.011	ND	0.010	0.13	0.011	ND	0.011	ND	0.010	0.014	0.010	ND	0.020	ND	0.020	ND	0.010	0.010

11-30-2017

Table 2
Historical Groundwater Data - 2015 Landau PQLs vs. MTCA Cleanup Levels
Yakima Mill Site

					Location	FPP-MW-01		FPP-MW-01		FPP-MW-01		FPP-MW-02		FPP-MW-02		FPP-MW-02		FPP-MW-03		FPP-MW-03		FPP-MW-03	
					Date	12/19/2014		3/24/2015		6/25/2015		12/18/2014		3/26/2015		6/24/2015		9/16/2014		9/16/2014		12/18/2014	
					Sample Type	N		N		N		N		N		N		N		FD		N	
					Result Type	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result
					Data Status	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource
Parameter	Total or Dissolved	Units	Washington GW Method A	Washington Groundwater Method B Cancer	Washington Groundwater Method B Noncancer																		
Effective Date			07/01/2015	07/01/2015	07/01/2015																		
Exceedance Key			No Exceedances	Shade	Border																		
Pyridine	NA	ug/l			8.00	--	--	--	--	--	--	--	--	--	--	--	--	2.0	ND	2.0	ND	2.0	ND
VOCs						--		--		--		--		--		--		--		--		--	
1,1,1,2-Tetrachloroethane	NA	ug/l		1.68	240	--	--	--	--	--	--	--	--	--	--	--	--	0.10	ND	0.10	ND	0.10	ND
1,1,1-Trichloroethane	NA	ug/l	200		16000	--	--	--	--	--	--	--	--	--	--	--	--	2.0	ND	2.0	ND	2.0	ND
1,1,2,2-Tetrachloroethane	NA	ug/l		0.219	160	--	--	--	--	--	--	--	--	--	--	--	--	0.10	ND	0.10	ND	0.10	ND
1,1,2-Trichloroethane	NA	ug/l		0.768	32.0	--	--	--	--	--	--	--	--	--	--	--	--	0.10	ND	0.10	ND	0.10	ND
1,1-Dichloroethane	NA	ug/l		7.68	1600	--	--	--	--	--	--	--	--	--	--	--	--	2.0	ND	2.0	ND	2.0	ND
1,1-Dichloroethylene	NA	ug/l			400	--	--	--	--	--	--	--	--	--	--	--	--	2.0	ND	2.0	ND	0.014	ND
1,1-Dichloropropene	NA	ug/l				--	--	--	--	--	--	--	--	--	--	--	--	2.0	ND	2.0	ND	2.0	ND
1,2,3-Trichlorobenzene	NA	ug/l				--	--	--	--	--	--	--	--	--	--	--	--	2.0	ND	2.0	ND	2.0	ND
1,2,3-Trichloropropane	NA	ug/l		0.00146	32.0	--	--	--	--	--	--	--	--	--	--	--	--	0.023	ND	0.023	ND	0.023	ND
1,2,4-Trichlorobenzene	NA	ug/l		1.51	80.0	--	--	--	--	--	--	--	--	--	--	--	--	0.10	ND	0.10	ND	0.10	ND
1,2,4-Trimethylbenzene	NA	ug/l				--	--	--	--	--	--	--	--	--	--	--	--	2.0	ND	2.0	ND	2.0	ND
1,2-Dibromo-3-chloropropane (DBCP)	NA	ug/l		0.0547	1.60	--	--	--	--	--	--	--	--	--	--	--	--	10	ND	10	ND	0.10	ND
1,2-Dibromoethane (EDB)	NA	ug/l	0.0100	0.0219	72.0	--	--	--	--	--	--	--	--	--	--	--	--	0.010	ND	0.010	ND	0.010	ND
1,2-Dichlorobenzene	NA	ug/l			720	--	--	--	--	--	--	--	--	--	--	--	--	2.0	ND	2.0	ND	2.0	ND
1,2-Dichloroethane	NA	ug/l	5.00	0.481	48.0	--	--	--	--	--	--	--	--	--	--	--	--	2.0	ND	2.0	ND	0.014	ND
1,2-Dichloroethylene, cis	NA	ug/l			16.0	--	--	--	--	--	--	--	--	--	--	--	--	2.0	ND	2.0	ND	2.0	ND
1,2-Dichloroethylene, trans	NA	ug/l			160	--	--	--	--	--	--	--	--	--	--	--	--	2.0	ND	2.0	ND	2.0	ND
1,2-Dichloropropane	NA	ug/l		1.22	720	--	--	--	--	--	--	--	--	--	--	--	--	0.10	ND	0.10	ND	0.10	ND
1,3,5-Trimethylbenzene	NA	ug/l			80.0	--	--	--	--	--	--	--	--	--	--	--	--	2.0	ND	2.0	ND	2.0	ND
1,3-Dichlorobenzene	NA	ug/l				--	--	--	--	--	--	--	--	--	--	--	--	2.0	ND	2.0	ND	2.0	ND
1,3-Dichloropropane	NA	ug/l				--	--	--	--	--	--	--	--	--	--	--	--	2.0	ND	2.0	ND	2.0	ND
1,3-Dichloropropene, cis	NA	ug/l		0.438	240	--	--	--	--	--	--	--	--	--	--	--	--	2.0	ND	2.0	ND	2.0	ND
1,3-Dichloropropene, trans	NA	ug/l		0.438	240	--	--	--	--	--	--	--	--	--	--	--	--	2.0	ND	2.0	ND	0.058	ND
1,4-Dichlorobenzene	NA	ug/l		8.10	560	--	--	--	--	--	--	--	--	--	--	--	--	2.0	ND	2.0	ND	2.0	ND
2,2-Dichloropropane	NA	ug/l				--	--	--	--	--	--	--	--	--	--	--	--	2.0	ND	2.0	ND	2.0	ND
2-Hexanone	NA	ug/l				--	--	--	--	--	--	--	--	--	--	--	--	10	ND	10	ND	10	ND
Acetone	NA	ug/l			7200	--	--	--	--	--	--	--	--	--	--	--	--	25	ND	25	ND	25	ND
Acrylonitrile	NA	ug/l		0.0810	320	--	--	--	--	--	--	--	--	--	--	--	--	10	ND	10	ND	0.057	ND
Benzene	NA	ug/l	5.00	0.795	32.0	--	--	--	--	--	--	--	--	--	--	--	--	2.0	ND	2.0	ND	0.028	ND
Bromobenzene	NA	ug/l				--	--	--	--	--	--	--	--	--	--	--	--	2.0	ND	2.0	ND	2.0	ND
Bromochloromethane	NA	ug/l				--	--	--	--	--	--	--	--	--	--	--	--	2.0	ND	2.0	ND	2.0	ND
Bromodichloromethane	NA	ug/l		0.706	160	--	--	--	--	--	--	--	--	--	--	--	--	0.059	ND	0.059	ND	0.059	ND
Bromoform	NA	ug/l		5.54	160	--	--	--	--	--	--	--	--	--	--	--	--	2.0	ND	2.0	ND	2.0	ND
Bromomethane	NA	ug/l			11.2	--	--	--	--	--	--	--	--	--	--	--	--	2.0	ND	2.0	ND	2.0	ND
Butylbenzene	NA	ug/l			400	--	--	--	--	--	--	--	--	--	--	--	--	2.0	ND	2.0	ND	2.0	ND
Butylbenzene, sec	NA	ug/l			800	--	--	--	--	--	--	--	--	--	--	--	--	2.0	ND	2.0	ND	2.0	ND
Butylbenzene, tert	NA	ug/l			800	--	--	--	--	--	--	--	--	--	--	--	--	2.0	ND	2.0	ND	2.0	ND
Carbon disulfide	NA	ug/l			800	--	--	--	--	--	--	--	--	--	--	--	--	2.0	ND	2.0	ND	2.0	ND
Carbon tetrachloride	NA	ug/l		0.625	32.0	--	--	--	--	--	--	--	--	--	--	--	--	0.10	ND	0.10	ND	0.10	ND
Chlorobenzene	NA	ug/l			160	--	--	--	--	--	--	--	--	--	--	--	--	2.0	ND	2.0	ND	2.0	ND
Chlorodibromomethane	NA	ug/l		0.521	160	--	--	--	--	--	--	--	--	--	--	--	--	0.10	ND	0.10	ND	0.10	ND
Chloroethane	NA	ug/l				--	--	--	--	--	--	--	--	--	--	--	--	2.0	ND	2.0	ND	2.0	ND
Chloroform	NA	ug/l		1.41	80.0	--	--	--	--	--	--	--	--	--	--	--	--	0.10	ND	0.10	ND	0.14	ND
Chloromethane	NA	ug/l				--	--	--	--	--	--	--	--	--	--	--	--	2.0	ND	2.0	ND	2.0	ND
Chlorotoluene, o	NA	ug/l			160	--	--	--	--	--	--	--	--	--	--	--	--	2.0	ND	2.0	ND	2.0	ND
Chlorotoluene, p	NA	ug/l				--	--	--	--	--	--	--	--	--	--	--	--	2.0	ND	2.0	ND	2.0	ND
Cumene (isopropyl benzene)	NA	ug/l			800	--	--	--	--	--	--	--	--	--	--	--	--	2.0	ND	2.0	ND	2.0	ND
Cymene p- (toluene isopropyl p-)	NA	ug/l				--	--	--	--	--	--	--	--	--	--	--	--	2.0	ND	2.0	ND	2.0	ND
Dibromomethane (methylene bromide)	NA	ug/l			80.0	--	--	--	--	--	--	--	--	--	--	--	--	2.0	ND	2.0	ND	2.0	ND
Dichlorodifluoromethane (Freon-12)	NA	ug/l			1600	--	--	--	--	--	--	--	--	--	--	--	--	2.0	ND	2.0	ND	2.0	ND
Ethyl benzene	NA	ug/l	700		800	--	--	--	--	--	--	--	--	--	--	--	--	2.0	ND	2.0	ND	2.0	ND
Hexachlorobutadiene	NA	ug/l		0.561	8.00	--	--	--	--	--	--	--	--	--	--	--	--	2.0	ND	2.0	ND	0.069	ND
Hexane (C6)	NA	ug/l			480	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Methyl ethyl ketone (2-butanone)	NA	ug/l			4800	--	--	--	--	--	--	--	--	--	--	--	--	10	ND	10	ND	10	ND
Methyl isobutyl ketone (MIBK)	NA	ug/l			640	--	--	--	--	--	--	--	--	--	--	--	--	10	ND	10	ND	10	ND
Methyl tertiary butyl ether (MTBE)	NA	ug/l	20.0	24.3		--	--	--	--	--	--	--	--	--	--	--	--	2.0	ND	2.0	ND	2.0	ND

Table 2
Historical Groundwater Data - 2015 Landau PQLs vs. MTCA Cleanup Levels
Yakima Mill Site

Location						FPP-MW-01		FPP-MW-01		FPP-MW-01		FPP-MW-02		FPP-MW-02		FPP-MW-02		FPP-MW-03		FPP-MW-03		FPP-MW-03	
Date						12/19/2014		3/24/2015		6/25/2015		12/18/2014		3/26/2015		6/24/2015		9/16/2014		9/16/2014		12/18/2014	
Sample Type						N		N		N		N		N		N		N		FD		N	
Result Type						PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result
Data Status						SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource
Parameter	Total or Dissolved	Units	Washington GW Method A	Washington Groundwater Method B Cancer	Washington Groundwater Method B Noncancer																		
Effective Date			07/01/2015	07/01/2015	07/01/2015																		
Exceedance Key			No Exceedances	Shade	Border																		
Methylene chloride	NA	ug/l	5.00	21.9	48.0	--	--	--	--	--	--	--	--	--	--	--	--	5.0	ND	5.0	ND	0.68	ND
Naphthalene	NA	ug/l	160		160	--	--	--	--	--	--	--	--	--	--	--	--	2.0	ND	2.0	ND	--	--
Propylbenzene	NA	ug/l			800	--	--	--	--	--	--	--	--	--	--	--	--	2.0	ND	2.0	ND	2.0	ND
Styrene	NA	ug/l			1600	--	--	--	--	--	--	--	--	--	--	--	--	2.0	ND	2.0	ND	2.0	ND
Tetrachloroethylene	NA	ug/l	5.00	20.8	48.0	--	--	--	--	--	--	--	--	--	--	--	--	2.0	ND	2.0	ND	0.023	ND
Toluene	NA	ug/l	1000		640	--	--	--	--	--	--	--	--	--	--	--	--	2.0	ND	2.0	ND	2.0	ND
Trichloroethylene (TCE)	NA	ug/l	5.00	0.540	4.00	--	--	--	--	--	--	--	--	--	--	--	--	0.020	ND	0.020	ND	0.054	ND
Trichlorofluoromethane (Freon-11)	NA	ug/l			2400	--	--	--	--	--	--	--	--	--	--	--	--	2.0	ND	2.0	ND	2.0	ND
Vinyl chloride	NA	ug/l	0.200		24.0	--	--	--	--	--	--	--	--	--	--	--	--	0.20	ND	0.20	ND	0.031	ND
Xylene, m & p	NA	ug/l			1600	--	--	--	--	--	--	--	--	--	--	--	--	4.0	ND	4.0	ND	4.0	ND
Xylene, o	NA	ug/l			1600	--	--	--	--	--	--	--	--	--	--	--	--	2.0	ND	2.0	ND	2.0	ND
Pesticides																							
4,4'-DDD	NA	ug/l		0.365		--	--	--	--	--	--	--	--	--	--	--	--	0.011	ND	0.011	ND	0.010	ND
4,4'-DDE	NA	ug/l		0.257		--	--	--	--	--	--	--	--	--	--	--	--	0.011	ND	0.011	ND	0.010	ND
4,4'-DDT	NA	ug/l	0.300	0.257	8.00	--	--	--	--	--	--	--	--	--	--	--	--	0.011	ND	0.011	ND	0.010	ND
a-BHC	NA	ug/l		0.0139	128	--	--	--	--	--	--	--	--	--	--	--	--	0.011	ND	0.011	ND	0.010	ND
Aldrin	NA	ug/l		0.00257	0.240	--	--	--	--	--	--	--	--	--	--	--	--	0.011	ND	0.011	ND	0.010	ND
b-BHC	NA	ug/l		0.0486		--	--	--	--	--	--	--	--	--	--	--	--	0.011	ND	0.011	ND	0.010	ND
Chlordane, alpha & gamma	NA	ug/l		0.250	8.00	--	--	--	--	--	--	--	--	--	--	--	--	0.011	ND	0.011	ND	0.010	ND
d-BHC	NA	ug/l				--	--	--	--	--	--	--	--	--	--	--	--	0.011	ND	0.011	ND	0.010	ND
Dieldrin	NA	ug/l		0.00547	0.800	--	--	--	--	--	--	--	--	--	--	--	--	0.011	ND	0.011	ND	0.010	ND
Endosulfan I	NA	ug/l			96.0	--	--	--	--	--	--	--	--	--	--	--	--	0.011	ND	0.011	ND	0.010	ND
Endosulfan II	NA	ug/l			96.0	--	--	--	--	--	--	--	--	--	--	--	--	0.011	ND	0.011	ND	0.010	ND
Endosulfan sulfate	NA	ug/l			96.0	--	--	--	--	--	--	--	--	--	--	--	--	0.011	ND	0.011	ND	0.010	ND
Endrin	NA	ug/l			4.80	--	--	--	--	--	--	--	--	--	--	--	--	0.011	ND	0.011	ND	0.010	ND
Endrin aldehyde	NA	ug/l				--	--	--	--	--	--	--	--	--	--	--	--	0.011	ND	0.011	ND	0.010	ND
g-BHC (Lindane)	NA	ug/l	0.200	0.0795	4.80	--	--	--	--	--	--	--	--	--	--	--	--	0.011	ND	0.011	ND	0.010	ND
Heptachlor	NA	ug/l		0.0194	8.00	--	--	--	--	--	--	--	--	--	--	--	--	0.011	ND	0.011	ND	0.010	ND
Heptachlor epoxide	NA	ug/l		0.00481	0.104	--	--	--	--	--	--	--	--	--	--	--	--	0.011	ND	0.011	ND	0.010	ND
Hexachlorobenzene	NA	ug/l		0.0547	12.8	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	0.010	ND
Methoxychlor	NA	ug/l			80.0	--	--	--	--	--	--	--	--	--	--	--	--	0.011	ND	0.011	ND	0.010	ND
Toxaphene	NA	ug/l		0.0795		--	--	--	--	--	--	--	--	--	--	--	--	0.53	ND	0.52	ND	0.50	ND
PCBs																							
Aroclor 1016	NA	ug/l		1.25	1.12	--	--	--	--	--	--	--	--	--	--	--	--	0.0053	ND	0.0052	ND	0.0050	ND
Aroclor 1221	NA	ug/l				--	--	--	--	--	--	--	--	--	--	--	--	0.011	ND	0.011	ND	0.010	ND
Aroclor 1232	NA	ug/l				--	--	--	--	--	--	--	--	--	--	--	--	0.0053	ND	0.0052	ND	0.0050	ND
Aroclor 1242	NA	ug/l				--	--	--	--	--	--	--	--	--	--	--	--	0.0053	ND	0.0052	ND	0.0050	ND
Aroclor 1248	NA	ug/l				--	--	--	--	--	--	--	--	--	--	--	--	0.0053	ND	0.0052	ND	0.0050	ND
Aroclor 1254	NA	ug/l		0.0438	0.320	--	--	--	--	--	--	--	--	--	--	--	--	0.0053	ND	0.0052	ND	0.0050	ND
Aroclor 1260	NA	ug/l		0.0438		--	--	--	--	--	--	--	--	--	--	--	--	0.0053	ND	0.0052	ND	0.0050	ND
Total Petroleum Hydrocarbons																							
Total Petroleum Hydrocarbons (as diesel)	NA	ug/l	500			130	3600	130	3000	130	8600	130	670	130	940 J	130	450	310	ND	310	ND	310	ND
Total Petroleum Hydrocarbons (as diesel), silica gel	NA	ug/l	500			130	1400	130	950	130	3000	130	220	130	220 J	130	140		--	--	--	--	--
Total Petroleum Hydrocarbons (as gasoline)	NA	ug/l	800			--	--	--	--	--	--	--	--	--	--	--	--	130	ND	130	ND	130	ND
Total Petroleum Hydrocarbons (as motor oil)	NA	ug/l	500			250	1000	250	1100	250	1900 J	250	270	250	790	250	250 J	310	ND	310	ND	310	ND
Total Petroleum Hydrocarbons (as motor oil), silica gel	NA	ug/l	500			250	260	250	620	250	470 J	250	ND	250	570	250	ND	--	--	--	--	--	--

Landau qualifier - J: Indicates the analyte was positively identified; the associated numerical value is the approximate concentration of the analyte in the sample.
Landau qualifier - UJ: The analyte was not detected in the sample; the reported sample reporting limit is an estimate.
N: Normal Sample.
FD: Field Duplicate Sample.
ND: Not detected.
PQL: Practical Quantitation Limit.
SSource: Laboratory and/or field data obtained from a secondary source external to Barr. Second source QA/QC evaluation procedures may or may not have been performed beyond the original data generator.
Table was updated (items in red) after original submittal to add Landau qualifiers to be consistent with the memo.

Table 2
Historical Groundwater Data - 2015 Landau PQLs vs. MTCA Cleanup Levels
Yakima Mill Site

					Location	FPP-MW-03		FPP-MW-03		FPP-MW-03		FPP-MW-03		FPP-MW-03		MW-06		MW-06		MW-06		MW-06		MW-07	
					Date	12/18/2014		3/26/2015		3/26/2015		6/24/2015		6/24/2015		9/17/2014		12/19/2014		3/24/2015		6/24/2015		9/16/2014	
					Sample Type	FD		N		FD		N		FD		N		N		N		N		N	
					Result Type	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result
					Data Status	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource
Parameter	Total or Dissolved	Units	Washington GW Method A	Washington Groundwater Method B Cancer	Washington Groundwater Method B Noncancer																				
Effective Date			07/01/2015	07/01/2015	07/01/2015																				
Exceedance Key			No Exceedances	Shade	Border																				
General Parameters																									
Alkalinity, bicarbonate, as CaCO3	NA	mg/l				0.0	120	0.0	100	0.0	100	15	150	15	150	--	--	15	160	0.0	150	15	110	15	140
Alkalinity, total, as CaCO3	NA	mg/l				0.0	120	0.0	100	0.0	100	15	150	15	150	--	--	15	160	0.0	150	15	110	15	140
Carbon, total organic	NA	mg/l				0.50	1.2	0.50	1.2	0.50	1.3	0.50	2.1	0.50	2.1	--	--	0.50	4.7	0.50	3.8	0.50	4.3	0.50	3.2
Chloride	NA	mg/l				0.092	8.7	0.092	9.2	0.092	9.2	0.92	11	0.92	10	0.46	20	0.46	17	0.46	18	0.92	9.0	0.092	12
Fluoride	NA	mg/l			0.64	0.16	0.17	0.16	ND	0.16	ND	0.16	ND	0.16	ND	0.16	0.17	0.16	0.41	0.16	ND	0.16	ND	0.16	0.25
Nitrogen, ammonia, as N	NA	mg/l				0.050	0.62	0.050	0.21	0.050	0.2	0.050	0.32	0.050	0.29	--	--	0.050	1.1	0.050	0.64	0.050	0.36	0.050	2.8
Nitrogen, nitrate, as N	NA	mg/l			25.6	0.034	ND	0.034	ND	0.034	ND	0.15	ND	0.034	ND	0.36	ND	0.034	ND	0.034	ND	0.050	ND	0.034	0.39
Nitrogen, nitrite, as N	NA	mg/l			1.6	0.043	ND	0.043	ND	0.043	ND	0.043	ND	0.043	ND	0.043	ND UJ	0.043	ND	0.043	ND	0.043	ND	0.043	ND
Solids, total dissolved	NA	mg/l				5.0	170	5.0	140	5.0	130	5.0	160	5.0	160	--	--	5.0	250	5.0	180	5.0	130	5.0	130
Sulfate, as SO4	NA	mg/l				0.26	10	0.26	5.1	0.26	4.8	2.6	4.7	2.6	4.6	0.26	2	0.26	ND	0.26	ND	0.26	1.7 J	0.26	1.8
Metals																									
Arsenic	Dissolved	ug/l	5.00	0.0583	4.80	0.45	0.83	0.45	ND	0.45	1	0.45	1.3	0.45	1.2	1.0	1.3	0.45	1.7	0.45	2.2	0.45	1.1	1.0	1.3
Arsenic	Total	ug/l	5.00	0.0583	4.80	0.45	1.2	0.45	1	0.45	ND	1.2	ND	1.6	ND	1.0	1.3	0.45	2.5	0.45	1.1	1.5	ND	1.0	1.7
Barium	Dissolved	ug/l			3200	1.0	20	1.0	16	1.0	16	1.0	24	1.0	24	1.0	44	1.0	55	1.0	47	1.0	29	1.0	28
Barium	Total	ug/l			3200	1.0	19	1.0	17	1.0	17	1.0	23	1.0	22	1.0	44	1.0	55	1.0	50	1.0	29	1.0	30
Cadmium	Dissolved	ug/l	5.00		8.00	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND
Cadmium	Total	ug/l	5.00		8.00	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND
Calcium	Dissolved	ug/l				100	24000	100	20000	100	20000	100	26000	100	27000	100	32000	100	35000	100	32000	100	22000	100	23000
Calcium	Total	ug/l				100	24000	100	20000	100	20000	100	27000	100	25000	100	33000	100	34000	100	32000	100	22000	100	23000
Chromium	Dissolved	ug/l	50.0			2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
Chromium	Total	ug/l	50.0			2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
Chromium, hexavalent	Dissolved	ug/l			48.0	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	10	ND
Chromium, hexavalent	Total	ug/l			48.0	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	10	ND
Iron	Dissolved	ug/l			11200	50	8000	50	6500	50	6600	50	9100	50	9200	50	3100	50	23000	50	23000	50	8700	50	6800
Iron	Total	ug/l			11200	50	8000	50	6800	50	6700	50	9200	50	8300	50	2800	50	24000	50	23000	50	8900	50	7100
Lead	Dissolved	ug/l	15.0			0.28	ND	0.28	ND	0.28	ND	0.28	ND	0.28	ND	1.0	ND	0.28	ND	0.28	ND	0.28	ND	1.0	ND
Lead	Total	ug/l	15.0			0.28	ND	0.28	ND	0.28	ND	0.28	ND	0.30	ND	1.0	ND	0.28	ND	0.28	ND	0.28	ND	1.0	ND
Magnesium	Dissolved	ug/l				50	9300	50	7800	50	7800	50	11000	50	11000	50	12000	50	12000	50	11000	50	8000	50	7900
Magnesium	Total	ug/l				50	9400	50	8100	50	7900	50	11000	50	9500	50	12000	50	11000	50	11000	50	8100	50	8000
Manganese	Dissolved	ug/l			2240	2.0	390	2.0	320	2.0	320	2.0	500	2.0	480	2.0	1300	2.0	2300	2.0	2200	2.0	1200	2.0	1600
Manganese	Total	ug/l			2240	2.0	410	2.0	320	2.0	320	2.0	480	2.0	430	2.0	1300	2.0	2300	2.0	2200	2.0	1200	2.0	1700
Mercury	Dissolved	ug/l	2.00			0.11	ND	0.20	ND	0.20	ND	0.11	ND	0.11	ND	0.20	ND	0.11	ND	0.11	ND	0.11	ND	0.20	ND
Mercury	Total	ug/l	2.00			0.11	ND	0.11	ND	0.11	ND	0.11	ND	0.11	ND	0.20	ND	0.11	ND	0.11	ND	0.11	ND	0.20	ND
Potassium	Dissolved	ug/l				--	--	50	3100	50	3100	50	3600	50	3600	--	--	--	--	50	9200	50	7100	--	--
Potassium	Total	ug/l				--	--	50	3100	50	3100	50	3600	50	3300	--	--	--	--	50	9300	50	7200	--	--
Selenium	Dissolved	ug/l			80.0	4.0	ND	4.0	ND	4.0	ND	4.0	ND	4.0	ND	4.0	ND	4.0	ND	4.0	ND	4.0	ND	4.0	ND
Selenium	Total	ug/l			80.0	4.0	ND	4.0	ND	4.0	ND	4.0	ND	4.0	ND	4.0	ND	4.0	ND	4.0	ND	4.0	ND	4.0	ND
Silver	Dissolved	ug/l			80.0	0.20	ND	0.20	ND	0.20	ND	0.20	ND	0.20	ND	1.0	ND	0.20	ND	0.20	ND	0.20	ND	1.0	ND
Silver	Total	ug/l			80.0	0.20	ND	0.20	ND	0.20	ND	0.20	ND	0.20	ND	1.0	ND	0.20	ND	0.20	ND	0.20	ND	1.0	ND
Sodium	Dissolved	ug/l				50	15000	50	13000	50	13000	50	19000	50	18000	50	15000	50	14000	50	13000	50	10000	50	13000
Sodium	Total	ug/l				50	15000	50	13000	50	13000	50	18000	50	16000	50	14000	50	14000	50	14000	50	10000	50	13000
SVOCs																									
1,2,4-Trichlorobenzene	NA	ug/l		1.51	80.0	2.0	ND	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	2.0	ND
1,2-Dichlorobenzene	NA	ug/l			720	2.0	ND	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	2.0	ND
1,3-Dichlorobenzene	NA	ug/l				2.0	ND	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	2.0	ND
1,4-Dichlorobenzene	NA	ug/l		8.10	560	2.0	ND	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	2.0	ND
1-Methylnaphthalene	NA	ug/l		1.51	560	0.020	ND	0.020	ND	0.020	ND	0.020	ND	0.020	ND	0.020	ND	--	--	--	--	--	--	0.020	ND
2,2'-oxybis (1-chloropropane)	NA	ug/l		0.625	320	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	--	--	--	--	2.0	ND
2,3,4,6-Tetrachlorophenol	NA	ug/l			480	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	--	--	--	--	2.0	ND
2,4,5-Trichlorophenol	NA	ug/l			800	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	--	--	--	--	2.0	ND
2,4,6-Trichlorophenol	NA	ug/l		3.98	8.00	0.83	ND	0.85	ND	0.85	ND	0.85	ND	0.84	ND	--	--	--	--	--	--	--	--	2.0	ND
2,4-Dichlorophenol	NA	ug/l			24.0	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	--	--	--	--	2.0	ND
2,4-Dimethylphenol	NA	ug/l			160	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	--	--	--	--	2.0	ND
2,4-Dinitrophenol	NA	ug/l			32.0	10	ND	10	ND	10	ND	10	ND	10	ND	--	--	--	--	--	--	--	--	10	ND
2,4-Dinitrotoluene	NA	ug/l		0.282	32.0	0.72	ND	0.73	ND	0.73	ND	0.73	ND	0.73	ND	--	--	--	--	--	--	--	--	0.78	ND
2,6-Dichlorophenol	NA	ug/l				2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	--	--	--	--	2.0	ND

Table 2
Historical Groundwater Data - 2015 Landau PQLs vs. MTCA Cleanup Levels
Yakima Mill Site

					Location	FPP-MW-03		FPP-MW-03		FPP-MW-03		FPP-MW-03		FPP-MW-03		MW-06		MW-06		MW-06		MW-06		MW-07	
					Date	12/18/2014		3/26/2015		3/26/2015		6/24/2015		6/24/2015		9/17/2014		12/19/2014		3/24/2015		6/24/2015		9/16/2014	
					Sample Type	FD		N		FD		N		FD		N		N		N		N		N	
					Result Type	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result
					Data Status	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource
Parameter	Total or Dissolved	Units	Washington GW Method A	Washington Groundwater Method B Cancer	Washington Groundwater Method B Noncancer																				
Effective Date			07/01/2015	07/01/2015	07/01/2015																				
Exceedance Key			No Exceedances	Shade	Border																				
2,6-Dinitrotoluene	NA	ug/l		0.0583	4.80	1.7	ND	1.7	ND	1.7	ND	1.7	ND	1.7	ND	--	--	--	--	--	--	--	--	1.8	ND
2-Chloronaphthalene	NA	ug/l			640	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	--	--	--	--	2.0	ND
2-Chlorophenol	NA	ug/l			40.0	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	--	--	--	--	2.0	ND
2-Methyl-4,6-dinitrophenol	NA	ug/l				2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	--	--	--	--	2.0	ND
2-Methylnaphthalene	NA	ug/l			32.0	0.020	ND	0.020	ND	0.020	ND	0.020	ND	0.020	ND	0.020	ND	--	--	--	--	--	--	0.020	ND
2-Methylphenol (o-cresol)	NA	ug/l			400	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	--	--	--	--	2.0	ND
2-Nitroaniline	NA	ug/l			160	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	--	--	--	--	2.0	ND
2-Nitrophenol	NA	ug/l				2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	--	--	--	--	2.0	ND
3,3`-Dichlorobenzidine	NA	ug/l		0.194		1.9	ND	1.9	ND	1.9	ND	1.9	ND	1.9	ND	--	--	--	--	--	--	--	--	2.0	ND
3,4-Methylphenol (m,p cresols)	NA	ug/l				2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	--	--	--	--	2.0	ND
3-Nitroaniline	NA	ug/l				5.0	ND	5.0	ND	5.0	ND	5.0	ND	5.0	ND	--	--	--	--	--	--	--	--	5.0	ND
4-Bromophenyl phenyl ether	NA	ug/l				2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	--	--	--	--	2.0	ND
4-Chloro-3-methylphenol	NA	ug/l				2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	--	--	--	--	2.0	ND
4-Chloroaniline	NA	ug/l		0.219	32.0	1.8	ND	1.8	ND	1.8	ND	1.8	ND	1.8	ND	--	--	--	--	--	--	--	--	2.0	ND
4-Chlorophenyl phenyl ether	NA	ug/l				2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	--	--	--	--	2.0	ND
4-Nitroaniline	NA	ug/l				2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	--	--	--	--	2.0	ND
4-Nitrophenol	NA	ug/l				2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	--	--	--	--	2.0	ND
Acenaphthene	NA	ug/l			960	0.014	ND	0.014	ND	0.014	ND	0.014	ND	0.014	ND	0.020	ND	--	--	--	--	--	--	0.020	ND
Acenaphthylene	NA	ug/l				0.020	ND	0.020	ND	0.020	ND	0.020	ND	0.020	ND	0.020	ND	--	--	--	--	--	--	0.020	ND
Aniline	NA	ug/l		7.68	56.0	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	--	--	--	--	2.0	ND
Anthracene	NA	ug/l			4800	0.010	ND	0.010	ND	0.010	ND	0.010	ND	0.010	ND	0.020	ND	--	--	--	--	--	--	0.020	ND
Azobenzene	NA	ug/l		0.795		1.5	ND	1.5	ND	1.5	ND	1.5	ND	1.5	ND	--	--	--	--	--	--	--	--	2.0	ND
Benz(a)anthracene	NA	ug/l		0.120		0.017	ND	0.017	ND	0.017	ND	0.017	ND	0.017	ND	0.020	ND	--	--	--	--	--	--	0.020	ND
Benzo(a)pyrene	NA	ug/l	0.100	0.0120		0.027	ND	0.027	ND	0.027	ND	0.027	ND	0.027	ND	0.029	ND	--	--	--	--	--	--	0.029	ND
Benzo(b)fluoranthene	NA	ug/l		0.120		0.0068	ND	0.0068	ND	0.0068	ND	0.0068	ND	0.0068	ND	0.020	ND	--	--	--	--	--	--	0.020	ND
Benzo(g,h,i)perylene	NA	ug/l				0.019	ND	0.019	ND	0.019	ND	0.019	ND	0.019	ND	0.020	ND	--	--	--	--	--	--	0.020	ND
Benzo(k)fluoranthene	NA	ug/l		1.20		0.013	ND	0.013	ND	0.013	ND	0.013	ND	0.013	ND	0.020	ND	--	--	--	--	--	--	0.020	ND
Benzoic acid	NA	ug/l			64000	10	ND	10	ND	10	ND	10	ND	10	ND	--	--	--	--	--	--	--	--	10	ND
Benzyl alcohol	NA	ug/l			800	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	--	--	--	--	2.0	ND
Bis(2-chloroethoxy)methane	NA	ug/l				2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	--	--	--	--	2.0	ND
Bis(2-chloroethyl)ether	NA	ug/l		0.0398		0.87	ND	0.89	ND	0.89	ND	0.89	ND	0.88	ND	--	--	--	--	--	--	--	--	0.94	ND
Bis(2-ethylhexyl)phthalate	NA	ug/l		6.25	320	0.75	ND	0.76	ND	0.76	ND	0.76	ND	0.76	ND	--	--	--	--	--	--	--	--	2.0	ND
Butyl benzyl phthalate	NA	ug/l		46.1	3200	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	--	--	--	--	2.0	ND
Carbazole	NA	ug/l				2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	--	--	--	--	2.0	ND
Chrysene	NA	ug/l		12.0		0.018	ND	0.018	ND	0.018	ND	0.018	ND	0.018	ND	0.020	ND	--	--	--	--	--	--	0.020	ND
Dibenz(a,h)anthracene	NA	ug/l		0.0120		0.011	ND	0.011	ND	0.011	ND	0.011	ND	0.011	ND	0.012	ND	--	--	--	--	--	--	0.012	ND
Dibenzofuran	NA	ug/l			16.0	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	--	--	--	--	2.0	ND
Diethyl phthalate	NA	ug/l			12800	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	--	--	--	--	2.0	ND
Dimethyl phthalate	NA	ug/l				2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	--	--	--	--	2.0	ND
Di-n-butyl phthalate	NA	ug/l			1600	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	--	--	--	--	2.0	ND
Di-n-octyl phthalate	NA	ug/l			160	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	--	--	--	--	2.0	ND
Fluoranthene	NA	ug/l			640	0.0092	ND	0.0093	ND	0.0093	ND	0.0093	ND	0.0092	ND	0.020	ND	--	--	--	--	--	--	0.020	ND
Fluorene	NA	ug/l			640	0.009	0.0097	0.0092	ND	0.0092	ND	0.0092	ND	0.0091	ND	0.020	ND	--	--	--	--	--	--	0.020	ND
Hexachlorobenzene	NA	ug/l		0.0547	12.8	0.59	ND	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	2.0	ND
Hexachlorobutadiene	NA	ug/l		0.561	8.00	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	2.0	ND
Hexachlorocyclopentadiene	NA	ug/l			48.0	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	--	--	--	--	2.0	ND
Hexachloroethane	NA	ug/l		1.09	5.60	1.9	ND	1.9	ND	1.9	ND	1.9	ND	1.9	ND	--	--	--	--	--	--	--	--	2.0	ND
Indeno(1,2,3-cd)pyrene	NA	ug/l		0.120		0.014	ND	0.014	ND	0.014	ND	0.014	ND	0.014	ND	0.020	ND	--	--	--	--	--	--	0.020	ND
Isophorone	NA	ug/l		46.1	1600	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	--	--	--	--	2.0	ND
Naphthalene	NA	ug/l	160		160	0.013	ND	0.014	ND UJ	0.014	0.089 J	0.014	ND	0.013	ND	0.020	ND	--	--	--	--	--	--	0.020	ND
Nitrobenzene	NA	ug/l			16.0	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	--	--	--	--	2.0	ND
n-Nitrosodimethylamine	NA	ug/l		0.000858	0.0640	1.4	ND	1.4	ND	1.4	ND	1.4	ND	1.4	ND	--	--	--	--	--	--	--	--	1.5	ND
n-Nitrosodi-n-propylamine	NA	ug/l		0.0125		1.9	ND	1.9	ND	1.9	ND	1.9	ND	1.9	ND	--	--	--	--	--	--	--	--	2.0	ND
n-Nitrosodiphenylamine	NA	ug/l		17.9		2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	--	--	--	--	2.0	ND
Pentachlorophenol	NA	ug/l		0.219	80.0	0.12	ND	0.12	ND	0.12	ND	0.12	ND	0.12	ND	0.13	ND	--	--	--	--	--	--	0.13	ND
Phenanthrene	NA	ug/l				0.013	ND	0.014	ND	0.014	ND	0.014	ND	0.013	ND	0.020	ND	--	--	--	--	--	--	0.020	ND
Phenol	NA	ug/l			2400	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	--	--	--	--	2.0	ND
Pyrene	NA	ug/l			480	0.010	0.014	0.011	ND	0.011	ND	0.011	ND	0.011	ND	0.020	ND	--	--	--	--	--	--	0.020	ND

Table 2
Historical Groundwater Data - 2015 Landau PQLs vs. MTCA Cleanup Levels
Yakima Mill Site

					Location	FPP-MW-03		FPP-MW-03		FPP-MW-03		FPP-MW-03		FPP-MW-03		MW-06		MW-06		MW-06		MW-06		MW-07	
					Date	12/18/2014		3/26/2015		3/26/2015		6/24/2015		6/24/2015		9/17/2014		12/19/2014		3/24/2015		6/24/2015		9/16/2014	
					Sample Type	FD		N		FD		N		FD		N		N		N		N		N	
					Result Type	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result
					Data Status	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource
Parameter	Total or Dissolved	Units	Washington GW Method A	Washington Groundwater Method B Cancer	Washington Groundwater Method B Noncancer																				
Effective Date			07/01/2015	07/01/2015	07/01/2015																				
Exceedance Key			No Exceedances	Shade	Border																				
Pyridine	NA	ug/l			8.00	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	--	--	--	--	2.0	ND
VOCs						--		--		--		--		--		--		--		--		--		--	
1,1,1,2-Tetrachloroethane	NA	ug/l		1.68	240	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND	--	--	--	--	--	--	--	--	0.10	ND
1,1,1-Trichloroethane	NA	ug/l	200		16000	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	--	--	--	--	2.0	ND
1,1,2,2-Tetrachloroethane	NA	ug/l		0.219	160	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND	--	--	--	--	--	--	--	--	0.10	ND
1,1,2-Trichloroethane	NA	ug/l		0.768	32.0	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND	--	--	--	--	--	--	--	--	0.10	ND
1,1-Dichloroethane	NA	ug/l		7.68	1600	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	--	--	--	--	2.0	ND
1,1-Dichloroethylene	NA	ug/l			400	0.014	ND	0.014	ND	0.014	ND	0.014	ND	0.014	ND	--	--	--	--	--	--	--	--	2.0	ND
1,1-Dichloropropene	NA	ug/l				2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	--	--	--	--	2.0	ND
1,2,3-Trichlorobenzene	NA	ug/l				2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	--	--	--	--	2.0	ND
1,2,3-Trichloropropane	NA	ug/l		0.00146	32.0	0.023	ND	0.023	ND	0.023	ND	0.023	ND	0.023	ND	--	--	--	--	--	--	--	--	0.023	ND
1,2,4-Trichlorobenzene	NA	ug/l		1.51	80.0	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND	--	--	--	--	--	--	--	--	0.10	0.17
1,2,4-Trimethylbenzene	NA	ug/l				2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	--	--	--	--	2.0	ND
1,2-Dibromo-3-chloropropane (DBCP)	NA	ug/l		0.0547	1.60	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND	--	--	--	--	--	--	--	--	10	ND
1,2-Dibromoethane (EDB)	NA	ug/l	0.0100	0.0219	72.0	0.010	ND	0.010	ND	0.010	ND	0.010	ND	0.010	ND	--	--	--	--	--	--	--	--	0.010	ND
1,2-Dichlorobenzene	NA	ug/l			720	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	--	--	--	--	2.0	ND
1,2-Dichloroethane	NA	ug/l	5.00	0.481	48.0	0.014	ND	0.014	ND	0.014	ND	0.014	ND	0.014	ND	--	--	--	--	--	--	--	--	2.0	ND
1,2-Dichloroethylene, cis	NA	ug/l			16.0	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	--	--	--	--	2.0	ND
1,2-Dichloroethylene, trans	NA	ug/l			160	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	--	--	--	--	2.0	ND
1,2-Dichloropropane	NA	ug/l		1.22	720	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND	--	--	--	--	--	--	--	--	0.10	ND
1,3,5-Trimethylbenzene	NA	ug/l			80.0	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	--	--	--	--	2.0	ND
1,3-Dichlorobenzene	NA	ug/l				2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	--	--	--	--	2.0	ND
1,3-Dichloropropane	NA	ug/l				2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	--	--	--	--	2.0	ND
1,3-Dichloropropene, cis	NA	ug/l		0.438	240	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	--	--	--	--	2.0	ND
1,3-Dichloropropene, trans	NA	ug/l		0.438	240	0.058	ND	0.058	ND	0.058	ND	0.058	ND	0.058	ND	--	--	--	--	--	--	--	--	2.0	ND
1,4-Dichlorobenzene	NA	ug/l		8.10	560	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	--	--	--	--	2.0	ND
2,2-Dichloropropane	NA	ug/l				2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	--	--	--	--	2.0	ND
2-Hexanone	NA	ug/l				10	ND	10	ND	10	ND	10	ND	10	ND	--	--	--	--	--	--	--	--	10	ND
Acetone	NA	ug/l			7200	25	ND	25	ND	25	ND	25	ND	25	ND	--	--	--	--	--	--	--	--	25	ND
Acrylonitrile	NA	ug/l		0.0810	320	0.057	ND	0.057	ND	0.057	ND	0.057	ND	0.057	ND	--	--	--	--	--	--	--	--	10	ND
Benzene	NA	ug/l	5.00	0.795	32.0	0.028	ND	0.028	ND	0.028	ND	0.028	ND	0.028	ND	--	--	--	--	--	--	--	--	2.0	ND
Bromobenzene	NA	ug/l				2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	--	--	--	--	2.0	ND
Bromochloromethane	NA	ug/l				2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	--	--	--	--	2.0	ND
Bromodichloromethane	NA	ug/l		0.706	160	0.059	ND	0.059	ND	0.059	ND	0.059	ND	0.059	ND	--	--	--	--	--	--	--	--	0.059	ND
Bromoform	NA	ug/l		5.54	160	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	--	--	--	--	2.0	ND
Bromomethane	NA	ug/l			11.2	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	--	--	--	--	2.0	ND
Butylbenzene	NA	ug/l			400	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	--	--	--	--	2.0	ND
Butylbenzene, sec	NA	ug/l			800	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	--	--	--	--	2.0	ND
Butylbenzene, tert	NA	ug/l			800	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	--	--	--	--	2.0	ND
Carbon disulfide	NA	ug/l			800	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	--	--	--	--	2.0	ND
Carbon tetrachloride	NA	ug/l		0.625	32.0	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND	--	--	--	--	--	--	--	--	0.10	ND
Chlorobenzene	NA	ug/l			160	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	--	--	--	--	2.0	ND
Chlorodibromomethane	NA	ug/l		0.521	160	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND	--	--	--	--	--	--	--	--	0.10	ND
Chloroethane	NA	ug/l				2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	--	--	--	--	2.0	ND
Chloroform	NA	ug/l		1.41	80.0	0.14	ND	0.14	ND	0.14	ND	0.14	ND	0.14	ND	--	--	--	--	--	--	--	--	0.10	ND
Chloromethane	NA	ug/l				2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	--	--	--	--	2.0	ND
Chlorotoluene, o	NA	ug/l			160	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	--	--	--	--	2.0	ND
Chlorotoluene, p	NA	ug/l				2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	--	--	--	--	2.0	ND
Cumene (isopropyl benzene)	NA	ug/l			800	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	--	--	--	--	2.0	ND
Cymene p- (toluene isopropyl p-)	NA	ug/l				2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	--	--	--	--	2.0	ND
Dibromomethane (methylene bromide)	NA	ug/l			80.0	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	--	--	--	--	2.0	ND
Dichlorodifluoromethane (Freon-12)	NA	ug/l			1600	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	--	--	--	--	2.0	ND
Ethyl benzene	NA	ug/l	700		800	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	--	--	--	--	2.0	ND
Hexachlorobutadiene	NA	ug/l		0.561	8.00	0.069	ND	0.069	ND	0.069	ND	0.069	ND	0.069	ND	--	--	--	--	--	--	--	--	2.0	ND
Hexane (C6)	NA	ug/l			480	--	--	--	--	--	--	2.0	ND	2.0	ND	--	--	--	--	--	--	--	--	--	--
Methyl ethyl ketone (2-butanone)	NA	ug/l			4800	10	ND	10	ND	10	ND	10	ND	10	ND	--	--	--	--	--	--	--	--	10	ND
Methyl isobutyl ketone (MIBK)	NA	ug/l			640	10	ND	10	ND	10	ND	10	ND	10	ND	--	--	--	--	--	--	--	--	10	ND
Methyl tertiary butyl ether (MTBE)	NA	ug/l	20.0	24.3		2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	--	--	--	--	2.0	ND

Table 2
Historical Groundwater Data - 2015 Landau PQLs vs. MTCA Cleanup Levels
Yakima Mill Site

					Location	**FPP-MW-03**		**FPP-MW-03**		**FPP-MW-03**		**FPP-MW-03**		**FPP-MW-03**		**MW-06**		**MW-06**		**MW-06**		**MW-06**		**MW-07**	
					Date	**12/18/2014**		**3/26/2015**		**3/26/2015**		**6/24/2015**		**6/24/2015**		**9/17/2014**		**12/19/2014**		**3/24/2015**		**6/24/2015**		**9/16/2014**	
					Sample Type	**FD**		**N**		**FD**		**N**		**FD**		**N**		**N**		**N**		**N**		**N**	
					Result Type	**PQL**	**Result**	**PQL**	**Result**	**PQL**	**Result**	**PQL**	**Result**	**PQL**	**Result**	**PQL**	**Result**	**PQL**	**Result**	**PQL**	**Result**	**PQL**	**Result**	**PQL**	**Result**
					Data Status	**SSource**	**SSource**	**SSource**	**SSource**	**SSource**	**SSource**	**SSource**	**SSource**	**SSource**	**SSource**	**SSource**	**SSource**	**SSource**	**SSource**	**SSource**	**SSource**	**SSource**	**SSource**	**SSource**	**SSource**
Parameter	Total or Dissolved	Units	Washington GW Method A	Washington Groundwater Method B Cancer	Washington Groundwater Method B Noncancer																				
Effective Date			07/01/2015	07/01/2015	07/01/2015																				
Exceedance Key			No Exceedances	Shade	Border																				
Methylene chloride	NA	ug/l	5.00	21.9	48.0	0.68	ND	0.68	ND	0.68	ND	0.68	ND	0.68	ND	--	--	--	--	--	--	--	--	5.0	ND
Naphthalene	NA	ug/l	160		160	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	2.0	ND
Propylbenzene	NA	ug/l			800	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	--	--	--	--	2.0	ND
Styrene	NA	ug/l			1600	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	--	--	--	--	2.0	ND
Tetrachloroethylene	NA	ug/l	5.00	20.8	48.0	0.023	ND	0.023	ND	0.023	ND	0.023	ND	0.023	ND	--	--	--	--	--	--	--	--	2.0	ND
Toluene	NA	ug/l	1000		640	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	--	--	--	--	2.0	ND
Trichloroethylene (TCE)	NA	ug/l	5.00	0.540	4.00	0.054	ND	0.054	ND	0.054	ND	0.054	ND	0.054	ND	--	--	--	--	--	--	--	--	0.020	ND
Trichlorofluoromethane (Freon-11)	NA	ug/l			2400	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	--	--	--	--	2.0	ND
Vinyl chloride	NA	ug/l	0.200		24.0	0.031	ND	0.031	ND	0.031	ND	0.031	ND	0.031	ND	--	--	--	--	--	--	--	--	0.20	ND
Xylene, m & p	NA	ug/l			1600	4.0	ND	4.0	ND	4.0	ND	4.0	ND	4.0	ND	--	--	--	--	--	--	--	--	4.0	ND
Xylene, o	NA	ug/l			1600	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	--	--	--	--	2.0	ND
Pesticides																									
4,4'-DDD	NA	ug/l		0.365		0.010	ND	0.010	ND UJ	0.010	ND	0.010	ND	0.011	ND	--	--	--	--	--	--	--	--	0.011	ND
4,4'-DDE	NA	ug/l		0.257		0.010	ND	0.010	ND UJ	0.010	ND	0.010	ND	0.011	ND	--	--	--	--	--	--	--	--	0.011	ND
4,4'-DDT	NA	ug/l	0.300	0.257	8.00	0.010	ND	0.010	ND UJ	0.010	ND	0.010	ND	0.011	ND	--	--	--	--	--	--	--	--	0.011	ND
a-BHC	NA	ug/l		0.0139	128	0.010	ND	0.010	ND UJ	0.010	ND	0.010	ND	0.011	ND	--	--	--	--	--	--	--	--	0.011	ND
Aldrin	NA	ug/l		0.00257	0.240	0.010	ND	0.010	ND UJ	0.010	ND	0.010	ND	0.011	ND	--	--	--	--	--	--	--	--	0.011	ND
b-BHC	NA	ug/l		0.0486		0.010	ND	0.010	ND UJ	0.010	ND	0.010	ND	0.011	ND	--	--	--	--	--	--	--	--	0.011	ND
Chlordane, alpha & gamma	NA	ug/l		0.250	8.00	0.010	ND	0.010	ND UJ	0.010	ND	0.010	ND	0.011	ND	--	--	--	--	--	--	--	--	0.011	ND
d-BHC	NA	ug/l				0.010	ND	0.010	ND UJ	0.010	ND	0.010	ND	0.011	ND	--	--	--	--	--	--	--	--	0.011	ND
Dieldrin	NA	ug/l		0.00547	0.800	0.010	ND	0.010	ND UJ	0.010	ND	0.010	ND	0.011	ND	--	--	--	--	--	--	--	--	0.011	ND
Endosulfan I	NA	ug/l			96.0	0.010	ND	0.010	ND UJ	0.010	ND	0.010	ND	0.011	ND	--	--	--	--	--	--	--	--	0.011	ND
Endosulfan II	NA	ug/l			96.0	0.010	ND	0.010	ND UJ	0.010	ND	0.010	ND	0.011	ND	--	--	--	--	--	--	--	--	0.011	ND
Endosulfan sulfate	NA	ug/l			96.0	0.010	ND	0.010	ND UJ	0.010	ND	0.010	ND	0.011	ND	--	--	--	--	--	--	--	--	0.011	ND
Endrin	NA	ug/l			4.80	0.010	ND	0.010	ND UJ	0.010	ND	0.010	ND	0.011	ND	--	--	--	--	--	--	--	--	0.011	ND
Endrin aldehyde	NA	ug/l				0.010	ND	0.010	ND UJ	0.010	ND	0.010	ND	0.011	ND	--	--	--	--	--	--	--	--	0.011	ND
g-BHC (Lindane)	NA	ug/l	0.200	0.0795	4.80	0.010	ND	0.010	ND UJ	0.010	ND	0.010	ND	0.011	ND	--	--	--	--	--	--	--	--	0.011	ND
Heptachlor	NA	ug/l		0.0194	8.00	0.010	ND	0.010	ND UJ	0.010	ND	0.010	ND	0.011	ND	--	--	--	--	--	--	--	--	0.011	ND
Heptachlor epoxide	NA	ug/l		0.00481	0.104	0.010	ND	0.010	ND UJ	0.010	ND	0.010	ND	0.011	ND	--	--	--	--	--	--	--	--	0.011	ND
Hexachlorobenzene	NA	ug/l		0.0547	12.8	0.010	ND	0.010	ND UJ	0.010	ND	0.010	ND	0.011	ND	--	--	--	--	--	--	--	--	--	--
Methoxychlor	NA	ug/l			80.0	0.010	ND	0.010	ND UJ	0.010	ND	0.010	ND	0.011	ND	--	--	--	--	--	--	--	--	0.011	ND
Toxaphene	NA	ug/l		0.0795		0.50	ND	0.50	ND UJ	0.50	ND	0.50	ND	0.51	ND	--	--	--	--	--	--	--	--	0.52	ND
PCBs																									
Aroclor 1016	NA	ug/l		1.25	1.12	0.0050	ND	0.0050	ND	0.0050	ND	0.0050	ND	0.0051	ND	--	--	--	--	--	--	--	--	0.0052	ND
Aroclor 1221	NA	ug/l				0.010	ND	0.010	ND	0.010	ND	0.011	ND	0.011	ND	--	--	--	--	--	--	--	--	0.011	ND
Aroclor 1232	NA	ug/l				0.0050	ND	0.0050	ND	0.0050	ND	0.0050	ND	0.0051	ND	--	--	--	--	--	--	--	--	0.0052	ND
Aroclor 1242	NA	ug/l				0.0050	ND	0.0050	ND	0.0050	ND	0.0050	ND	0.0051	ND	--	--	--	--	--	--	--	--	0.0052	ND
Aroclor 1248	NA	ug/l				0.0050	ND	0.0050	ND	0.0050	ND	0.0050	ND	0.0051	ND	--	--	--	--	--	--	--	--	0.0052	ND
Aroclor 1254	NA	ug/l		0.0438	0.320	0.0050	ND	0.0050	ND	0.0050	ND	0.0050	ND	0.0051	ND	--	--	--	--	--	--	--	--	0.0052	ND
Aroclor 1260	NA	ug/l		0.0438		0.0050	ND	0.0050	ND	0.0050	ND	0.0050	ND	0.0051	ND	--	--	--	--	--	--	--	--	0.0052	ND
Total Petroleum Hydrocarbons																									
Total Petroleum Hydrocarbons (as diesel)	NA	ug/l	500			310	ND	310	ND	310	ND	310	ND	310	ND	310	ND	310	ND	310	ND	310	ND	310	ND
Total Petroleum Hydrocarbons (as diesel), silica gel	NA	ug/l	500			--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Total Petroleum Hydrocarbons (as gasoline)	NA	ug/l	800			130	ND	130	ND	130	ND	130	ND	130	ND	130	ND	130	ND	130	ND	130	ND	130	ND
Total Petroleum Hydrocarbons (as motor oil)	NA	ug/l	500			310	ND	310	ND	310	ND	310	ND	310	ND	310	ND	310	ND	310	ND	310	ND	310	ND
Total Petroleum Hydrocarbons (as motor oil), silica gel	NA	ug/l	500			--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--

Landau qualifier - J: Indicates the analyte was positively identified; the associated numerical value is the approximate concentration of the analyte in the sample.

Landau qualifier - UJ: The analyte was not detected in the sample; the reported sample reporting limit is an estimate.

N: Normal Sample.

FD: Field Duplicate Sample.

ND: Not detected.

PQL: Practical Quantitation Limit.

SSource: Laboratory and/or field data obtained from a secondary source external to Barr. Second source QA/QC evaluation procedures may or may not have been performed beyond the original data generator.

Table was updated (items in red) after original submittal to add Landau qualifiers to be consistent with the memo.

Table 2
Historical Groundwater Data - 2015 Landau PQLs vs. MTCA Cleanup Levels
Yakima Mill Site

					Location	MW-07		MW-07		MW-07		MW-08		MW-08		MW-08		MW-08		MW-09A		MW-09A	
					Date	12/16/2014		3/26/2015		6/25/2015		9/16/2014		12/19/2014		3/25/2015		6/25/2015		9/15/2014		12/17/2014	
					Sample Type	N		N		N		N		N		N		N		N		N	
					Result Type	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result
					Data Status	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource
Parameter	Total or Dissolved	Units	Washington GW Method A	Washington Groundwater Method B Cancer	Washington Groundwater Method B Noncancer																		
Effective Date			07/01/2015	07/01/2015	07/01/2015																		
Exceedance Key			No Exceedances	Shade	Border																		
General Parameters																							
Alkalinity, bicarbonate, as CaCO3	NA	mg/l				15	220	0.0	170	15	170	15	250	15	260	0.0	260	15	200	15	88	15	67
Alkalinity, total, as CaCO3	NA	mg/l				15	220	0.0	170	15	170	15	250	15	260	0.0	260	15	200	15	88	15	67
Carbon, total organic	NA	mg/l				0.50	4.2	0.50	4.1	0.50	3.8	0.50	8	0.50	4.5	0.50	3.8	0.50	4.3	0.50	1.6	0.50	1.0
Chloride	NA	mg/l				0.092	19	0.092	17	0.092	14	0.46	18	0.46	21	0.92	24	0.92	16	0.092	8.8	0.092	6.0
Fluoride	NA	mg/l			0.64	0.16	0.39	0.16	ND	0.16	ND	0.16	0.23	0.16	0.26	0.16	0.19	0.16	ND	0.16	0.41	0.16	0.32
Nitrogen, ammonia, as N	NA	mg/l				0.050	5.0	0.050	4.1	0.050	2.9	0.050	8.4	0.050	8.9	0.25	11	0.050	4.4	0.050	0.06	0.050	ND
Nitrogen, nitrate, as N	NA	mg/l			25.6	0.034	0.35	0.034	4.1	0.034	0.061	0.034	ND	0.034	0.44	0.34	27	0.034	0.047	0.034	3.3	0.034	0.53
Nitrogen, nitrite, as N	NA	mg/l			1.6	0.043	ND	0.043	ND	0.043	ND	0.043	ND	0.043	ND	0.043	ND	0.043	ND	0.043	ND	0.043	ND
Solids, total dissolved	NA	mg/l				5.0	240	5.0	210	5.0	170	5.0	230	5.0	300	5.0	290	5.0	240	5.0	170	5.0	100
Sulfate, as SO4	NA	mg/l				0.26	ND	0.26	0.67	0.26	1.1	0.26	0.41	0.26	0.82	0.26	1.2	0.26	ND	0.26	10	0.26	6.4
Metals																							
Arsenic	Dissolved	ug/l	5.00	0.0583	4.80	0.45	2.8	0.45	2.6	0.45	1.8	1.0	3.7	0.45	0.68	0.50	1.5	0.45	4.1	1.0	1.1	0.45	0.67
Arsenic	Total	ug/l	5.00	0.0583	4.80	0.45	2.6	0.45	2	0.45	1.4	1.0	4.8	0.45	1.2	0.50	1.6	0.45	3.3	1.0	ND	0.45	0.97
Barium	Dissolved	ug/l			3200	1.0	52	1.0	52	1.0	33	1.0	77	1.0	64	1.0	65	1.0	54	1.0	8.5	1.0	4.9
Barium	Total	ug/l			3200	1.0	49	1.0	52	1.0	34	1.0	98	1.0	65	1.0	63	1.0	54	1.0	8.5	1.0	5.1
Cadmium	Dissolved	ug/l	5.00		8.00	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND
Cadmium	Total	ug/l	5.00		8.00	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND
Calcium	Dissolved	ug/l				100	37000	100	34000	100	29000	100	31000	100	38000	100	43000	100	33000	100	21000	100	14000
Calcium	Total	ug/l				100	37000	100	33000	100	29000	100	32000	100	39000	100	42000	100	33000	100	20000	100	14000
Chromium	Dissolved	ug/l	50.0			2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
Chromium	Total	ug/l	50.0			2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
Chromium, hexavalent	Dissolved	ug/l			48.0	--	--	--	--	--	--	10	ND UJ	--	--	--	--	--	--	10	ND	--	--
Chromium, hexavalent	Total	ug/l			48.0	--	--	--	--	--	--	10	ND UJ	--	--	--	--	--	--	10	ND	--	--
Iron	Dissolved	ug/l			11200	50	23000	50	17000	50	11000	50	14000	50	7700	50	5900	50	24000	50	ND	50	ND
Iron	Total	ug/l			11200	50	22000	50	17000	50	11000	50	17000	50	6300	50	5200	50	23000	50	ND	50	ND
Lead	Dissolved	ug/l	15.0			0.28	ND	0.28	ND	0.28	ND	1.0	ND	0.28	ND	0.28	ND	0.28	ND	1.0	ND	0.28	ND
Lead	Total	ug/l	15.0			0.28	ND	0.28	ND	0.28	ND	1.0	2.1	0.28	ND	0.28	ND	0.28	ND	1.0	ND	0.28	ND
Magnesium	Dissolved	ug/l				50	13000	50	12000	50	10000	50	13000	50	17000	50	19000	50	13000	50	6600	50	4600
Magnesium	Total	ug/l				50	13000	50	12000	50	10000	50	14000	50	18000	50	19000	50	13000	50	6600	50	4400
Manganese	Dissolved	ug/l			2240	2.0	1900	2.0	1400	2.0	1400	2.0	1900	2.0	2000	2.0	2200	2.0	1800	2.0	ND	2.0	ND
Manganese	Total	ug/l			2240	2.0	2000	2.0	1400	2.0	1300	2.0	2000	2.0	2000	2.0	2200	2.0	1800	2.0	ND	2.0	ND
Mercury	Dissolved	ug/l	2.00			0.11	ND	0.11	ND	0.11	ND	0.20	ND	0.11	ND	0.11	ND	0.11	ND	0.20	ND	0.11	ND
Mercury	Total	ug/l	2.00			0.11	ND	0.11	ND	0.11	ND	0.20	ND	0.11	ND	0.11	ND	0.11	ND	0.20	ND	0.11	ND
Potassium	Dissolved	ug/l				--	--	50	8700	50	7800	--	--	--	--	50	20000	50	8000	--	--	--	--
Potassium	Total	ug/l				--	--	50	8500	50	7900	--	--	--	--	50	20000	50	7700	--	--	--	--
Selenium	Dissolved	ug/l			80.0	4.0	ND	4.0	ND	4.0	ND	4.0	ND	4.0	ND	4.0	ND	4.0	ND	4.0	ND	4.0	ND
Selenium	Total	ug/l			80.0	4.0	ND	4.0	ND	4.0	ND	4.0	ND	4.0	ND	4.0	ND	4.0	ND	4.0	ND	4.0	ND
Silver	Dissolved	ug/l			80.0	0.20	ND	0.20	ND	0.20	ND	1.0	ND	0.20	ND	0.20	ND	0.20	ND	1.0	ND	0.20	ND
Silver	Total	ug/l			80.0	0.20	ND	0.20	ND	0.20	ND	1.0	ND	0.20	ND	0.20	ND	0.20	ND	1.0	ND	0.20	ND
Sodium	Dissolved	ug/l				50	19000	50	18000	50	14000	50	25000	50	28000	50	30000	50	20000	50	11000	50	9400
Sodium	Total	ug/l				50	19000	50	18000	50	15000	50	26000	50	28000	50	30000	50	20000	50	11000	50	9000
SVOCs																							
1,2,4-Trichlorobenzene	NA	ug/l		1.51	80.0	2.0	ND	--	--	--	--	2.0	ND	2.0	ND	--	--	--	--	2.0	ND	2.0	ND
1,2-Dichlorobenzene	NA	ug/l			720	2.0	ND	--	--	--	--	2.0	ND	2.0	ND	--	--	--	--	2.0	ND	2.0	ND
1,3-Dichlorobenzene	NA	ug/l				2.0	ND	--	--	--	--	2.0	ND	2.0	ND	--	--	--	--	2.0	ND	2.0	ND
1,4-Dichlorobenzene	NA	ug/l		8.10	560	2.0	ND	--	--	--	--	2.0	ND	2.0	ND	--	--	--	--	2.0	ND	2.0	ND
1-Methylnaphthalene	NA	ug/l		1.51	560	0.020	ND	0.020	ND	0.020	ND	0.020	ND	0.020	ND	0.020	ND	0.020	ND	0.020	ND	0.020	ND
2,2'-oxybis (1-chloropropane)	NA	ug/l		0.625	320	2.0	ND	2.0	ND	2.0	ND UJ	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
2,3,4,6-Tetrachlorophenol	NA	ug/l			480	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
2,4,5-Trichlorophenol	NA	ug/l			800	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
2,4,6-Trichlorophenol	NA	ug/l		3.98	8.00	0.83	ND	0.90	ND	0.84	ND	2.0	ND	0.83	ND	0.83	ND	0.84	ND	2.0	ND	0.83	ND
2,4-Dichlorophenol	NA	ug/l			24.0	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
2,4-Dimethylphenol	NA	ug/l			160	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
2,4-Dinitrophenol	NA	ug/l			32.0	10	ND	10	ND	10	ND	10	ND	10	ND	10	ND	10	ND	10	ND	10	ND
2,4-Dinitrotoluene	NA	ug/l		0.282	32.0	0.72	ND	0.78	ND	0.73	ND UJ	0.78	ND	0.72	ND	0.72	ND	0.73	ND	0.78	ND	0.72	ND
2,6-Dichlorophenol	NA	ug/l				2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND

11-30-2017

Table 2
Historical Groundwater Data - 2015 Landau PQLs vs. MTCA Cleanup Levels
Yakima Mill Site

					Location	MW-07		MW-07		MW-07		MW-08		MW-08		MW-08		MW-08		MW-09A		MW-09A	
					Date	12/16/2014		3/26/2015		6/25/2015		9/16/2014		12/19/2014		3/25/2015		6/25/2015		9/15/2014		12/17/2014	
					Sample Type	N		N		N		N		N		N		N		N		N	
					Result Type	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result
					Data Status	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource
Parameter	Total or Dissolved	Units	Washington GW Method A	Washington Groundwater Method B Cancer	Washington Groundwater Method B Noncancer																		
Effective Date			07/01/2015	07/01/2015	07/01/2015																		
Exceedance Key			No Exceedances	Shade	Border																		
2,6-Dinitrotoluene	NA	ug/l		0.0583	4.80	1.7	ND	1.8	ND	1.7	ND UJ	1.8	ND	1.7	ND	1.7	ND	1.7	ND	1.8	ND	1.7	ND
2-Chloronaphthalene	NA	ug/l			640	2.0	ND	2.0	ND	2.0	ND UJ	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
2-Chlorophenol	NA	ug/l			40.0	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
2-Methyl-4,6-dinitrophenol	NA	ug/l				2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
2-Methylnaphthalene	NA	ug/l			32.0	0.020	ND	0.020	ND	0.020	ND	0.020	ND	0.020	ND	0.020	ND	0.020	ND	0.020	ND	0.020	ND
2-Methylphenol (o-cresol)	NA	ug/l			400	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
2-Nitroaniline	NA	ug/l			160	2.0	ND	2.0	ND	2.0	ND UJ	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
2-Nitrophenol	NA	ug/l				2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
3,3`-Dichlorobenzidine	NA	ug/l		0.194		1.9	ND	2.0	ND	1.9	ND UJ	2.0	ND	1.9	ND	1.9	ND	1.9	ND	2.0	ND	1.9	ND
3,4-Methylphenol (m,p cresols)	NA	ug/l				2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
3-Nitroaniline	NA	ug/l				5.0	ND	5.0	ND	5.0	ND UJ	5.0	ND	5.0	ND	5.0	ND	5.0	ND	5.0	ND	5.0	ND
4-Bromophenyl phenyl ether	NA	ug/l				2.0	ND	2.0	ND	2.0	ND UJ	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
4-Chloro-3-methylphenol	NA	ug/l				2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
4-Chloroaniline	NA	ug/l		0.219	32.0	1.8	ND	1.9	ND	1.8	ND UJ	2.0	ND	1.8	ND	1.8	ND	1.8	ND	2.0	ND	1.8	ND
4-Chlorophenyl phenyl ether	NA	ug/l				2.0	ND	2.0	ND	2.0	ND UJ	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
4-Nitroaniline	NA	ug/l				2.0	ND	2.0	ND	2.0	ND UJ	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
4-Nitrophenol	NA	ug/l				2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
Acenaphthene	NA	ug/l			960	0.014	ND	0.014	ND	0.014	ND	0.020	ND	0.014	ND	0.014	ND	0.014	ND	0.020	ND	0.014	ND
Acenaphthylene	NA	ug/l				0.020	ND	0.020	ND	0.020	ND	0.020	ND	0.020	ND	0.020	ND	0.020	ND	0.020	ND	0.020	ND
Aniline	NA	ug/l		7.68	56.0	2.0	ND	2.0	ND	2.0	ND UJ	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
Anthracene	NA	ug/l			4800	0.010	ND	0.010	0.017	0.010	ND	0.020	ND	0.010	ND	0.010	ND	0.010	ND	0.020	ND	0.010	ND
Azobenzene	NA	ug/l		0.795		1.5	ND	1.6	ND	1.5	ND UJ	2.0	ND	1.5	ND	1.5	ND	1.5	ND	2.0	ND	1.5	ND
Benz(a)anthracene	NA	ug/l		0.120		0.017	ND	0.017	ND	0.017	ND	0.020	ND	0.017	ND	0.017	ND	0.017	ND	0.020	ND	0.017	ND
Benzo(a)pyrene	NA	ug/l	0.100	0.0120		0.027	ND	0.027	ND	0.027	ND	0.029	ND	0.027	ND	0.027	ND	0.027	ND	0.029	ND	0.027	ND
Benzo(b)fluoranthene	NA	ug/l		0.120		0.0068	ND	0.0068	ND	0.0068	ND	0.020	ND	0.0068	ND	0.0068	ND	0.0068	ND	0.020	ND	0.0068	ND
Benzo(g,h,i)perylene	NA	ug/l				0.019	ND	0.019	ND	0.019	ND	0.020	ND	0.019	ND	0.019	ND	0.019	ND	0.020	ND	0.019	ND
Benzo(k)fluoranthene	NA	ug/l		1.20		0.013	ND	0.013	ND	0.013	ND	0.020	ND	0.013	ND	0.013	ND	0.013	ND	0.020	ND	0.013	ND
Benzoic acid	NA	ug/l			64000	10	ND	10	ND	10	ND	10	ND	10	ND	10	ND	10	ND	10	ND	10	ND
Benzyl alcohol	NA	ug/l			800	2.0	ND	2.0	ND	2.0	ND UJ	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
Bis(2-chloroethoxy)methane	NA	ug/l				2.0	ND	2.0	ND	2.0	ND UJ	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
Bis(2-chloroethyl)ether	NA	ug/l		0.0398		0.87	ND	0.94	ND	0.88	ND UJ	0.94	ND	0.87	ND	0.87	ND	0.88	ND	0.94	ND	0.87	ND
Bis(2-ethylhexyl)phthalate	NA	ug/l		6.25	320	0.75	ND	0.81	ND	0.75	ND UJ	2.0	10	0.75	49	0.75	ND	0.75	ND	2.0	ND	0.75	ND
Butyl benzyl phthalate	NA	ug/l		46.1	3200	2.0	ND	2.0	ND	2.0	ND UJ	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
Carbazole	NA	ug/l				2.0	ND	2.0	ND	2.0	ND UJ	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
Chrysene	NA	ug/l		12.0		0.018	ND	0.018	ND	0.018	ND	0.020	ND	0.018	ND	0.018	ND	0.018	ND	0.020	ND	0.018	ND
Dibenz(a,h)anthracene	NA	ug/l		0.0120		0.011	ND	0.011	ND	0.011	ND	0.012	ND	0.011	ND	0.011	ND	0.011	ND	0.012	ND	0.011	ND
Dibenzofuran	NA	ug/l			16.0	2.0	ND	2.0	ND	2.0	ND UJ	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
Diethyl phthalate	NA	ug/l			12800	2.0	ND	2.0	ND	2.0	ND UJ	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
Dimethyl phthalate	NA	ug/l				2.0	ND	2.0	ND	2.0	ND UJ	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
Di-n-butyl phthalate	NA	ug/l			1600	2.0	ND	2.0	ND	2.0	ND UJ	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
Di-n-octyl phthalate	NA	ug/l			160	2.0	ND	2.0	ND	2.0	ND UJ	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
Fluoranthene	NA	ug/l			640	0.0092	ND	0.0092	ND	0.0092	ND	0.020	ND	0.0092	ND	0.0092	ND	0.0092	ND	0.020	ND	0.0092	ND
Fluorene	NA	ug/l			640	0.0090	ND	0.0090	ND	0.0091	ND	0.020	ND	0.0090	ND	0.009	0.0096	0.0091	ND	0.020	ND	0.009	0.0092
Hexachlorobenzene	NA	ug/l		0.0547	12.8	0.59	ND	--	--	--	--	2.0	ND	0.59	ND	--	--	--	--	2.0	ND	0.59	ND
Hexachlorobutadiene	NA	ug/l		0.561	8.00	--	--	--	--	--	--	2.0	ND	--	--	--	--	--	--	2.0	ND	--	--
Hexachlorocyclopentadiene	NA	ug/l			48.0	2.0	ND	2.0	ND	2.0	ND UJ	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
Hexachloroethane	NA	ug/l		1.09	5.60	1.9	ND	2.0	ND	1.9	ND UJ	2.0	ND	1.9	ND	1.9	ND	1.9	ND	2.0	ND	1.9	ND
Indeno(1,2,3-cd)pyrene	NA	ug/l		0.120		0.014	ND	0.014	ND	0.014	ND	0.020	ND	0.014	ND	0.014	ND	0.014	ND	0.020	ND	0.014	ND
Isophorone	NA	ug/l		46.1	1600	2.0	ND	2.0	ND	2.0	ND UJ	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
Naphthalene	NA	ug/l	160		160	0.013	ND	0.013	ND	0.013	ND	0.020	ND	0.013	ND	0.013	ND	0.013	ND	0.020	ND	0.013	ND
Nitrobenzene	NA	ug/l			16.0	2.0	ND	2.0	ND	2.0	ND UJ	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
n-Nitrosodimethylamine	NA	ug/l		0.000858	0.0640	1.4	ND	1.5	ND	1.4	ND UJ	1.5	ND	1.4	ND	1.4	ND	1.4	ND	1.5	ND	1.4	ND
n-Nitrosodi-n-propylamine	NA	ug/l		0.0125		1.9	ND	2.0	ND	1.9	ND UJ	2.0	ND	1.9	ND	1.9	ND	1.9	ND	2.0	ND	1.9	ND
n-Nitrosodiphenylamine	NA	ug/l		17.9		2.0	ND	2.0	ND	2.0	ND UJ	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
Pentachlorophenol	NA	ug/l		0.219	80.0	0.12	ND	0.12	ND	0.12	ND	0.13	ND	0.12	ND	0.12	ND	0.12	ND	0.13	ND	0.12	ND
Phenanthrene	NA	ug/l				0.013	ND	0.013	0.015	0.013	ND	0.020	ND	0.013	ND	0.013	ND	0.013	ND	0.020	ND	0.013	ND
Phenol	NA	ug/l			2400	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
Pyrene	NA	ug/l			480	0.010	0.011	0.010	ND	0.011	ND	0.020	ND	0.010	ND	0.010	ND	0.011	ND	0.020	ND	0.010	ND

Table 2
Historical Groundwater Data - 2015 Landau PQLs vs. MTCA Cleanup Levels
Yakima Mill Site

					Location	MW-07		MW-07		MW-07		MW-08		MW-08		MW-08		MW-08		MW-09A		MW-09A	
					Date	12/16/2014		3/26/2015		6/25/2015		9/16/2014		12/19/2014		3/25/2015		6/25/2015		9/15/2014		12/17/2014	
					Sample Type	N		N		N		N		N		N		N		N		N	
					Result Type	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result
					Data Status	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource
Parameter	Total or Dissolved	Units	Washington GW Method A	Washington Groundwater Method B Cancer	Washington Groundwater Method B Noncancer																		
Effective Date			07/01/2015	07/01/2015	07/01/2015																		
Exceedance Key			No Exceedances	Shade	Border																		
Pyridine	NA	ug/l			8.00	2.0	ND	2.0	ND	2.0	ND UJ	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
VOCs						--		--		--		--		--		--		--		--		--	
1,1,1,2-Tetrachloroethane	NA	ug/l		1.68	240	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND
1,1,1-Trichloroethane	NA	ug/l	200		16000	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
1,1,2,2-Tetrachloroethane	NA	ug/l		0.219	160	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND
1,1,2-Trichloroethane	NA	ug/l		0.768	32.0	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND
1,1-Dichloroethane	NA	ug/l		7.68	1600	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
1,1-Dichloroethylene	NA	ug/l			400	0.014	ND	0.014	ND	0.014	ND	2.0	ND	0.014	ND	0.014	ND	0.014	ND	2.0	ND	0.014	ND
1,1-Dichloropropene	NA	ug/l				2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
1,2,3-Trichlorobenzene	NA	ug/l				2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
1,2,3-Trichloropropane	NA	ug/l		0.00146	32.0	0.023	ND	0.023	ND	0.023	ND	0.023	ND	0.023	ND	0.023	ND	0.023	ND	0.023	ND	0.023	ND
1,2,4-Trichlorobenzene	NA	ug/l		1.51	80.0	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND
1,2,4-Trimethylbenzene	NA	ug/l				2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
1,2-Dibromo-3-chloropropane (DBCP)	NA	ug/l		0.0547	1.60	0.10	ND	0.10	ND	0.10	ND	10	ND	0.10	ND	0.10	ND	0.10	ND	10	ND	0.10	ND
1,2-Dibromoethane (EDB)	NA	ug/l	0.0100	0.0219	72.0	0.010	ND	0.010	ND	0.010	ND	0.010	ND	0.010	ND	0.010	ND	0.010	ND	0.010	ND	0.010	ND
1,2-Dichlorobenzene	NA	ug/l			720	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
1,2-Dichloroethane	NA	ug/l	5.00	0.481	48.0	0.014	ND	0.014	ND	0.014	ND	2.0	ND	0.014	ND	0.014	ND	0.014	ND	2.0	ND	0.014	ND
1,2-Dichloroethylene, cis	NA	ug/l			16.0	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
1,2-Dichloroethylene, trans	NA	ug/l			160	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
1,2-Dichloropropane	NA	ug/l		1.22	720	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND
1,3,5-Trimethylbenzene	NA	ug/l			80.0	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
1,3-Dichlorobenzene	NA	ug/l				2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
1,3-Dichloropropane	NA	ug/l				2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
1,3-Dichloropropene, cis	NA	ug/l		0.438	240	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
1,3-Dichloropropene, trans	NA	ug/l		0.438	240	0.058	ND	0.058	ND	0.058	ND	2.0	ND	0.058	ND	0.058	ND	0.058	ND	2.0	ND	0.058	ND
1,4-Dichlorobenzene	NA	ug/l		8.10	560	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
2,2-Dichloropropane	NA	ug/l				2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
2-Hexanone	NA	ug/l				10	ND	10	ND	10	ND	10	ND	10	ND	10	ND	10	ND	10	ND	10	ND
Acetone	NA	ug/l			7200	25	ND	25	ND	25	ND	25	ND	25	ND	25	ND	25	ND	25	ND	25	ND
Acrylonitrile	NA	ug/l		0.0810	320	0.057	ND	0.057	ND	0.057	ND	10	ND	0.057	ND	0.057	ND	0.057	ND	10	ND	0.057	ND
Benzene	NA	ug/l	5.00	0.795	32.0	0.028	ND	0.028	ND	0.028	ND	2.0	ND	0.028	ND	0.028	ND	0.028	ND	2.0	ND	0.028	ND
Bromobenzene	NA	ug/l				2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
Bromochloromethane	NA	ug/l				2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
Bromodichloromethane	NA	ug/l		0.706	160	0.059	ND	0.059	ND	0.059	ND	0.059	ND	0.059	ND	0.059	ND	0.059	ND	0.059	ND	0.059	ND
Bromoform	NA	ug/l		5.54	160	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
Bromomethane	NA	ug/l			11.2	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
Butylbenzene	NA	ug/l			400	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
Butylbenzene, sec	NA	ug/l			800	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
Butylbenzene, tert	NA	ug/l			800	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
Carbon disulfide	NA	ug/l			800	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
Carbon tetrachloride	NA	ug/l		0.625	32.0	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND
Chlorobenzene	NA	ug/l			160	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
Chlorodibromomethane	NA	ug/l		0.521	160	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND
Chloroethane	NA	ug/l				2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
Chloroform	NA	ug/l		1.41	80.0	0.14	ND	0.14	ND	0.14	ND	0.10	ND	0.14	ND	0.14	ND	0.14	ND	0.10	1.7	0.14	22
Chloromethane	NA	ug/l				2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
Chlorotoluene, o	NA	ug/l			160	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
Chlorotoluene, p	NA	ug/l				2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
Cumene (isopropyl benzene)	NA	ug/l			800	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
Cymene p- (toluene isopropyl p-)	NA	ug/l				2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
Dibromomethane (methylene bromide)	NA	ug/l			80.0	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
Dichlorodifluoromethane (Freon-12)	NA	ug/l			1600	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
Ethyl benzene	NA	ug/l	700		800	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
Hexachlorobutadiene	NA	ug/l		0.561	8.00	0.069	ND	0.069	ND	0.069	ND	2.0	ND	0.069	ND	0.069	ND	0.069	ND	2.0	ND	0.069	ND
Hexane (C6)	NA	ug/l			480	--	--	--	--	2.0	ND	--	--	--	--	--	--	2.0	ND	--	--	--	--
Methyl ethyl ketone (2-butanone)	NA	ug/l			4800	10	ND	10	ND	10	ND	10	ND	10	ND	10	ND	10	ND	10	ND	10	ND
Methyl isobutyl ketone (MIBK)	NA	ug/l			640	10	ND	10	ND	10	ND	10	ND	10	ND	10	ND	10	ND	10	ND	10	ND
Methyl tertiary butyl ether (MTBE)	NA	ug/l	20.0	24.3		2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND

Table 2
Historical Groundwater Data - 2015 Landau PQLs vs. MTCA Cleanup Levels
Yakima Mill Site

Location						MW-07		MW-07		MW-07		MW-08		MW-08		MW-08		MW-08		MW-09A		MW-09A	
Date						12/16/2014		3/26/2015		6/25/2015		9/16/2014		12/19/2014		3/25/2015		6/25/2015		9/15/2014		12/17/2014	
Sample Type						N		N		N		N		N		N		N		N		N	
Result Type						PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result
Data Status						SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource
Parameter	Total or Dissolved	Units	Washington GW Method A	Washington Groundwater Method B Cancer	Washington Groundwater Method B Noncancer																		
Effective Date			07/01/2015	07/01/2015	07/01/2015																		
Exceedance Key			No Exceedances	Shade	Border																		
Methylene chloride	NA	ug/l	5.00	21.9	48.0	0.68	ND	0.68	ND	0.68	ND	5.0	ND	0.68	ND	0.68	ND	0.68	ND	5.0	ND	0.68	ND
Naphthalene	NA	ug/l	160		160	--	--	--	--	--	--	2.0	ND	--	--	--	--	--	--	2.0	ND	--	--
Propylbenzene	NA	ug/l			800	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
Styrene	NA	ug/l			1600	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
Tetrachloroethylene	NA	ug/l	5.00	20.8	48.0	0.023	ND	0.023	ND	0.023	ND	2.0	ND	0.023	ND	0.023	ND	0.023	ND	2.0	ND	0.023	ND
Toluene	NA	ug/l	1000		640	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
Trichloroethylene (TCE)	NA	ug/l	5.00	0.540	4.00	0.054	ND	0.054	ND	0.054	ND	0.020	ND	0.054	ND	0.054	ND	0.054	ND	0.020	ND	0.054	ND
Trichlorofluoromethane (Freon-11)	NA	ug/l			2400	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
Vinyl chloride	NA	ug/l	0.200		24.0	0.031	ND	0.031	ND	0.031	ND	0.20	ND	0.031	ND	0.031	ND	0.031	ND	0.20	ND	0.031	ND
Xylene, m & p	NA	ug/l			1600	4.0	ND	4.0	ND	4.0	ND	4.0	ND	4.0	ND	4.0	ND	4.0	ND	4.0	ND	4.0	ND
Xylene, o	NA	ug/l			1600	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
Pesticides																							
4,4'-DDD	NA	ug/l		0.365		0.011	ND	0.010	ND	0.010	ND	0.011	ND	0.011	ND	0.011	ND	0.010	ND	0.010	ND	0.010	ND
4,4'-DDE	NA	ug/l		0.257		0.011	ND	0.010	ND	0.010	ND	0.011	ND	0.011	ND	0.011	ND	0.010	ND	0.010	ND	0.010	ND
4,4'-DDT	NA	ug/l	0.300	0.257	8.00	0.011	ND	0.010	ND	0.010	ND	0.011	ND	0.011	ND	0.011	ND	0.010	ND	0.010	ND	0.010	ND
a-BHC	NA	ug/l		0.0139	128	0.011	ND	0.010	ND	0.010	ND	0.011	ND	0.011	ND	0.011	ND	0.010	ND	0.010	ND	0.010	ND
Aldrin	NA	ug/l		0.00257	0.240	0.011	ND	0.010	ND	0.010	ND	0.011	ND	0.011	ND	0.011	ND	0.010	ND	0.010	ND	0.010	ND
b-BHC	NA	ug/l		0.0486		0.011	ND	0.010	ND	0.010	ND	0.011	ND	0.011	ND	0.011	ND	0.010	ND	0.010	ND	0.010	ND
Chlordane, alpha & gamma	NA	ug/l		0.250	8.00	0.011	ND	0.010	ND	0.010	ND	0.011	ND	0.011	ND	0.011	ND	0.010	ND	0.010	ND	0.010	ND
d-BHC	NA	ug/l				0.011	ND	0.010	ND	0.010	ND	0.011	ND	0.011	ND	0.011	ND	0.010	ND	0.010	ND	0.010	ND
Dieldrin	NA	ug/l		0.00547	0.800	0.011	ND	0.010	ND	0.010	ND	0.011	ND	0.011	ND	0.011	ND	0.010	ND	0.010	ND	0.010	ND
Endosulfan I	NA	ug/l			96.0	0.011	ND	0.010	ND	0.010	ND	0.011	ND	0.011	ND	0.011	ND	0.010	ND	0.010	ND	0.010	ND
Endosulfan II	NA	ug/l			96.0	0.011	ND	0.010	ND	0.010	ND	0.011	ND	0.011	ND	0.011	ND	0.010	ND	0.010	ND	0.010	ND
Endosulfan sulfate	NA	ug/l			96.0	0.011	ND	0.010	ND	0.010	ND	0.011	ND	0.011	ND	0.011	ND	0.010	ND	0.010	ND	0.010	ND
Endrin	NA	ug/l			4.80	0.011	ND	0.010	ND	0.010	ND	0.011	ND	0.011	ND	0.011	ND	0.010	ND	0.010	ND	0.010	ND
Endrin aldehyde	NA	ug/l				0.011	ND	0.010	ND	0.010	ND	0.011	ND	0.011	ND	0.011	ND	0.010	ND	0.010	ND	0.010	ND
g-BHC (Lindane)	NA	ug/l	0.200	0.0795	4.80	0.011	ND	0.010	ND	0.010	ND	0.011	ND	0.011	ND	0.011	ND	0.010	ND	0.010	ND	0.010	ND
Heptachlor	NA	ug/l		0.0194	8.00	0.011	ND	0.010	ND	0.010	ND	0.011	ND	0.011	ND	0.011	ND	0.010	ND	0.010	ND	0.010	ND
Heptachlor epoxide	NA	ug/l		0.00481	0.104	0.011	ND	0.010	ND	0.010	ND	0.011	ND	0.011	ND	0.011	ND	0.010	ND	0.010	ND	0.010	ND
Hexachlorobenzene	NA	ug/l		0.0547	12.8	0.011	ND	0.010	ND	0.010	ND	--	--	0.011	ND	0.011	ND	0.010	ND	--	--	0.010	ND
Methoxychlor	NA	ug/l			80.0	0.011	ND	0.010	ND	0.010	ND	0.011	ND	0.011	ND	0.011	ND	0.010	ND	0.010	ND	0.010	ND
Toxaphene	NA	ug/l		0.0795		0.52	ND	0.50	ND	0.50	ND	0.51	ND	0.53	ND	0.52	ND	0.50	ND	0.50	ND	0.50	ND
PCBs																							
Aroclor 1016	NA	ug/l		1.25	1.12	0.0052	ND	0.0050	ND	0.0050	ND	0.022	ND	0.0053	ND	0.0052	ND	0.0050	ND	0.0050	ND	0.0050	ND
Aroclor 1221	NA	ug/l				0.011	ND	0.010	ND	0.010	ND	0.017	ND	0.011	ND	0.023	ND	0.010	ND	0.010	ND	0.010	ND
Aroclor 1232	NA	ug/l				0.0052	ND	0.0050	ND	0.005	0.0097	0.047	ND	0.0053	ND	0.026	ND	0.0050	ND	0.0050	ND	0.0050	ND
Aroclor 1242	NA	ug/l				0.0052	0.040	0.005	0.026	0.0050	ND	0.028	ND	0.0053	0.010	0.011	ND	0.0050	ND	0.0050	ND	0.0050	ND
Aroclor 1248	NA	ug/l				0.0052	ND	0.0050	ND	0.0050	ND	0.012	ND	0.0053	ND	0.0064	ND	0.005	0.020	0.0050	ND	0.0050	ND
Aroclor 1254	NA	ug/l		0.0438	0.320	0.0052	ND	0.0050	ND	0.0050	ND	0.017	ND	0.0053	ND	0.0052	ND	0.0050	ND	0.0050	ND	0.0050	ND
Aroclor 1260	NA	ug/l		0.0438		0.0052	ND	0.0050	ND	0.0050	ND	0.0051	ND	0.0053	ND	0.0052	ND	0.0050	ND	0.0050	ND	0.0050	ND
Total Petroleum Hydrocarbons																							
Total Petroleum Hydrocarbons (as diesel)	NA	ug/l	500			310	ND	310	ND	310	ND	310	ND	310	ND	310	ND	310	ND	310	ND	310	ND
Total Petroleum Hydrocarbons (as diesel), silica gel	NA	ug/l	500			--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Total Petroleum Hydrocarbons (as gasoline)	NA	ug/l	800			130	ND	130	ND	130	ND	130	ND	130	ND	130	ND	130	ND	130	ND	130	ND
Total Petroleum Hydrocarbons (as motor oil)	NA	ug/l	500			310	ND	310	ND	310	ND	310	ND	310	ND	310	ND	310	ND	310	ND	310	ND
Total Petroleum Hydrocarbons (as motor oil), silica gel	NA	ug/l	500			--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--

Landau qualifier - J: Indicates the analyte was positively identified; the associated numerical value is the approximate concentration of the analyte in the sample.
Landau qualifier - UJ: The analyte was not detected in the sample; the reported sample reporting limit is an estimate.
N: Normal Sample.
FD: Field Duplicate Sample.
ND: Not detected.
PQL: Practical Quantitation Limit.
SSource: Laboratory and/or field data obtained from a secondary source external to Barr. Second source QA/QC evaluation procedures may or may not have been performed beyond the original data generator.
Table was updated (items in red) after original submittal to add Landau qualifiers to be consistent with the memo.

Table 2
Historical Groundwater Data - 2015 Landau PQLs vs. MTCA Cleanup Levels
Yakima Mill Site

					Location	MW-09A		MW-09A		MW-100		MW-100		MW-100		MW-100		MW-101		MW-101		MW-101		MW-101	
					Date	3/26/2015		6/24/2015		9/16/2014		12/17/2014		3/23/2015		6/24/2015		9/17/2014		12/18/2014		3/25/2015		6/25/2015	
					Sample Type	N		N		N		N		N		N		N		N		N		N	
					Result Type	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result
					Data Status	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource
Parameter	Total or Dissolved	Units	Washington GW Method A	Washington Groundwater Method B Cancer	Washington Groundwater Method B Noncancer																				
Effective Date			07/01/2015	07/01/2015	07/01/2015																				
Exceedance Key			No Exceedances	Shade	Border																				
General Parameters																									
Alkalinity, bicarbonate, as CaCO3	NA	mg/l				0.0	110	15	85	15	130	15	120	0.0	120	15	98	15	360	0.0	230	0.0	190	15	210
Alkalinity, total, as CaCO3	NA	mg/l				0.0	110	15	85	15	130	15	120	0.0	120	15	98	15	360	0.0	230	0.0	190	15	210
Carbon, total organic	NA	mg/l				0.50	0.83	0.50	1.3	0.50	1.6	0.50	1.0	0.50	0.88	0.50	1.3	1.0	33	0.50	8.6	0.50	6.4	2.0	10
Chloride	NA	mg/l				0.092	12	0.92	12	0.092	12	0.092	10	0.092	11	0.92	9.7	4.6	20	0.092	12	0.092	11	0.92	10
Fluoride	NA	mg/l			0.64	0.16	ND	0.16	ND	0.16	0.37	0.16	0.31	0.16	ND	0.16	ND	0.16	0.71	0.16	0.19	0.16	0.17	0.16	0.18
Nitrogen, ammonia, as N	NA	mg/l				0.050	ND	0.050	ND	0.050	0.21	0.050	0.056	0.050	ND	0.050	ND	0.050	1.8	0.050	1.7	0.050	1	0.050	0.75
Nitrogen, nitrate, as N	NA	mg/l			25.6	0.034	2	0.34	4.0	0.034	1.1	0.034	1.3	0.034	1.2	0.34	3.2	1.7	3.5	0.034	ND	0.034	0.045	0.034	ND
Nitrogen, nitrite, as N	NA	mg/l			1.6	0.043	ND	0.043	ND	0.043	0.6	0.043	ND	0.043	ND	0.043	ND	0.043	ND	0.043	ND	0.043	ND	0.043	ND
Solids, total dissolved	NA	mg/l				5.0	180	5.0	140	5.0	230	5.0	150	5.0	180	5.0	180	5.0	430	5.0	260	5.0	260	5.0	270
Sulfate, as SO4	NA	mg/l				0.26	11	2.6	12	0.26	14	0.26	12	0.26	10	2.6	17	0.26	ND	0.26	ND	0.26	ND	0.26	ND
Metals																									
Arsenic	Dissolved	ug/l	5.00	0.0583	4.80	0.45	ND	0.45	1.1	1.0	1	0.45	ND	0.45	0.61	0.45	1.2	1.0	2.9	0.45	1.5	0.50	4.2	0.45	2.1
Arsenic	Total	ug/l	5.00	0.0583	4.80	0.45	ND	0.86	ND	1.0	ND	0.45	0.88	0.45	0.86	0.76	ND	1.0	3.1	0.45	1.6	0.50	2.7	2.5	ND
Barium	Dissolved	ug/l			3200	1.0	11	1.0	8.3	1.0	8.2	1.0	5.9	1.0	6.5	1.0	5.7	1.0	74	1.0	51	1.0	36	1.0	49
Barium	Total	ug/l			3200	1.0	10	1.0	8.1	1.0	11	1.0	8.2	1.0	6.8	1.0	7.3	1.0	93	1.0	50	1.0	37	1.0	56
Cadmium	Dissolved	ug/l	5.00		8.00	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND
Cadmium	Total	ug/l	5.00		8.00	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND
Calcium	Dissolved	ug/l				100	27000	100	23000	100	22000	100	28000	100	32000	100	27000	100	65000	100	48000	100	38000	100	41000
Calcium	Total	ug/l				100	26000	100	22000	100	22000	100	29000	100	33000	100	25000	100	71000	100	47000	100	39000	100	44000
Chromium	Dissolved	ug/l	50.0			2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
Chromium	Total	ug/l	50.0			2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	2.6	2.0	ND	2.0	ND	2.0	ND
Chromium, hexavalent	Dissolved	ug/l			48.0	--	--	--	--	10	ND	--	--	--	--	--	--	10	ND	--	--	--	--	--	--
Chromium, hexavalent	Total	ug/l			48.0	--	--	--	--	10	ND	--	--	--	--	--	--	10	ND	--	--	--	--	--	--
Iron	Dissolved	ug/l			11200	50	ND	50	ND	50	ND	50	ND	50	ND	50	ND	50	19000	50	23000	50	21000	50	16000
Iron	Total	ug/l			11200	50	ND	50	ND	50	400	50	260	50	110	50	100	50	23000	50	22000	50	21000	50	17000
Lead	Dissolved	ug/l	15.0			0.28	ND	0.28	ND	1.0	ND	0.28	ND	0.28	ND	0.28	ND	1.0	ND	0.28	ND	0.28	ND	0.28	ND
Lead	Total	ug/l	15.0			0.28	ND	0.32	ND	1.0	ND	0.28	ND	0.28	ND	0.35	ND	1.0	1.5	0.28	ND	0.28	ND	0.28	ND
Magnesium	Dissolved	ug/l				50	9100	50	7600	50	9400	50	9000	50	9700	50	8300	50	20000	50	15000	50	13000	50	12000
Magnesium	Total	ug/l				50	8800	50	6700	50	9900	50	9000	50	9900	50	7400	50	22000	50	15000	50	14000	50	13000
Manganese	Dissolved	ug/l			2240	2.0	ND	2.0	ND	2.0	190	2.0	230	2.0	110	2.0	46	2.0	3000	2.0	2000	2.0	1600	2.0	1900
Manganese	Total	ug/l			2240	2.0	ND	2.0	ND	2.0	200	2.0	320	2.0	110	2.0	190	2.0	3200	2.0	2000	2.0	1700	2.0	1800
Mercury	Dissolved	ug/l	2.00			0.11	ND	0.11	ND	0.20	ND	0.11	ND	0.11	ND	0.11	ND	0.20	ND	0.11	ND	0.11	ND	0.11	ND
Mercury	Total	ug/l	2.00			0.11	ND	0.11	ND	0.20	ND	0.11	ND	0.11	ND	0.11	ND	0.20	ND	0.11	ND	0.11	ND	0.11	ND
Potassium	Dissolved	ug/l				50	3600	50	3400	--	--	--	--	50	3800	50	3400	--	--	--	--	50	5900	50	9100
Potassium	Total	ug/l				50	3400	50	3100	--	--	--	--	50	3900	50	3200	--	--	--	--	50	6100	50	9700
Selenium	Dissolved	ug/l			80.0	4.0	ND	4.0	ND	4.0	ND	4.0	ND	4.0	ND	4.0	ND	4.0	ND	4.0	ND	4.0	ND	4.0	ND
Selenium	Total	ug/l			80.0	4.0	ND	4.0	ND	4.0	ND	4.0	ND	4.0	ND	4.0	ND	4.0	ND	4.0	ND	4.0	ND	4.0	ND
Silver	Dissolved	ug/l			80.0	0.20	ND	0.20	ND	1.0	ND	0.20	ND	0.20	ND	0.20	ND	1.0	ND	0.20	ND	0.20	ND	0.20	ND
Silver	Total	ug/l			80.0	0.20	ND	0.20	ND	1.0	ND	0.20	ND	0.20	ND	0.20	ND	1.0	ND	0.20	ND	0.20	ND	0.20	ND
Sodium	Dissolved	ug/l				50	14000	50	13000	50	20000	50	11000	50	12000	50	10000	50	29000	50	22000	50	20000	50	19000
Sodium	Total	ug/l				50	13000	50	11000	50	21000	50	11000	50	12000	50	9100	50	31000	50	21000	50	20000	50	21000
SVOCs																									
1,2,4-Trichlorobenzene	NA	ug/l		1.51	80.0	--	--	--	--	2.0	ND	2.0	ND	--	--	--	--	2.0	ND	2.0	ND	--	--	--	--
1,2-Dichlorobenzene	NA	ug/l			720	--	--	--	--	2.0	ND	2.0	ND	--	--	--	--	2.0	ND	2.0	ND	--	--	--	--
1,3-Dichlorobenzene	NA	ug/l				--	--	--	--	2.0	ND	2.0	ND	--	--	--	--	2.0	ND	2.0	ND	--	--	--	--
1,4-Dichlorobenzene	NA	ug/l		8.10	560	--	--	--	--	2.0	ND	2.0	ND	--	--	--	--	2.0	ND	2.0	ND	--	--	--	--
1-Methylnaphthalene	NA	ug/l		1.51	560	0.020	ND	0.020	ND	0.020	ND	0.020	ND	0.020	ND	0.020	ND	0.020	ND	0.020	ND	0.020	ND	0.020	ND
2,2'-oxybis (1-chloropropane)	NA	ug/l		0.625	320	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
2,3,4,6-Tetrachlorophenol	NA	ug/l			480	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
2,4,5-Trichlorophenol	NA	ug/l			800	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
2,4,6-Trichlorophenol	NA	ug/l		3.98	8.00	0.90	ND	0.83	ND	2.0	ND	0.85	ND	0.83	ND	0.83	ND	2.0	ND	0.85	ND	0.83	ND	0.84	ND
2,4-Dichlorophenol	NA	ug/l			24.0	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
2,4-Dimethylphenol	NA	ug/l			160	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
2,4-Dinitrophenol	NA	ug/l			32.0	10	ND	10	ND	10	ND	10	ND	10	ND	10	ND	10	ND	10	ND	10	ND	10	ND
2,4-Dinitrotoluene	NA	ug/l		0.282	32.0	0.78	ND	0.72	ND	0.78	ND	0.73	ND	0.72	ND	0.72	ND	0.78	ND	0.73	ND	0.72	ND	0.73	ND
2,6-Dichlorophenol	NA	ug/l				2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND

Table 2
Historical Groundwater Data - 2015 Landau PQLs vs. MTCA Cleanup Levels
Yakima Mill Site

					Location	MW-09A		MW-09A		MW-100		MW-100		MW-100		MW-100		MW-101		MW-101		MW-101		MW-101	
					Date	3/26/2015		6/24/2015		9/16/2014		12/17/2014		3/23/2015		6/24/2015		9/17/2014		12/18/2014		3/25/2015		6/25/2015	
					Sample Type	N		N		N		N		N		N		N		N		N		N	
					Result Type	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result
					Data Status	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource
Parameter	Total or Dissolved	Units	Washington GW Method A	Washington Groundwater Method B Cancer	Washington Groundwater Method B Noncancer																				
Effective Date			07/01/2015	07/01/2015	07/01/2015																				
Exceedance Key			No Exceedances	Shade	Border																				
2,6-Dinitrotoluene	NA	ug/l		0.0583	4.80	1.8	ND	1.7	ND	1.8	ND	1.7	ND	1.7	ND	1.7	ND	1.8	ND	1.7	ND	1.7	ND	1.7	ND
2-Chloronaphthalene	NA	ug/l			640	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
2-Chlorophenol	NA	ug/l			40.0	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
2-Methyl-4,6-dinitrophenol	NA	ug/l				2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
2-Methylnaphthalene	NA	ug/l			32.0	0.020	ND	0.020	ND	0.020	ND	0.020	ND	0.020	ND	0.020	ND	0.020	ND	0.020	ND	0.020	ND	0.020	ND
2-Methylphenol (o-cresol)	NA	ug/l			400	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
2-Nitroaniline	NA	ug/l			160	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
2-Nitrophenol	NA	ug/l				2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
3,3`-Dichlorobenzidine	NA	ug/l		0.194		2.0	ND	1.9	ND	2.0	ND	1.9	ND	1.9	ND	1.9	ND	2.0	ND	1.9	ND	1.9	ND	1.9	ND
3,4-Methylphenol (m,p cresols)	NA	ug/l				2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	20	110	2.0	ND	2.0	ND	2.0	ND
3-Nitroaniline	NA	ug/l				5.0	ND	5.0	ND	5.0	ND	5.0	ND	5.0	ND	5.0	ND	5.0	ND	5.0	ND	5.0	ND	5.0	ND
4-Bromophenyl phenyl ether	NA	ug/l				2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
4-Chloro-3-methylphenol	NA	ug/l				2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
4-Chloroaniline	NA	ug/l		0.219	32.0	1.9	ND	1.8	ND	2.0	ND	1.8	ND	1.8	ND	1.8	ND	2.0	ND	1.8	ND	1.8	ND	1.8	ND
4-Chlorophenyl phenyl ether	NA	ug/l				2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
4-Nitroaniline	NA	ug/l				2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
4-Nitrophenol	NA	ug/l				2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
Acenaphthene	NA	ug/l			960	0.014	ND	0.014	ND	0.020	ND	0.014	ND	0.014	ND	0.014	ND	0.020	ND	0.014	ND	0.014	ND	0.014	ND
Acenaphthylene	NA	ug/l				0.020	ND	0.020	ND	0.020	ND	0.020	ND	0.020	ND	0.020	ND	0.020	ND	0.020	ND	0.020	ND	0.020	ND
Aniline	NA	ug/l		7.68	56.0	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
Anthracene	NA	ug/l			4800	0.010	ND	0.010	ND	0.020	ND	0.010	ND	0.010	ND	0.010	ND	0.020	ND	0.010	ND	0.010	ND	0.010	ND
Azobenzene	NA	ug/l		0.795		1.6	ND	1.5	ND	2.0	ND	1.5	ND	1.5	ND	1.5	ND	2.0	ND	1.5	ND	1.5	ND	1.5	ND
Benz(a)anthracene	NA	ug/l		0.120		0.017	ND	0.017	ND	0.020	ND	0.017	ND	0.017	ND	0.017	ND	0.020	ND	0.017	ND	0.017	ND	0.017	ND
Benzo(a)pyrene	NA	ug/l	0.100	0.0120		0.027	ND	0.027	ND	0.029	ND	0.027	ND	0.027	ND	0.027	ND	0.029	ND	0.027	ND	0.027	ND	0.027	ND
Benzo(b)fluoranthene	NA	ug/l		0.120		0.0068	ND	0.0068	ND	0.020	ND	0.0068	ND	0.0068	ND	0.0068	ND	0.020	ND	0.0068	ND	0.0068	ND	0.0068	ND
Benzo(g,h,i)perylene	NA	ug/l				0.019	ND	0.019	ND	0.020	ND	0.019	ND	0.019	ND	0.019	ND	0.020	ND	0.019	ND	0.019	ND	0.019	ND
Benzo(k)fluoranthene	NA	ug/l		1.20		0.013	ND	0.013	ND	0.020	ND	0.013	ND	0.013	ND	0.013	ND	0.020	ND	0.013	ND	0.013	ND	0.013	ND
Benzoic acid	NA	ug/l			64000	10	ND	10	ND	10	ND	10	ND	10	ND	10	ND	10	ND	10	ND	10	ND	10	ND
Benzyl alcohol	NA	ug/l			800	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
Bis(2-chloroethoxy)methane	NA	ug/l				2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
Bis(2-chloroethyl)ether	NA	ug/l		0.0398		0.94	ND	0.87	ND	0.94	ND	0.89	ND	0.87	ND	0.87	ND	0.94	ND	0.89	ND	0.87	ND	0.88	ND
Bis(2-ethylhexyl)phthalate	NA	ug/l		6.25	320	0.81	ND	0.75	ND	2.0	ND	0.76	ND	0.75	ND	0.75	ND	2.0	ND	0.76	30	0.75	ND	0.75	ND
Butyl benzyl phthalate	NA	ug/l		46.1	3200	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
Carbazole	NA	ug/l				2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
Chrysene	NA	ug/l		12.0		0.018	ND	0.018	ND	0.020	ND	0.018	ND	0.018	ND	0.018	ND	0.020	ND	0.018	ND	0.018	ND	0.018	ND
Dibenz(a,h)anthracene	NA	ug/l		0.0120		0.011	ND	0.011	ND	0.012	ND	0.011	ND	0.011	ND	0.011	ND	0.012	ND	0.011	ND	0.011	ND	0.011	ND
Dibenzofuran	NA	ug/l			16.0	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
Diethyl phthalate	NA	ug/l			12800	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
Dimethyl phthalate	NA	ug/l				2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
Di-n-butyl phthalate	NA	ug/l			1600	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
Di-n-octyl phthalate	NA	ug/l			160	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
Fluoranthene	NA	ug/l			640	0.0092	ND	0.0092	ND	0.020	ND	0.0093	ND	0.0092	ND	0.0092	ND	0.020	ND	0.0093	ND	0.0092	ND	0.0092	ND
Fluorene	NA	ug/l			640	0.0090	ND	0.0090	ND	0.020	ND	0.0092	ND	0.0090	ND	0.0090	ND	0.020	ND	0.0092	ND	0.0090	ND	0.0091	ND
Hexachlorobenzene	NA	ug/l		0.0547	12.8	--	--	--	--	2.0	ND	0.60	ND	--	--	--	--	2.0	ND	0.60	ND	--	--	--	--
Hexachlorobutadiene	NA	ug/l		0.561	8.00	--	--	--	--	2.0	ND	--	--	--	--	--	--	2.0	ND	--	--	--	--	--	--
Hexachlorocyclopentadiene	NA	ug/l			48.0	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
Hexachloroethane	NA	ug/l		1.09	5.60	2.0	ND	1.9	ND	2.0	ND	1.9	ND	1.9	ND	1.9	ND	2.0	ND	1.9	ND	1.9	ND	1.9	ND
Indeno(1,2,3-cd)pyrene	NA	ug/l		0.120		0.014	ND	0.014	ND	0.020	ND	0.014	ND	0.014	ND	0.014	ND	0.020	ND	0.014	ND	0.014	ND	0.014	ND
Isophorone	NA	ug/l		46.1	1600	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
Naphthalene	NA	ug/l	160		160	0.013	ND	0.013	ND	0.020	ND	0.014	ND	0.013	0.02	0.013	ND	0.020	0.06	0.014	0.014	0.013	0.13	0.013	ND
Nitrobenzene	NA	ug/l			16.0	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
n-Nitrosodimethylamine	NA	ug/l		0.000858	0.0640	1.5	ND	1.4	ND	1.5	ND	1.4	ND	1.4	ND	1.4	ND	1.5	ND	1.4	ND	1.4	ND	1.4	ND
n-Nitrosodi-n-propylamine	NA	ug/l		0.0125		2.0	ND	1.9	ND	2.0	ND	1.9	ND	1.9	ND	1.9	ND	2.0	ND	1.9	ND	1.9	ND	1.9	ND
n-Nitrosodiphenylamine	NA	ug/l		17.9		2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
Pentachlorophenol	NA	ug/l		0.219	80.0	0.12	ND	0.12	ND	0.13	ND	0.12	ND	0.12	ND	0.12	ND	0.13	ND	0.12	ND	0.12	ND	0.12	ND
Phenanthrene	NA	ug/l				0.013	ND	0.013	ND	0.020	ND	0.014	ND	0.013	ND	0.013	ND	0.020	ND	0.014	ND	0.013	ND	0.013	ND
Phenol	NA	ug/l			2400	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
Pyrene	NA	ug/l			480	0.010	ND	0.010	ND	0.020	ND	0.011	ND	0.010	ND	0.010	ND	0.020	ND	0.011	ND	0.010	ND	0.011	ND

Table 2
Historical Groundwater Data - 2015 Landau PQLs vs. MTCA Cleanup Levels
Yakima Mill Site

					Location	MW-09A		MW-09A		MW-100		MW-100		MW-100		MW-100		MW-101		MW-101		MW-101		MW-101	
					Date	3/26/2015		6/24/2015		9/16/2014		12/17/2014		3/23/2015		6/24/2015		9/17/2014		12/18/2014		3/25/2015		6/25/2015	
					Sample Type	N		N		N		N		N		N		N		N		N		N	
					Result Type	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result
					Data Status	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource
Parameter	Total or Dissolved	Units	Washington GW Method A	Washington Groundwater Method B Cancer	Washington Groundwater Method B Noncancer																				
Effective Date			07/01/2015	07/01/2015	07/01/2015																				
Exceedance Key			No Exceedances	Shade	Border																				
Pyridine	NA	ug/l			8.00	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
VOCs						--		--		--		--		--		--		--		--		--		--	
1,1,1,2-Tetrachloroethane	NA	ug/l		1.68	240	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND
1,1,1-Trichloroethane	NA	ug/l	200		16000	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
1,1,2,2-Tetrachloroethane	NA	ug/l		0.219	160	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND
1,1,2-Trichloroethane	NA	ug/l		0.768	32.0	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND
1,1-Dichloroethane	NA	ug/l		7.68	1600	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
1,1-Dichloroethylene	NA	ug/l			400	0.014	ND	0.014	ND	2.0	ND	0.014	ND	0.014	ND	0.014	ND	2.0	ND	0.014	ND	0.014	ND	0.014	ND
1,1-Dichloropropene	NA	ug/l				2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
1,2,3-Trichlorobenzene	NA	ug/l				2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
1,2,3-Trichloropropane	NA	ug/l		0.00146	32.0	0.023	ND	0.023	ND	0.023	ND	0.023	ND	0.023	ND	0.023	ND	0.023	ND	0.023	ND	0.023	ND	0.023	ND
1,2,4-Trichlorobenzene	NA	ug/l		1.51	80.0	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND
1,2,4-Trimethylbenzene	NA	ug/l				2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
1,2-Dibromo-3-chloropropane (DBCP)	NA	ug/l		0.0547	1.60	0.10	ND	0.10	ND	10	ND	0.10	ND	0.10	ND	0.10	ND	10	ND	0.10	ND	0.10	ND	0.10	ND
1,2-Dibromoethane (EDB)	NA	ug/l	0.0100	0.0219	72.0	0.010	ND	0.010	ND	0.010	ND	0.010	ND	0.010	ND	0.010	ND	0.010	ND	0.010	ND	0.010	ND	0.010	ND
1,2-Dichlorobenzene	NA	ug/l			720	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
1,2-Dichloroethane	NA	ug/l	5.00	0.481	48.0	0.014	ND	0.014	ND	2.0	ND	0.014	ND	0.014	ND	0.014	ND	2.0	ND	0.014	ND	0.014	ND	0.014	ND
1,2-Dichloroethylene, cis	NA	ug/l			16.0	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
1,2-Dichloroethylene, trans	NA	ug/l			160	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
1,2-Dichloropropane	NA	ug/l		1.22	720	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND
1,3,5-Trimethylbenzene	NA	ug/l			80.0	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
1,3-Dichlorobenzene	NA	ug/l				2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
1,3-Dichloropropane	NA	ug/l				2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
1,3-Dichloropropene, cis	NA	ug/l		0.438	240	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
1,3-Dichloropropene, trans	NA	ug/l		0.438	240	0.058	ND	0.058	ND	2.0	ND	0.058	ND	0.058	ND	0.058	ND	2.0	ND	0.058	ND	0.058	ND	0.058	ND
1,4-Dichlorobenzene	NA	ug/l		8.10	560	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
2,2-Dichloropropane	NA	ug/l				2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
2-Hexanone	NA	ug/l				10	ND	10	ND	10	ND	10	ND	10	ND	10	ND	10	ND	10	ND	10	ND	10	ND
Acetone	NA	ug/l			7200	25	ND	25	ND	25	ND	25	ND	25	ND	25	ND	25	ND	25	ND	25	ND	25	ND
Acrylonitrile	NA	ug/l		0.0810	320	0.057	ND	0.057	ND	10	ND	0.057	ND	0.057	ND	0.057	ND	10	ND	0.057	ND	0.057	ND	0.057	ND
Benzene	NA	ug/l	5.00	0.795	32.0	0.028	ND	0.028	ND	2.0	ND	0.028	ND	0.028	ND	0.028	ND	2.0	ND	0.028	ND	0.028	ND	0.028	ND
Bromobenzene	NA	ug/l				2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
Bromochloromethane	NA	ug/l				2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
Bromodichloromethane	NA	ug/l		0.706	160	0.059	ND	0.059	ND	0.059	ND	0.059	ND	0.059	ND	0.059	ND	0.059	ND	0.059	ND	0.059	ND	0.059	ND
Bromoform	NA	ug/l		5.54	160	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
Bromomethane	NA	ug/l			11.2	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
Butylbenzene	NA	ug/l			400	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
Butylbenzene, sec	NA	ug/l			800	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
Butylbenzene, tert	NA	ug/l			800	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
Carbon disulfide	NA	ug/l			800	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
Carbon tetrachloride	NA	ug/l		0.625	32.0	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND
Chlorobenzene	NA	ug/l			160	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
Chlorodibromomethane	NA	ug/l		0.521	160	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND
Chloroethane	NA	ug/l				2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
Chloroform	NA	ug/l		1.41	80.0	0.14	2.5	0.14	ND	0.10	1.2	0.14	1.2	0.14	1.1	0.14	ND	0.10	ND	0.14	ND	0.14	ND	0.14	ND
Chloromethane	NA	ug/l				2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
Chlorotoluene, o	NA	ug/l			160	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
Chlorotoluene, p	NA	ug/l				2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
Cumene (isopropyl benzene)	NA	ug/l			800	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
Cymene p- (toluene isopropyl p-)	NA	ug/l				2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
Dibromomethane (methylene bromide)	NA	ug/l			80.0	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
Dichlorodifluoromethane (Freon-12)	NA	ug/l			1600	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
Ethyl benzene	NA	ug/l	700		800	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
Hexachlorobutadiene	NA	ug/l		0.561	8.00	0.069	ND	0.069	ND	2.0	ND	0.069	ND	0.069	ND	0.069	ND	2.0	ND	0.069	ND	0.069	ND	0.069	ND
Hexane (C6)	NA	ug/l			480	--	--	2.0	ND	--	--	--	--	--	--	2.0	ND	--	--	--	--	--	--	2.0	ND
Methyl ethyl ketone (2-butanone)	NA	ug/l			4800	10	ND	10	ND	10	ND	10	ND	10	ND	10	ND	10	ND	10	ND	10	ND	10	ND
Methyl isobutyl ketone (MIBK)	NA	ug/l			640	10	ND	10	ND	10	ND	10	ND	10	ND	10	ND	10	ND	10	ND	10	ND	10	ND
Methyl tertiary butyl ether (MTBE)	NA	ug/l	20.0	24.3		2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND

Table 2
Historical Groundwater Data - 2015 Landau PQLs vs. MTCA Cleanup Levels
Yakima Mill Site

11-30-2017

					Location	MW-09A		MW-09A		MW-100		MW-100		MW-100		MW-100		MW-101		MW-101		MW-101		MW-101	
					Date	3/26/2015		6/24/2015		9/16/2014		12/17/2014		3/23/2015		6/24/2015		9/17/2014		12/18/2014		3/25/2015		6/25/2015	
					Sample Type	N		N		N		N		N		N		N		N		N		N	
					Result Type	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result
					Data Status	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource
Parameter	Total or Dissolved	Units	Washington GW Method A	Washington Groundwater Method B Cancer	Washington Groundwater Method B Noncancer																				
Effective Date			07/01/2015	07/01/2015	07/01/2015																				
Exceedance Key			No Exceedances	Shade	Border																				
Methylene chloride	NA	ug/l	5.00	21.9	48.0	0.68	ND	0.68	ND	5.0	ND	0.68	ND	0.68	ND	0.68	ND	5.0	ND	0.68	ND	0.68	ND	0.68	ND
Naphthalene	NA	ug/l	160		160	--	--	--	--	2.0	ND	--	--	--	--	--	--	2.0	ND	--	--	--	--	--	--
Propylbenzene	NA	ug/l			800	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
Styrene	NA	ug/l			1600	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
Tetrachloroethylene	NA	ug/l	5.00	20.8	48.0	0.023	ND	0.023	ND	2.0	ND	0.023	ND	0.023	ND	0.023	ND	2.0	ND	0.023	ND	0.023	ND	0.023	ND
Toluene	NA	ug/l	1000		640	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
Trichloroethylene (TCE)	NA	ug/l	5.00	0.540	4.00	0.054	ND	0.054	ND	0.020	ND	0.054	ND	0.054	ND	0.054	ND	0.020	ND	0.054	ND	0.054	ND	0.054	ND
Trichlorofluoromethane (Freon-11)	NA	ug/l			2400	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
Vinyl chloride	NA	ug/l	0.200		24.0	0.031	ND	0.031	ND	0.20	ND	0.031	ND	0.031	ND	0.031	ND	0.20	ND	0.031	ND	0.031	ND	0.031	ND
Xylene, m & p	NA	ug/l			1600	4.0	ND	4.0	ND	4.0	ND	4.0	ND	4.0	ND	4.0	ND	4.0	ND	4.0	ND	4.0	ND	4.0	ND
Xylene, o	NA	ug/l			1600	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
Pesticides																									
4,4'-DDD	NA	ug/l		0.365		0.011	ND	0.010	ND	0.011	ND	0.010	ND	0.011	ND	0.010	ND	0.011	ND	0.011	ND	0.011	ND	0.010	ND
4,4'-DDE	NA	ug/l		0.257		0.011	ND	0.010	ND	0.011	ND	0.010	ND	0.011	ND	0.010	ND	0.011	ND	0.011	ND	0.011	ND	0.010	ND
4,4'-DDT	NA	ug/l	0.300	0.257	8.00	0.011	ND	0.010	ND	0.011	ND	0.010	ND	0.011	ND	0.010	ND	0.011	ND	0.011	ND	0.011	ND	0.010	ND
a-BHC	NA	ug/l		0.0139	128	0.011	ND	0.010	ND	0.011	ND	0.010	ND	0.011	ND	0.010	ND	0.011	ND	0.011	ND	0.011	ND	0.010	ND
Aldrin	NA	ug/l		0.00257	0.240	0.011	ND	0.010	ND	0.011	ND	0.010	ND	0.011	ND	0.010	ND	0.011	ND	0.011	ND	0.011	ND	0.010	ND
b-BHC	NA	ug/l		0.0486		0.011	ND	0.010	ND	0.011	ND	0.010	ND	0.011	ND	0.010	ND	0.011	ND	0.011	ND	0.011	ND	0.010	ND
Chlordane, alpha & gamma	NA	ug/l		0.250	8.00	0.011	ND	0.010	ND	0.011	ND	0.010	ND	0.011	ND	0.010	ND	0.011	ND	0.011	ND	0.011	ND	0.010	ND
d-BHC	NA	ug/l				0.011	ND	0.010	ND	0.011	ND	0.010	ND	0.011	ND	0.010	ND	0.011	ND	0.011	ND	0.011	ND	0.010	ND
Dieldrin	NA	ug/l		0.00547	0.800	0.011	ND	0.010	ND	0.011	ND	0.010	ND	0.011	ND	0.010	ND	0.011	ND	0.011	ND	0.011	ND	0.010	ND
Endosulfan I	NA	ug/l			96.0	0.011	ND	0.010	ND	0.011	ND	0.010	ND	0.011	ND	0.010	ND	0.011	ND	0.011	ND	0.011	ND	0.010	ND
Endosulfan II	NA	ug/l			96.0	0.011	0.012	0.010	ND	0.012	ND	0.010	0.014	0.011	0.017	0.010	ND	0.040	ND	0.011	ND	0.011	ND	0.010	ND
Endosulfan sulfate	NA	ug/l			96.0	0.011	ND	0.010	ND	0.011	ND	0.010	ND	0.011	ND	0.010	ND	0.011	ND	0.011	ND	0.011	ND	0.010	ND
Endrin	NA	ug/l			4.80	0.011	ND	0.010	ND	0.011	ND	0.010	ND	0.011	ND	0.010	ND	0.011	ND	0.011	ND	0.011	ND	0.010	ND
Endrin aldehyde	NA	ug/l				0.011	ND	0.010	ND	0.011	ND	0.010	ND	0.011	ND	0.010	ND	0.011	ND	0.011	ND	0.011	ND	0.010	ND
g-BHC (Lindane)	NA	ug/l	0.200	0.0795	4.80	0.011	ND	0.010	ND	0.011	ND	0.010	ND	0.011	ND	0.010	ND	0.011	ND	0.011	ND	0.011	ND	0.010	ND
Heptachlor	NA	ug/l		0.0194	8.00	0.011	ND	0.010	ND	0.011	ND	0.010	ND	0.011	ND	0.010	ND	0.011	ND	0.011	ND	0.011	ND	0.010	ND
Heptachlor epoxide	NA	ug/l		0.00481	0.104	0.011	ND	0.010	ND	0.011	ND	0.010	ND	0.011	ND	0.010	ND	0.011	ND	0.011	ND	0.011	ND	0.010	ND
Hexachlorobenzene	NA	ug/l		0.0547	12.8	0.011	ND	0.010	ND	--	--	0.010	ND	0.011	ND	0.010	ND	--	--	0.011	ND	0.011	ND	0.010	ND
Methoxychlor	NA	ug/l			80.0	0.011	ND	0.010	ND	0.011	ND	0.010	ND	0.011	ND	0.010	ND	0.011	ND	0.011	ND	0.011	ND	0.010	ND
Toxaphene	NA	ug/l		0.0795		0.51	ND	0.50	ND	0.51	ND	0.50	ND	0.51	ND	0.50	ND	0.51	ND	0.52	ND	0.51	ND	0.50	ND
PCBs																									
Aroclor 1016	NA	ug/l		1.25	1.12	0.0051	ND	0.0050	ND	0.0051	ND	0.0050	ND	0.0051	ND	0.0050	ND	0.0051	ND	0.0052	ND	0.0051	ND	0.0050	ND
Aroclor 1221	NA	ug/l				0.011	ND	0.014	ND	0.011	ND	0.010	ND	0.011	ND	0.010	ND	0.011	ND	0.011	ND	0.014	ND	0.010	ND
Aroclor 1232	NA	ug/l				0.0051	ND	0.0050	ND	0.0051	ND	0.0050	ND	0.0051	ND	0.0050	ND	0.0051	ND	0.0052	ND	0.0056	ND	0.0050	ND
Aroclor 1242	NA	ug/l				0.0051	ND	0.0050	ND	0.0051	ND	0.0050	ND	0.0051	ND	0.0050	ND	0.0051	ND	0.0052	ND	0.0051	ND	0.0050	ND
Aroclor 1248	NA	ug/l				0.0051	ND	0.0050	ND	0.0051	ND	0.0050	ND	0.0051	ND	0.0050	ND	0.0051	ND	0.0052	ND	0.0051	ND	0.0050	ND
Aroclor 1254	NA	ug/l		0.0438	0.320	0.0051	ND	0.0050	ND	0.0051	ND	0.0050	ND	0.0051	ND	0.0050	ND	0.0051	ND	0.0052	ND	0.0051	ND	0.0050	ND
Aroclor 1260	NA	ug/l		0.0438		0.0051	ND	0.0050	ND	0.0051	ND	0.0050	ND	0.0051	ND	0.0050	ND	0.0051	ND	0.0052	ND	0.0051	ND	0.0050	ND
Total Petroleum Hydrocarbons																									
Total Petroleum Hydrocarbons (as diesel)	NA	ug/l	500			310	ND	310	ND	310	ND	310	ND	310	ND	310	ND	130 310	1800 310	130 310	450 ND	130	350 ND	130	450 J ND
Total Petroleum Hydrocarbons (as diesel), silica gel	NA	ug/l	500			--	--	--	--	--	--	--	--	--	--	--	--	130	520	130	140	130	ND	130	ND
Total Petroleum Hydrocarbons (as gasoline)	NA	ug/l	800			130	ND	130	ND	130	ND	130	ND	130	ND	130	ND	130	ND	130	ND	--	--	--	--
Total Petroleum Hydrocarbons (as motor oil)	NA	ug/l	500			310	ND	310	ND	310	ND	310	ND	310	ND	310	ND	250 310	1500 310	250 310	410 310	250	ND	250	280
Total Petroleum Hydrocarbons (as motor oil), silica gel	NA	ug/l	500			--	--	--	--	--	--	--	--	--	--	--	--	250	360	250	ND	250	ND	250	ND

Landau qualifier - J: Indicates the analyte was positively identified; the associated numerical value is the approximate concentration of the analyte in the sample.
Landau qualifier - UJ: The analyte was not detected in the sample; the reported sample reporting limit is an estimate.
N: Normal Sample.
FD: Field Duplicate Sample.
ND: Not detected.
PQL: Practical Quantitation Limit.
SSource: Laboratory and/or field data obtained from a secondary source external to Barr. Second source QA/QC evaluation procedures may or may not have been performed beyond the original data generator.
Table was updated (items in red) after original submittal to add Landau qualifiers to be consistent with the memo.

Table 2
Historical Groundwater Data - 2015 Landau PQLs vs. MTCA Cleanup Levels
Yakima Mill Site

					Location	MW-102		MW-102		MW-102		MW-102		MW-103		MW-103		MW-103		MW-103		MW-104	
					Date	9/16/2014		12/19/2014		3/26/2015		6/25/2015		9/16/2014		12/19/2014		3/24/2015		6/25/2015		9/16/2014	
					Sample Type	N		N		N		N		N		N		N		N		N	
					Result Type	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result
					Data Status	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource
Parameter	Total or Dissolved	Units	Washington GW Method A	Washington Groundwater Method B Cancer	Washington Groundwater Method B Noncancer																		
Effective Date			07/01/2015	07/01/2015	07/01/2015																		
Exceedance Key			No Exceedances	Shade	Border																		
General Parameters																							
Alkalinity, bicarbonate, as CaCO3	NA	mg/l				15	130	15	130	0.0	150	15	140	15	220	15	210	0.0	220	15	220	15	200
Alkalinity, total, as CaCO3	NA	mg/l				15	130	15	130	0.0	150	15	140	15	220	15	210	0.0	220	15	220	15	200
Carbon, total organic	NA	mg/l				0.50	1.9	0.50	1.5	0.50	2	0.50	1.7	0.50	4	0.50	4.3	0.50	4.1	0.50	4.9	0.50	4.9
Chloride	NA	mg/l				0.092	11	0.092	11	0.092	13	0.92	11	0.092	19	0.46	24	0.092	19	0.092	19	0.092	18
Fluoride	NA	mg/l			0.64	0.16	0.26	0.16	0.28	0.16	ND	0.16	ND	0.16	0.24	0.16	0.46	0.16	ND	0.16	ND	0.16	0.19
Nitrogen, ammonia, as N	NA	mg/l				0.050	2.5	0.050	2.2	0.050	2.4	0.050	2.3	0.050	3.1	0.050	2.0	0.050	2	0.050	2.0	0.050	2
Nitrogen, nitrate, as N	NA	mg/l			25.6	0.034	ND	0.034	ND	0.034	ND	0.034	ND	0.034	ND	0.034	ND	0.034	ND	0.034	ND UJ	0.034	0.036
Nitrogen, nitrite, as N	NA	mg/l			1.6	0.043	ND	0.043	ND	0.043	ND	0.043	ND	0.043	ND	0.043	ND	0.043	ND	0.043	ND	0.043	ND
Solids, total dissolved	NA	mg/l				5.0	190	5.0	190	5.0	170	5.0	200	5.0	230	5.0	300	5.0	240	5.0	240	5.0	220
Sulfate, as SO4	NA	mg/l				0.26	13	0.26	10	0.26	9	2.6	12	0.26	0.3	0.26	0.29	0.26	ND	0.26	ND	0.26	ND
Metals																							
Arsenic	Dissolved	ug/l	5.00	0.0583	4.80	1.0	1.3	0.45	ND	0.45	ND	0.45	ND	1.0	3.8	0.45	4.9	0.50	7.3	0.45	6.1	1.0	5.7
Arsenic	Total	ug/l	5.00	0.0583	4.80	1.0	ND	0.45	ND	0.45	ND	0.45	ND	1.0	3.5	0.45	5.3	0.50	6	0.45	6.6	1.0	5.8
Barium	Dissolved	ug/l			3200	1.0	21	1.0	27	1.0	31	1.0	30	1.0	50	1.0	55	1.0	59	1.0	52	1.0	49
Barium	Total	ug/l			3200	1.0	22	1.0	27	1.0	32	1.0	31	1.0	53	1.0	58	1.0	61	1.0	52	1.0	51
Cadmium	Dissolved	ug/l	5.00		8.00	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND
Cadmium	Total	ug/l	5.00		8.00	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND
Calcium	Dissolved	ug/l				100	22000	100	26000	100	28000	100	27000	100	35000	100	43000	100	45000	100	40000	100	36000
Calcium	Total	ug/l				100	22000	100	25000	100	27000	100	27000	100	36000	100	43000	100	45000	100	39000	100	36000
Chromium	Dissolved	ug/l	50.0			2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
Chromium	Total	ug/l	50.0			2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
Chromium, hexavalent	Dissolved	ug/l			48.0	10	ND	--	--	--	--	--	--	10	ND	--	--	--	--	--	--	10	ND
Chromium, hexavalent	Total	ug/l			48.0	10	ND	--	--	--	--	--	--	10	ND	--	--	--	--	--	--	10	ND
Iron	Dissolved	ug/l			11200	50	4200	50	5400	50	6400	50	6000	50	22000	50	29000	50	28000	50	26000	50	26000
Iron	Total	ug/l			11200	50	4700	50	5300	50	6800	50	6100	50	22000	50	29000	50	28000	50	26000	50	27000
Lead	Dissolved	ug/l	15.0			1.0	ND	0.28	ND	0.28	ND	0.28	ND	1.0	ND	0.28	ND	0.28	ND	0.28	ND	1.0	ND
Lead	Total	ug/l	15.0			1.0	ND	0.28	ND	0.28	0.46	0.28	ND	1.0	ND	0.28	ND	0.28	ND	0.28	ND	1.0	1
Magnesium	Dissolved	ug/l				50	8300	50	9900	50	11000	50	11000	50	12000	50	15000	50	16000	50	14000	50	12000
Magnesium	Total	ug/l				50	8900	50	9300	50	11000	50	11000	50	13000	50	15000	50	16000	50	14000	50	13000
Manganese	Dissolved	ug/l			2240	2.0	710	2.0	720	2.0	860	2.0	800	2.0	2500	2.0	2900	2.0	2900	10	2900	2.0	2300
Manganese	Total	ug/l			2240	2.0	740	2.0	710	2.0	850	2.0	800	2.0	2500	2.0	2900	2.0	2900	10	2900	2.0	2400
Mercury	Dissolved	ug/l	2.00			0.20	ND	0.11	ND	0.20	ND	0.11	ND	0.20	ND	0.11	ND	0.11	ND	0.11	ND	0.20	ND
Mercury	Total	ug/l	2.00			0.20	ND	0.11	ND	0.11	ND	0.11	ND	0.20	ND	0.11	ND	0.11	ND	0.11	ND	0.20	ND
Potassium	Dissolved	ug/l				--	--	--	--	50	4900	50	4700	--	--	--	--	50	5900	50	5500	--	--
Potassium	Total	ug/l				--	--	--	--	50	4700	50	4700	--	--	--	--	50	5900	50	5400	--	--
Selenium	Dissolved	ug/l			80.0	4.0	ND	4.0	ND	4.0	ND	4.0	ND	4.0	ND	4.0	ND	4.0	ND	4.0	ND	4.0	ND
Selenium	Total	ug/l			80.0	4.0	ND	4.0	ND	4.0	ND	4.0	ND	4.0	ND	4.0	ND	4.0	ND	4.0	ND	4.0	ND
Silver	Dissolved	ug/l			80.0	1.0	ND	0.20	ND	0.20	ND	0.20	ND	1.0	ND	0.20	ND	0.20	ND	0.20	ND	1.0	ND
Silver	Total	ug/l			80.0	1.0	ND	0.20	ND	0.20	ND	0.20	ND	1.0	ND	0.20	ND	0.20	ND	0.20	ND	1.0	ND
Sodium	Dissolved	ug/l				50	14000	50	16000	50	16000	50	16000	50	22000	50	23000	50	23000	50	22000	50	18000
Sodium	Total	ug/l				50	15000	50	14000	50	16000	50	16000	50	23000	50	23000	50	23000	50	22000	50	18000
SVOCs																							
1,2,4-Trichlorobenzene	NA	ug/l		1.51	80.0	2.0	ND	2.0	ND	--	--	--	--	2.0	ND	2.0	ND	--	--	--	--	2.0	ND
1,2-Dichlorobenzene	NA	ug/l			720	2.0	ND	2.0	ND	--	--	--	--	2.0	ND	2.0	ND	--	--	--	--	2.0	ND
1,3-Dichlorobenzene	NA	ug/l				2.0	ND	2.0	ND	--	--	--	--	2.0	ND	2.0	ND	--	--	--	--	2.0	ND
1,4-Dichlorobenzene	NA	ug/l		8.10	560	2.0	ND	2.0	ND	--	--	--	--	2.0	ND	2.0	ND	--	--	--	--	2.0	ND
1-Methylnaphthalene	NA	ug/l		1.51	560	0.020	ND	0.020	ND	0.020	0.038	0.020	ND	0.020	ND	0.020	ND	0.020	ND	0.020	ND	0.020	ND
2,2'-oxybis (1-chloropropane)	NA	ug/l		0.625	320	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
2,3,4,6-Tetrachlorophenol	NA	ug/l			480	2.0	ND UJ	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
2,4,5-Trichlorophenol	NA	ug/l			800	2.0	ND UJ	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
2,4,6-Trichlorophenol	NA	ug/l		3.98	8.00	2.0	ND UJ	0.83	ND	0.83	ND	0.85	ND	2.0	ND	0.83	ND	0.85	ND	0.85	ND	2.0	ND
2,4-Dichlorophenol	NA	ug/l			24.0	2.0	ND UJ	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
2,4-Dimethylphenol	NA	ug/l			160	2.0	ND UJ	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
2,4-Dinitrophenol	NA	ug/l			32.0	10	ND UJ	10	ND	10	ND	10	ND	10	ND	10	ND	10	ND	10	ND	10	ND
2,4-Dinitrotoluene	NA	ug/l		0.282	32.0	0.78	ND	0.72	ND	0.72	ND	0.73	ND	0.78	ND	0.72	ND	0.73	ND	0.74	ND	0.78	ND
2,6-Dichlorophenol	NA	ug/l				2.0	ND UJ	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND

Table 2
Historical Groundwater Data - 2015 Landau PQLs vs. MTCA Cleanup Levels
Yakima Mill Site

					Location	MW-102		MW-102		MW-102		MW-102		MW-103		MW-103		MW-103		MW-103		MW-104	
					Date	9/16/2014		12/19/2014		3/26/2015		6/25/2015		9/16/2014		12/19/2014		3/24/2015		6/25/2015		9/16/2014	
					Sample Type	N		N		N		N		N		N		N		N		N	
					Result Type	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result
					Data Status	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource
Parameter	Total or Dissolved	Units	Washington GW Method A	Washington Groundwater Method B Cancer	Washington Groundwater Method B Noncancer																		
Effective Date			07/01/2015	07/01/2015	07/01/2015																		
Exceedance Key			No Exceedances	Shade	Border																		
2,6-Dinitrotoluene	NA	ug/l		0.0583	4.80	1.8	ND	1.7	ND	1.7	ND	1.7	ND	1.8	ND	1.7	ND	1.7	ND	1.7	ND	1.8	ND
2-Chloronaphthalene	NA	ug/l			640	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
2-Chlorophenol	NA	ug/l			40.0	2.0	ND UJ	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
2-Methyl-4,6-dinitrophenol	NA	ug/l				2.0	ND UJ	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
2-Methylnaphthalene	NA	ug/l			32.0	0.020	0.029	0.020	0.028	0.020	0.061	0.020	ND	0.020	ND	0.020	ND	0.020	ND	0.020	ND	0.020	ND
2-Methylphenol (o-cresol)	NA	ug/l			400	2.0	ND UJ	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
2-Nitroaniline	NA	ug/l			160	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
2-Nitrophenol	NA	ug/l				2.0	ND UJ	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
3,3`-Dichlorobenzidine	NA	ug/l		0.194		2.0	ND	1.9	ND	1.9	ND	1.9	ND	2.0	ND	1.9	ND	1.9	ND	1.9	ND	2.0	ND
3,4-Methylphenol (m,p cresols)	NA	ug/l				2.0	ND UJ	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
3-Nitroaniline	NA	ug/l				5.0	ND	5.0	ND	5.0	ND	5.0	ND	5.0	ND	5.0	ND	5.0	ND	5.0	ND	5.0	ND
4-Bromophenyl phenyl ether	NA	ug/l				2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
4-Chloro-3-methylphenol	NA	ug/l				2.0	ND UJ	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
4-Chloroaniline	NA	ug/l		0.219	32.0	2.0	ND	1.8	ND	1.8	ND	1.8	ND	2.0	ND	1.8	ND	1.8	ND	1.8	ND	2.0	ND
4-Chlorophenyl phenyl ether	NA	ug/l				2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
4-Nitroaniline	NA	ug/l				2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
4-Nitrophenol	NA	ug/l				2.0	ND UJ	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
Acenaphthene	NA	ug/l			960	0.020	ND	0.014	ND	0.014	ND	0.014	ND	0.020	ND	0.014	ND	0.014	ND	0.014	ND	0.020	ND
Acenaphthylene	NA	ug/l				0.020	ND	0.020	ND	0.020	ND	0.020	ND	0.020	ND	0.020	ND	0.020	ND	0.020	ND	0.020	ND
Aniline	NA	ug/l		7.68	56.0	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
Anthracene	NA	ug/l			4800	0.020	ND	0.010	ND	0.010	ND	0.010	ND	0.020	ND	0.010	ND	0.010	ND	0.010	ND	0.020	ND
Azobenzene	NA	ug/l		0.795		2.0	ND	1.5	ND	1.5	ND	1.5	ND	2.0	ND	1.5	ND	1.5	ND	1.6	ND	2.0	ND
Benz(a)anthracene	NA	ug/l		0.120		0.020	ND	0.017	ND	0.017	ND	0.017	ND	0.020	ND	0.017	ND	0.017	ND	0.017	ND	0.020	ND
Benzo(a)pyrene	NA	ug/l	0.100	0.0120		0.029	ND	0.027	ND	0.027	ND	0.027	ND	0.029	ND	0.027	ND	0.027	ND	0.027	ND	0.029	ND
Benzo(b)fluoranthene	NA	ug/l		0.120		0.020	ND	0.0068	ND	0.0068	ND	0.0068	ND	0.020	ND	0.0068	ND	0.0068	ND	0.0069	ND	0.020	ND
Benzo(g,h,i)perylene	NA	ug/l				0.020	ND	0.019	ND	0.019	ND	0.019	ND	0.020	ND	0.019	ND	0.019	ND	0.019	ND	0.020	ND
Benzo(k)fluoranthene	NA	ug/l		1.20		0.020	ND	0.013	ND	0.013	ND	0.013	ND	0.020	ND	0.013	ND	0.013	ND	0.013	ND	0.020	ND
Benzoic acid	NA	ug/l			64000	10	ND UJ	10	ND	10	ND	10	ND	10	ND	10	ND	10	ND	10	ND	10	ND
Benzyl alcohol	NA	ug/l			800	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
Bis(2-chloroethoxy)methane	NA	ug/l				2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
Bis(2-chloroethyl)ether	NA	ug/l		0.0398		0.94	ND	0.87	ND	0.87	ND	0.89	ND	0.94	ND	0.87	ND	0.89	ND	0.89	ND	0.94	ND
Bis(2-ethylhexyl)phthalate	NA	ug/l		6.25	320	2.0	ND	0.75	26	0.75	ND	0.76	ND	2.0	ND	0.75	38	0.76	ND	0.77	ND	2.0	ND
Butyl benzyl phthalate	NA	ug/l		46.1	3200	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
Carbazole	NA	ug/l				2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
Chrysene	NA	ug/l		12.0		0.020	ND	0.018	ND	0.018	ND	0.018	ND	0.020	ND	0.018	ND	0.018	ND	0.018	ND	0.020	ND
Dibenz(a,h)anthracene	NA	ug/l		0.0120		0.012	ND	0.011	ND	0.011	ND	0.011	ND	0.012	ND	0.011	ND	0.011	ND	0.011	ND	0.012	ND
Dibenzofuran	NA	ug/l			16.0	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
Diethyl phthalate	NA	ug/l			12800	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
Dimethyl phthalate	NA	ug/l				2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
Di-n-butyl phthalate	NA	ug/l			1600	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
Di-n-octyl phthalate	NA	ug/l			160	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
Fluoranthene	NA	ug/l			640	0.020	ND	0.0092	ND	0.0092	ND	0.0093	ND	0.020	ND	0.0092	ND	0.0093	ND	0.0094	ND	0.020	ND
Fluorene	NA	ug/l			640	0.020	ND	0.0090	ND	0.0090	ND	0.0092	ND	0.020	ND	0.0090	ND	0.0092	ND	0.0093	ND	0.020	ND
Hexachlorobenzene	NA	ug/l		0.0547	12.8	2.0	ND	0.59	ND	--	--	--	--	2.0	ND	0.59	ND	--	--	--	--	2.0	ND
Hexachlorobutadiene	NA	ug/l		0.561	8.00	2.0	ND	--	--	--	--	--	--	2.0	ND	--	--	--	--	--	--	2.0	ND
Hexachlorocyclopentadiene	NA	ug/l			48.0	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
Hexachloroethane	NA	ug/l		1.09	5.60	2.0	ND	1.9	ND	1.9	ND	1.9	ND	2.0	ND	1.9	ND	1.9	ND	1.9	ND	2.0	ND
Indeno(1,2,3-cd)pyrene	NA	ug/l		0.120		0.020	ND	0.014	ND	0.014	ND	0.014	ND	0.020	ND	0.014	ND	0.014	ND	0.014	ND	0.020	ND
Isophorone	NA	ug/l		46.1	1600	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
Naphthalene	NA	ug/l	160		160	0.020	ND	0.013	0.015	0.013	0.015	0.014	ND	0.020	0.042	0.013	0.020	0.014	ND	0.014	ND	0.020	0.039
Nitrobenzene	NA	ug/l			16.0	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
n-Nitrosodimethylamine	NA	ug/l		0.000858	0.0640	1.5	ND	1.4	ND	1.4	ND	1.4	ND	1.5	ND	1.4	ND	1.4	ND	1.4	ND	1.5	ND
n-Nitrosodi-n-propylamine	NA	ug/l		0.0125		2.0	ND	1.9	ND	1.9	ND	1.9	ND	2.0	ND	1.9	ND	1.9	ND	1.9	ND	2.0	ND
n-Nitrosodiphenylamine	NA	ug/l		17.9		2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
Pentachlorophenol	NA	ug/l		0.219	80.0	0.13	ND	0.12	ND	0.12	ND	0.12	ND	0.13	ND	0.12	ND	0.12	ND	0.13	ND	0.13	ND
Phenanthrene	NA	ug/l				0.020	ND	0.013	ND	0.013	ND	0.014	ND	0.020	ND	0.013	ND	0.014	ND	0.014	ND	0.020	ND
Phenol	NA	ug/l			2400	2.0	ND UJ	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
Pyrene	NA	ug/l			480	0.020	ND	0.010	ND	0.010	ND	0.011	ND	0.020	ND	0.010	ND	0.011	ND	0.011	ND	0.020	ND

Table 2
Historical Groundwater Data - 2015 Landau PQLs vs. MTCA Cleanup Levels
Yakima Mill Site

					Location	MW-102		MW-102		MW-102		MW-102		MW-103		MW-103		MW-103		MW-103		MW-104	
					Date	9/16/2014		12/19/2014		3/26/2015		6/25/2015		9/16/2014		12/19/2014		3/24/2015		6/25/2015		9/16/2014	
					Sample Type	N		N		N		N		N		N		N		N		N	
					Result Type	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result
					Data Status	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource
Parameter	Total or Dissolved	Units	Washington GW Method A	Washington Groundwater Method B Cancer	Washington Groundwater Method B Noncancer																		
Effective Date			07/01/2015	07/01/2015	07/01/2015																		
Exceedance Key			No Exceedances	Shade	Border																		
Pyridine	NA	ug/l			8.00	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
VOCs						--		--		--		--		--		--		--		--		--	
1,1,1,2-Tetrachloroethane	NA	ug/l		1.68	240	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND
1,1,1-Trichloroethane	NA	ug/l	200		16000	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
1,1,2,2-Tetrachloroethane	NA	ug/l		0.219	160	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND
1,1,2-Trichloroethane	NA	ug/l		0.768	32.0	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND
1,1-Dichloroethane	NA	ug/l		7.68	1600	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
1,1-Dichloroethylene	NA	ug/l			400	2.0	ND	0.014	ND	0.014	ND	0.014	ND	2.0	ND	0.014	ND	0.014	ND	0.014	ND	2.0	ND
1,1-Dichloropropene	NA	ug/l				2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
1,2,3-Trichlorobenzene	NA	ug/l				2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
1,2,3-Trichloropropane	NA	ug/l		0.00146	32.0	0.023	ND	0.023	ND	0.023	ND	0.023	ND	0.023	ND	0.023	ND	0.023	ND	0.023	ND	0.023	ND
1,2,4-Trichlorobenzene	NA	ug/l		1.51	80.0	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND
1,2,4-Trimethylbenzene	NA	ug/l				2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
1,2-Dibromo-3-chloropropane (DBCP)	NA	ug/l		0.0547	1.60	10	ND	0.10	ND	0.10	ND	0.10	ND	10	ND	0.10	ND	0.10	ND	0.10	ND	10	ND
1,2-Dibromoethane (EDB)	NA	ug/l	0.0100	0.0219	72.0	0.010	ND	0.010	ND	0.010	ND	0.010	ND	0.010	ND	0.010	ND	0.010	ND	0.010	ND	0.010	ND
1,2-Dichlorobenzene	NA	ug/l			720	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
1,2-Dichloroethane	NA	ug/l	5.00	0.481	48.0	2.0	ND	0.014	ND	0.014	ND	0.014	ND	2.0	ND	0.014	ND	0.014	ND	0.014	ND	2.0	ND
1,2-Dichloroethylene, cis	NA	ug/l			16.0	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
1,2-Dichloroethylene, trans	NA	ug/l			160	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
1,2-Dichloropropane	NA	ug/l		1.22	720	0.1	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND
1,3,5-Trimethylbenzene	NA	ug/l			80.0	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
1,3-Dichlorobenzene	NA	ug/l				2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
1,3-Dichloropropane	NA	ug/l				2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
1,3-Dichloropropene, cis	NA	ug/l		0.438	240	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
1,3-Dichloropropene, trans	NA	ug/l		0.438	240	2.0	ND	0.058	ND	0.058	ND	0.058	ND	2.0	ND	0.058	ND	0.058	ND	0.058	ND	2.0	ND
1,4-Dichlorobenzene	NA	ug/l		8.10	560	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
2,2-Dichloropropane	NA	ug/l				2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
2-Hexanone	NA	ug/l				10	ND	10	ND	10	ND	10	ND	10	ND	10	ND	10	ND	10	ND	10	ND
Acetone	NA	ug/l			7200	25	ND	25	ND	25	ND	25	ND	25	ND	25	ND	25	ND	25	ND	25	ND
Acrylonitrile	NA	ug/l		0.0810	320	10	ND	0.057	ND	0.057	ND	0.057	ND	10	ND	0.057	ND	0.057	ND	0.057	ND	10	ND
Benzene	NA	ug/l	5.00	0.795	32.0	2.0	ND	0.028	ND	0.028	ND	0.028	ND	2.0	ND	0.028	ND	0.028	ND	0.028	ND	2.0	ND
Bromobenzene	NA	ug/l				2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
Bromochloromethane	NA	ug/l				2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
Bromodichloromethane	NA	ug/l		0.706	160	0.059	ND	0.059	ND	0.059	ND	0.059	ND	0.059	ND	0.059	ND	0.059	ND	0.059	ND	0.059	ND
Bromoform	NA	ug/l		5.54	160	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
Bromomethane	NA	ug/l			11.2	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
Butylbenzene	NA	ug/l			400	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
Butylbenzene, sec	NA	ug/l			800	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
Butylbenzene, tert	NA	ug/l			800	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
Carbon disulfide	NA	ug/l			800	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
Carbon tetrachloride	NA	ug/l		0.625	32.0	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND
Chlorobenzene	NA	ug/l			160	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
Chlorodibromomethane	NA	ug/l		0.521	160	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND
Chloroethane	NA	ug/l				2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
Chloroform	NA	ug/l		1.41	80.0	0.10	ND	0.14	ND	0.14	ND	0.14	ND	0.10	ND	0.14	ND	0.14	ND	0.14	ND	0.10	ND
Chloromethane	NA	ug/l				2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
Chlorotoluene, o	NA	ug/l			160	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
Chlorotoluene, p	NA	ug/l				2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
Cumene (isopropyl benzene)	NA	ug/l			800	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
Cymene p- (toluene isopropyl p-)	NA	ug/l				2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
Dibromomethane (methylene bromide)	NA	ug/l			80.0	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
Dichlorodifluoromethane (Freon-12)	NA	ug/l			1600	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
Ethyl benzene	NA	ug/l	700		800	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
Hexachlorobutadiene	NA	ug/l		0.561	8.00	2.0	ND	0.069	ND	0.069	ND	0.069	ND	2.0	ND	0.069	ND	0.069	ND	0.069	ND	2.0	ND
Hexane (C6)	NA	ug/l			480	--	--	--	--	--	--	2.0	ND	--	--	--	--	--	--	2.0	ND	--	--
Methyl ethyl ketone (2-butanone)	NA	ug/l			4800	10	ND	10	ND	10	ND	10	ND	10	ND	10	ND	10	ND	10	ND	10	ND
Methyl isobutyl ketone (MIBK)	NA	ug/l			640	10	ND	10	ND	10	ND	10	ND	10	ND	10	ND	10	ND	10	ND	10	ND
Methyl tertiary butyl ether (MTBE)	NA	ug/l	20.0	24.3		2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND

Table 2
Historical Groundwater Data - 2015 Landau PQLs vs. MTCA Cleanup Levels
Yakima Mill Site

					Location	MW-102		MW-102		MW-102		MW-102		MW-103		MW-103		MW-103		MW-103		MW-104	
					Date	9/16/2014		12/19/2014		3/26/2015		6/25/2015		9/16/2014		12/19/2014		3/24/2015		6/25/2015		9/16/2014	
					Sample Type	N		N		N		N		N		N		N		N		N	
					Result Type	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result
					Data Status	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource
Parameter	Total or Dissolved	Units	Washington GW Method A	Washington Groundwater Method B Cancer	Washington Groundwater Method B Noncancer																		
Effective Date			07/01/2015	07/01/2015	07/01/2015																		
Exceedance Key			No Exceedances	Shade	Border																		
Methylene chloride	NA	ug/l	5.00	21.9	48.0	5.0	ND	0.68	ND	0.68	ND	0.68	ND	5.0	ND	0.68	ND	0.68	ND	0.68	ND	5.0	ND
Naphthalene	NA	ug/l	160		160	2.0	ND	--	--	--	--	--	--	2.0	ND	--	--	--	--	--	--	2.0	ND
Propylbenzene	NA	ug/l			800	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
Styrene	NA	ug/l			1600	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
Tetrachloroethylene	NA	ug/l	5.00	20.8	48.0	2.0	ND	0.023	ND	0.023	ND	0.023	ND	2.0	ND	0.023	ND	0.023	ND	0.023	ND	2.0	ND
Toluene	NA	ug/l	1000		640	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
Trichloroethylene (TCE)	NA	ug/l	5.00	0.540	4.00	0.020	ND	0.054	ND	0.054	ND	0.054	ND	0.020	ND	0.054	ND	0.054	ND	0.054	ND	0.020	ND
Trichlorofluoromethane (Freon-11)	NA	ug/l			2400	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
Vinyl chloride	NA	ug/l	0.200		24.0	0.20	ND	0.031	ND	0.031	ND	0.031	ND	0.20	ND	0.031	ND	0.031	ND	0.031	ND	0.20	ND
Xylene, m & p	NA	ug/l			1600	4.0	ND	4.0	ND	4.0	ND	4.0	ND	4.0	ND	4.0	ND	4.0	ND	4.0	ND	4.0	ND
Xylene, o	NA	ug/l			1600	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
Pesticides																							
4,4'-DDD	NA	ug/l		0.365		0.011	ND	0.010	ND	0.011	ND	0.010	ND	0.011	0.15	0.010	0.12	0.010	0.065	0.011	0.084	0.011	ND
4,4'-DDE	NA	ug/l		0.257		0.011	ND	0.010	ND	0.011	ND	0.010	ND	0.011	ND	0.010	ND	0.010	ND	0.011	ND	0.011	ND
4,4'-DDT	NA	ug/l	0.300	0.257	8.00	0.011	ND	0.010	ND	0.011	ND	0.010	ND	0.011	0.09	0.010	ND	0.010	ND	0.011	ND	0.011	ND
a-BHC	NA	ug/l		0.0139	128	0.011	ND	0.010	ND	0.011	ND	0.010	ND	0.011	ND	0.010	ND	0.010	ND	0.011	ND	0.011	ND
Aldrin	NA	ug/l		0.00257	0.240	0.011	ND	0.010	ND	0.011	ND	0.010	ND	0.011	ND	0.010	ND	0.010	ND	0.011	ND	0.011	ND
b-BHC	NA	ug/l		0.0486		0.011	ND	0.010	ND	0.011	ND	0.010	ND	0.011	ND	0.010	ND	0.010	ND	0.011	ND	0.011	ND
Chlordane, alpha & gamma	NA	ug/l		0.250	8.00	0.011	ND	0.010	ND	0.011	ND	0.010	ND	0.011	ND	0.010	ND	0.010	ND	0.011	ND	0.011	ND
d-BHC	NA	ug/l				0.011	ND	0.010	ND	0.011	ND	0.010	ND	0.011	ND	0.010	ND	0.010	ND	0.011	ND	0.011	ND
Dieldrin	NA	ug/l		0.00547	0.800	0.011	ND	0.010	ND	0.011	ND	0.010	ND	0.011	ND	0.010	ND	0.010	ND	0.011	ND	0.011	ND
Endosulfan I	NA	ug/l			96.0	0.011	ND	0.010	ND	0.011	ND	0.010	ND	0.011	ND	0.010	ND	0.010	ND	0.011	ND	0.011	ND
Endosulfan II	NA	ug/l			96.0	0.011	ND	0.011	ND	0.011	0.019	0.010	ND	0.017	ND	0.019	ND	0.010	0.068	0.011	0.039	0.011	ND
Endosulfan sulfate	NA	ug/l			96.0	0.011	ND	0.010	ND	0.011	ND	0.010	ND	0.011	ND	0.010	ND	0.010	ND	0.011	ND	0.011	ND
Endrin	NA	ug/l			4.80	0.011	ND	0.010	ND	0.011	ND	0.010	ND	0.011	ND	0.010	ND	0.010	ND	0.011	ND	0.011	ND
Endrin aldehyde	NA	ug/l				0.011	ND	0.010	ND	0.011	ND	0.010	ND	0.011	ND	0.010	ND	0.010	ND	0.011	ND	0.011	ND
g-BHC (Lindane)	NA	ug/l	0.200	0.0795	4.80	0.011	ND	0.010	ND	0.011	ND	0.010	ND	0.011	ND	0.010	ND	0.010	ND	0.011	ND	0.011	ND
Heptachlor	NA	ug/l		0.0194	8.00	0.011	ND	0.010	ND	0.011	ND	0.010	ND	0.011	ND	0.010	ND	0.010	ND	0.011	ND	0.011	ND
Heptachlor epoxide	NA	ug/l		0.00481	0.104	0.011	ND	0.010	ND	0.011	ND	0.010	ND	0.011	ND	0.010	ND	0.010	ND	0.011	ND	0.011	ND
Hexachlorobenzene	NA	ug/l		0.0547	12.8	--	--	0.010	ND	0.011	ND	0.010	ND	--	--	0.010	ND	0.010	ND	0.011	ND	--	--
Methoxychlor	NA	ug/l			80.0	0.011	ND	0.010	ND	0.011	ND	0.010	ND	0.011	ND	0.010	ND	0.010	ND	0.011	ND	0.011	ND
Toxaphene	NA	ug/l		0.0795		0.51	ND	0.50	ND	0.51	ND	0.50	ND	0.51	ND	0.50	ND	0.50	ND	0.52	ND	0.52	ND
PCBs																							
Aroclor 1016	NA	ug/l		1.25	1.12	0.0051	ND	0.0050	ND	0.0051	ND	0.0050	ND	0.0051	ND	0.0050	ND	0.0094	ND	0.0052	ND	0.0052	ND
Aroclor 1221	NA	ug/l				0.011	ND	0.010	ND	0.011	ND	0.010	ND	0.011	ND	0.010	ND	0.010	ND	0.011	ND	0.011	ND
Aroclor 1232	NA	ug/l				0.0051	ND	0.0050	ND	0.0051	ND	0.0050	ND	0.0051	ND	0.0050	ND	0.012	ND	0.0052	0.0071	0.0052	ND
Aroclor 1242	NA	ug/l				0.0051	0.0085	0.0050	ND	0.0051	ND	0.0050	ND	0.0051	0.022	0.005	0.0080	0.0089	ND	0.0052	ND	0.0052	0.027
Aroclor 1248	NA	ug/l				0.0051	ND	0.0050	ND	0.0051	ND	0.0050	ND	0.0051	ND	0.0050	ND	0.0054	ND	0.0052	ND	0.0052	ND
Aroclor 1254	NA	ug/l		0.0438	0.320	0.0051	ND	0.0050	ND	0.0051	ND	0.0050	ND	0.0066	ND	0.0057	ND	0.0050	ND	0.0052	ND	0.0052	ND
Aroclor 1260	NA	ug/l		0.0438		0.0051	ND	0.0050	ND	0.0051	ND	0.0050	ND	0.0051	ND	0.0050	ND	0.0050	ND	0.0052	ND	0.0052	ND
Total Petroleum Hydrocarbons																							
Total Petroleum Hydrocarbons (as diesel)	NA	ug/l	500			310	ND	310	ND	310	ND	310	ND	310	ND	310	ND	310	ND	310	ND	310	ND
Total Petroleum Hydrocarbons (as diesel), silica gel	NA	ug/l	500			--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Total Petroleum Hydrocarbons (as gasoline)	NA	ug/l	800			130	ND	130	ND	130	ND	130	ND	130	ND	130	ND	130	ND	130	ND	130	ND
Total Petroleum Hydrocarbons (as motor oil)	NA	ug/l	500			310	ND	310	ND	310	ND	310	ND	310	ND	310	ND	310	ND	310	ND	310	ND
Total Petroleum Hydrocarbons (as motor oil), silica gel	NA	ug/l	500			--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--

Landau qualifier - J: Indicates the analyte was positively identified; the associated numerical value is the approximate concentration of the analyte in the sample.

Landau qualifier - UJ: The analyte was not detected in the sample; the reported sample reporting limit is an estimate.

N: Normal Sample.

FD: Field Duplicate Sample.

ND: Not detected.

PQL: Practical Quantitation Limit.

SSource: Laboratory and/or field data obtained from a secondary source external to Barr. Second source QA/QC evaluation procedures may or may not have been performed beyond the original data generator.

Table was updated (items in red) after original submittal to add Landau qualifiers to be consistent with the memo.

Table 2
Historical Groundwater Data - 2015 Landau PQLs vs. MTCA Cleanup Levels
Yakima Mill Site

					Location	MW-104		MW-104		MW-104		MW-105		MW-105		MW-105		MW-105		MW-106		MW-106		MW-106	
					Date	12/16/2014		3/24/2015		6/24/2015		9/15/2014		12/16/2014		3/24/2015		6/25/2015		9/16/2014		9/16/2014		12/19/2014	
					Sample Type	N		N		N		N		N		N		N		N		FD		N	
					Result Type	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result
					Data Status	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource
Parameter	Total or Dissolved	Units	Washington GW Method A	Washington Groundwater Method B Cancer	Washington Groundwater Method B Noncancer																				
Effective Date			07/01/2015	07/01/2015	07/01/2015																				
Exceedance Key			No Exceedances	Shade	Border																				
General Parameters																									
Alkalinity, bicarbonate, as CaCO3	NA	mg/l				15	200	0.0	180	15	200	15	220	15	190	0.0	180	15	110	15	280	15	280	15	400
Alkalinity, total, as CaCO3	NA	mg/l				15	200	0.0	180	15	200	15	220	15	190	0.0	180	15	110	15	280	15	280	15	400
Carbon, total organic	NA	mg/l				0.50	4.1	0.50	4.2	0.50	5.0	0.50	6.2	0.50	5.3	0.50	5.2	0.50	5.9	0.50	5.8	0.50	5.8	1.0	11
Chloride	NA	mg/l				0.092	18	0.092	15	0.92	16	0.46	18	0.46	17	0.092	19	0.92	5.9	0.092	18	0.092	18	0.092	17
Fluoride	NA	mg/l			0.64	0.16	0.26	0.16	ND	0.16	ND	0.16	0.22	0.16	ND	0.16	ND	0.16	ND	0.16	0.51	0.16	0.37	0.16	0.26
Nitrogen, ammonia, as N	NA	mg/l				0.050	2.1	0.050	1.7	0.050	1.7	0.050	0.13	0.050	1.7	0.050	1	0.050	0.89	0.050	5.3	0.050	5.6	0.050	9.0
Nitrogen, nitrate, as N	NA	mg/l			25.6	0.034	ND	0.034	ND	0.034	ND	0.034	0.081	0.034	ND	0.034	ND	0.034	ND	0.034	0.043 J	0.034	0.12 J	0.034	ND
Nitrogen, nitrite, as N	NA	mg/l			1.6	0.043	ND	0.043	ND	0.043	ND	0.043	ND	0.043	ND	0.043	ND	0.043	ND	0.043	ND	0.043	ND	0.043	ND
Solids, total dissolved	NA	mg/l				5.0	250	5.0	210	5.0	160	5.0	900 230	5.0	220	5.0	230	5.0	240	5.0	320	5.0	320	5.0	460
Sulfate, as SO4	NA	mg/l				0.26	ND	0.26	17	0.26	ND	0.26	2.5	0.26	ND	0.26	ND	0.26	1.6	0.26	20	0.26	20	0.26	0.29
Metals																									
Arsenic	Dissolved	ug/l	5.00	0.0583	4.80	0.45	5.4	0.50	6.4	0.45	5.8	1.0	3.7	0.45	4.2	0.50	4.6	0.45	2.8	1.0	5.7	1.0	5.3	0.45	8.4
Arsenic	Total	ug/l	5.00	0.0583	4.80	0.45	4.8	0.50	6.7	0.45	6.2	1.0	3.7	0.45	3.9	0.50	4.8	0.45	3.2	1.0	5.2	1.0	5.1	0.45	7.9
Barium	Dissolved	ug/l			3200	1.0	48	1.0	51	1.0	51	1.0	54	1.0	62	1.0	66	1.0	32	1.0	45	1.0	45	1.0	140
Barium	Total	ug/l			3200	1.0	56	1.0	51	1.0	52	1.0	60	1.0	64	1.0	67	1.0	34	1.0	46	1.0	45	1.0	140
Cadmium	Dissolved	ug/l	5.00		8.00	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND
Cadmium	Total	ug/l	5.00		8.00	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND
Calcium	Dissolved	ug/l				100	37000	100	38000	100	38000	100	29000	100	37000	100	40000	100	21000	100	28000	100	29000	100	76000
Calcium	Total	ug/l				100	37000	100	38000	100	39000	100	29000	100	38000	100	41000	100	22000	100	27000	100	28000	100	75000
Chromium	Dissolved	ug/l	50.0			2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
Chromium	Total	ug/l	50.0			2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
Chromium, hexavalent	Dissolved	ug/l			48.0	--	--	--	--	--	--	10	ND	--	--	--	--	--	--	10	ND	10	ND UJ	--	--
Chromium, hexavalent	Total	ug/l			48.0	--	--	--	--	--	--	10	ND	--	--	--	--	--	--	10	ND	10	ND UJ	--	--
Iron	Dissolved	ug/l			11200	50	27000	50	28000	50	27000	50	20000	50	30000	50	32000	50	17000	50	7000	50	6900	50	56000
Iron	Total	ug/l			11200	50	27000	50	28000	50	29000	50	20000	50	31000	50	32000	50	17000	50	7300	50	6800	50	57000
Lead	Dissolved	ug/l	15.0			0.28	ND	0.28	ND	0.28	ND	1.0	ND	0.28	ND	0.28	ND	0.28	ND	1.0	ND	1.0	ND	0.28	ND
Lead	Total	ug/l	15.0			0.28	1.7	0.28	ND	0.28	ND	1.0	ND	0.28	ND	0.28	ND	0.28	ND	1.0	ND	1.0	ND	0.28	ND
Magnesium	Dissolved	ug/l				50	13000	50	14000	50	13000	50	9100	50	12000	50	13000	50	6500	50	11000	50	11000	50	23000
Magnesium	Total	ug/l				50	13000	50	14000	50	14000	50	9600	50	12000	50	13000	50	6800	50	10000	50	11000	50	23000
Manganese	Dissolved	ug/l			2240	2.0	2100	2.0	2100	2.0	2100	2.0	2700	2.0	2900	2.0	3000	2.0	1700	2.0	2000	2.0	1900	10	5700
Manganese	Total	ug/l			2240	2.0	2000	2.0	2100	2.0	2100	2.0	2700	2.0	2900	2.0	3000	2.0	1700	2.0	1800	2.0	1800	10	5500
Mercury	Dissolved	ug/l	2.00			0.11	ND	0.11	ND	0.11	ND	0.20	ND	0.11	ND	0.11	ND	0.11	ND	0.20	ND	0.20	ND	0.11	ND
Mercury	Total	ug/l	2.00			0.11	ND	0.11	ND	0.11	ND	0.20	ND	0.11	ND	0.11	ND	0.11	ND	0.20	ND	0.20	ND	0.11	ND
Potassium	Dissolved	ug/l				--	--	50	6800	50	6600	--	--	--	--	50	7700	50	5400	--	--	--	--	--	--
Potassium	Total	ug/l				--	--	50	6800	50	6700	--	--	--	--	50	7800	50	5500	--	--	--	--	--	--
Selenium	Dissolved	ug/l			80.0	4.0	ND	4.0	ND	4.0	ND	4.0	ND	4.0	ND	4.0	ND	4.0	ND	4.0	ND	4.0	ND	4.0	ND
Selenium	Total	ug/l			80.0	4.0	ND	4.0	ND	4.0	ND	4.0	ND	4.0	ND	4.0	ND	4.0	ND	4.0	ND	4.0	ND	4.0	ND
Silver	Dissolved	ug/l			80.0	0.20	ND	0.20	ND	0.20	ND	1.0	ND	0.20	ND	0.20	ND	0.20	ND	1.0	ND	1.0	ND	0.20	ND
Silver	Total	ug/l			80.0	0.20	ND	0.20	ND	0.20	ND	1.0	ND	0.20	ND	0.20	ND	0.20	ND	1.0	ND	1.0	ND	0.20	ND
Sodium	Dissolved	ug/l				50	18000	50	18000	50	18000	50	28000	50	16000	50	17000	50	11000	50	57000	50	62000	50	30000
Sodium	Total	ug/l				50	18000	50	18000	50	18000	50	35000	50	17000	50	17000	50	11000	50	64000	50	65000	50	30000
SVOCs																									
1,2,4-Trichlorobenzene	NA	ug/l		1.51	80.0	2.0	ND	--	--	--	--	2.0	ND	2.0	ND	--	--	--	--	2.0	ND	2.0	ND	2.0	ND
1,2-Dichlorobenzene	NA	ug/l			720	2.0	ND	--	--	--	--	2.0	ND	2.0	ND	--	--	--	--	2.0	ND	2.0	ND	2.0	ND
1,3-Dichlorobenzene	NA	ug/l				2.0	ND	--	--	--	--	2.0	ND	2.0	ND	--	--	--	--	2.0	ND	2.0	ND	2.0	ND
1,4-Dichlorobenzene	NA	ug/l		8.10	560	2.0	ND	--	--	--	--	2.0	ND	2.0	ND	--	--	--	--	2.0	ND	2.0	ND	2.0	ND
1-Methylnaphthalene	NA	ug/l		1.51	560	0.020	ND	0.020	ND	0.020	ND	0.020	ND	0.020	ND	0.020	ND	0.020	ND	0.020	0.08 J	0.020	0.12 J	0.020	0.22
2,2'-oxybis (1-chloropropane)	NA	ug/l		0.625	320	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
2,3,4,6-Tetrachlorophenol	NA	ug/l			480	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
2,4,5-Trichlorophenol	NA	ug/l			800	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
2,4,6-Trichlorophenol	NA	ug/l		3.98	8.00	0.83	ND	0.83	ND	0.84	ND	2.0	ND	0.83	ND	0.83	ND	0.83	ND	2.0	ND	2.0	ND	0.83	ND
2,4-Dichlorophenol	NA	ug/l			24.0	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
2,4-Dimethylphenol	NA	ug/l			160	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
2,4-Dinitrophenol	NA	ug/l			32.0	10	ND	10	ND	10	ND	10	ND	10	ND	10	ND	10	ND	10	ND	10	ND	10	ND
2,4-Dinitrotoluene	NA	ug/l		0.282	32.0	0.72	ND	0.72	ND	0.73	ND	0.78	ND	0.72	ND	0.72	ND	0.72	ND	0.78	ND	0.78	ND	0.72	ND
2,6-Dichlorophenol	NA	ug/l				2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND

Table 2
Historical Groundwater Data - 2015 Landau PQLs vs. MTCA Cleanup Levels
Yakima Mill Site

					Location	MW-104		MW-104		MW-104		MW-105		MW-105		MW-105		MW-105		MW-106		MW-106		MW-106	
					Date	12/16/2014		3/24/2015		6/24/2015		9/15/2014		12/16/2014		3/24/2015		6/25/2015		9/16/2014		9/16/2014		12/19/2014	
					Sample Type	N		N		N		N		N		N		N		N		FD		N	
					Result Type	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result
					Data Status	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource
Parameter	Total or Dissolved	Units	Washington GW Method A	Washington Groundwater Method B Cancer	Washington Groundwater Method B Noncancer																				
Effective Date			07/01/2015	07/01/2015	07/01/2015																				
Exceedance Key			No Exceedances	Shade	Border																				
2,6-Dinitrotoluene	NA	ug/l		0.0583	4.80	1.7	ND	1.7	ND	1.7	ND	1.8	ND	1.7	ND	1.7	ND	1.7	ND	1.8	ND	1.8	ND	1.7	ND
2-Chloronaphthalene	NA	ug/l			640	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
2-Chlorophenol	NA	ug/l			40.0	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
2-Methyl-4,6-dinitrophenol	NA	ug/l				2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
2-Methylnaphthalene	NA	ug/l			32.0	0.020	ND	0.020	ND	0.020	ND	0.020	ND	0.020	ND	0.020	ND	0.020	ND	0.020	0.055 J	0.020	0.079 J	0.020	0.052
2-Methylphenol (o-cresol)	NA	ug/l			400	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
2-Nitroaniline	NA	ug/l			160	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
2-Nitrophenol	NA	ug/l				2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
3,3`-Dichlorobenzidine	NA	ug/l		0.194		1.9	ND	1.9	ND	1.9	ND	2.0	ND	1.9	ND	1.9	ND	1.9	ND	2.0	ND	2.0	ND	1.9	ND
3,4-Methylphenol (m,p cresols)	NA	ug/l				2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
3-Nitroaniline	NA	ug/l				5.0	ND	5.0	ND	5.0	ND	5.0	ND	5.0	ND	5.0	ND	5.0	ND	5.0	ND	5.0	ND	5.0	ND
4-Bromophenyl phenyl ether	NA	ug/l				2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
4-Chloro-3-methylphenol	NA	ug/l				2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
4-Chloroaniline	NA	ug/l		0.219	32.0	1.8	ND	1.8	ND	1.8	ND	2.0	ND	1.8	ND	1.8	ND	1.8	ND	2.0	ND	2.0	ND	1.8	ND
4-Chlorophenyl phenyl ether	NA	ug/l				2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
4-Nitroaniline	NA	ug/l				2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
4-Nitrophenol	NA	ug/l				2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
Acenaphthene	NA	ug/l			960	0.014	ND	0.014	ND	0.014	ND	0.020	0.097	0.014	0.16	0.014	0.12	0.014	0.10	0.020	0.042	0.020	0.056	0.014	0.13
Acenaphthylene	NA	ug/l				0.020	ND	0.020	ND	0.020	ND	0.020	ND	0.020	ND	0.020	ND	0.020	ND	0.020	ND	0.020	ND	0.020	ND
Aniline	NA	ug/l		7.68	56.0	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
Anthracene	NA	ug/l			4800	0.010	0.010	0.010	0.012	0.010	ND	0.020	ND	0.010	0.010	0.010	0.012	0.010	ND	0.020	ND	0.020	0.036	0.010	ND
Azobenzene	NA	ug/l		0.795		1.5	ND	1.5	ND	1.5	ND	2.0	ND	1.5	ND	1.5	ND	1.5	ND	2.0	ND	2.0	ND	1.5	ND
Benz(a)anthracene	NA	ug/l		0.120		0.017	ND	0.017	ND	0.017	ND	0.020	ND	0.017	ND	0.017	ND	0.017	ND	0.020	ND	0.020	ND	0.017	ND
Benzo(a)pyrene	NA	ug/l	0.100	0.0120		0.027	ND	0.027	ND	0.027	ND	0.029	ND	0.027	ND	0.027	ND	0.027	ND	0.029	ND	0.029	ND	0.027	ND
Benzo(b)fluoranthene	NA	ug/l		0.120		0.0068	ND	0.0068	ND	0.0068	ND	0.020	ND	0.0068	ND	0.0068	ND	0.0068	ND	0.020	ND	0.020	ND	0.0068	ND
Benzo(g,h,i)perylene	NA	ug/l				0.019	ND	0.019	ND	0.019	ND	0.020	ND	0.019	ND	0.019	ND	0.019	ND	0.020	ND	0.020	ND	0.019	ND
Benzo(k)fluoranthene	NA	ug/l		1.20		0.013	ND	0.013	ND	0.013	ND	0.020	ND	0.013	ND	0.013	ND	0.013	ND	0.020	ND	0.020	ND	0.013	ND
Benzoic acid	NA	ug/l			64000	10	ND	10	ND	10	ND	10	ND	10	ND	10	ND	10	ND	10	ND	10	ND	10	ND
Benzyl alcohol	NA	ug/l			800	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
Bis(2-chloroethoxy)methane	NA	ug/l				2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
Bis(2-chloroethyl)ether	NA	ug/l		0.0398		0.87	ND	0.87	ND	0.88	ND	0.94	ND	0.87	ND	0.87	ND	0.87	ND	0.94	ND	0.94	ND	0.87	ND
Bis(2-ethylhexyl)phthalate	NA	ug/l		6.25	320	0.75	ND	0.75	ND	0.75	ND	2.0	ND	0.75	ND	0.75	ND	0.75	ND	2.0	ND	2.0	ND	0.75	60
Butyl benzyl phthalate	NA	ug/l		46.1	3200	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
Carbazole	NA	ug/l				2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
Chrysene	NA	ug/l		12.0		0.018	ND	0.018	ND	0.018	ND	0.020	ND	0.018	ND	0.018	ND	0.018	ND	0.020	ND	0.020	ND	0.018	ND
Dibenz(a,h)anthracene	NA	ug/l		0.0120		0.011	ND	0.011	ND	0.011	ND	0.012	ND	0.011	ND	0.011	ND	0.011	ND	0.012	ND	0.012	ND	0.011	ND
Dibenzofuran	NA	ug/l			16.0	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
Diethyl phthalate	NA	ug/l			12800	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
Dimethyl phthalate	NA	ug/l				2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
Di-n-butyl phthalate	NA	ug/l			1600	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
Di-n-octyl phthalate	NA	ug/l			160	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
Fluoranthene	NA	ug/l			640	0.0092	ND	0.0092	ND	0.0092	ND	0.020	ND	0.0092	0.018	0.0092	0.02	0.0092	0.018	0.020	ND	0.020	ND	0.0092	0.010
Fluorene	NA	ug/l			640	0.0090	ND	0.0090	ND	0.0091	ND	0.020	ND	0.0090	ND	0.0090	ND	0.0090	ND	0.020	ND	0.020	ND	0.0090	ND
Hexachlorobenzene	NA	ug/l		0.0547	12.8	0.59	ND	--	--	--	--	2.0	ND	0.59	ND	--	--	--	--	2.0	ND	2.0	ND	0.59	ND
Hexachlorobutadiene	NA	ug/l		0.561	8.00	--	--	--	--	--	--	2.0	ND	--	--	--	--	--	--	2.0	ND	2.0	ND	--	--
Hexachlorocyclopentadiene	NA	ug/l			48.0	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
Hexachloroethane	NA	ug/l		1.09	5.60	1.9	ND	1.9	ND	1.9	ND	2.0	ND	1.9	ND	1.9	ND	1.9	ND	2.0	ND	2.0	ND	1.9	ND
Indeno(1,2,3-cd)pyrene	NA	ug/l		0.120		0.014	ND	0.014	ND	0.014	ND	0.020	ND	0.014	ND	0.014	ND	0.014	ND	0.020	ND	0.020	ND	0.014	ND
Isophorone	NA	ug/l		46.1	1600	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
Naphthalene	NA	ug/l	160		160	0.013	ND	0.013	0.017	0.013	ND	0.020	0.034	0.013	0.082	0.013	ND	0.013	ND	0.020	0.064	0.020	0.074	0.013	ND
Nitrobenzene	NA	ug/l			16.0	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
n-Nitrosodimethylamine	NA	ug/l		0.000858	0.0640	1.4	ND	1.4	ND	1.4	ND	1.5	ND	1.4	ND	1.4	ND	1.4	ND	1.5	ND	1.5	ND	1.4	ND
n-Nitrosodi-n-propylamine	NA	ug/l		0.0125		1.9	ND	1.9	ND	1.9	ND	2.0	ND	1.9	ND	1.9	ND	1.9	ND	2.0	ND	2.0	ND	1.9	ND
n-Nitrosodiphenylamine	NA	ug/l		17.9		2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	4.2
Pentachlorophenol	NA	ug/l		0.219	80.0	0.12	ND	0.12	ND	0.12	ND	0.13	ND	0.12	ND	0.12	ND	0.12	ND	0.13	ND	0.13	ND	0.12	ND
Phenanthrene	NA	ug/l				0.013	ND	0.013	ND	0.013	ND	0.020	ND	0.013	ND	0.013	ND	0.013	ND	0.020	0.03	0.020	0.031	0.013	ND
Phenol	NA	ug/l			2400	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
Pyrene	NA	ug/l			480	0.010	ND	0.010	ND	0.011	ND	0.020	ND	0.010	0.015	0.010	0.017	0.010	0.035	0.020	ND	0.020	ND	0.010	ND

Table 2
Historical Groundwater Data - 2015 Landau PQLs vs. MTCA Cleanup Levels
Yakima Mill Site

					Location	MW-104		MW-104		MW-104		MW-105		MW-105		MW-105		MW-105		MW-106		MW-106		MW-106	
					Date	12/16/2014		3/24/2015		6/24/2015		9/15/2014		12/16/2014		3/24/2015		6/25/2015		9/16/2014		9/16/2014		12/19/2014	
					Sample Type	N		N		N		N		N		N		N		N		FD		N	
					Result Type	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result
					Data Status	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource
Parameter	Total or Dissolved	Units	Washington GW Method A	Washington Groundwater Method B Cancer	Washington Groundwater Method B Noncancer																				
Effective Date			07/01/2015	07/01/2015	07/01/2015																				
Exceedance Key			No Exceedances	Shade	Border																				
Pyridine	NA	ug/l			8.00	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
VOCs						--		--		--		--		--		--		--		--		--		--	
1,1,1,2-Tetrachloroethane	NA	ug/l		1.68	240	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND
1,1,1-Trichloroethane	NA	ug/l	200		16000	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
1,1,2,2-Tetrachloroethane	NA	ug/l		0.219	160	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND
1,1,2-Trichloroethane	NA	ug/l		0.768	32.0	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND
1,1-Dichloroethane	NA	ug/l		7.68	1600	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
1,1-Dichloroethylene	NA	ug/l			400	0.014	ND	0.014	ND	0.014	ND	2.0	ND	0.014	ND	0.014	ND	0.014	ND	2.0	ND	2.0	ND	0.014	ND
1,1-Dichloropropene	NA	ug/l				2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
1,2,3-Trichlorobenzene	NA	ug/l				2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
1,2,3-Trichloropropane	NA	ug/l		0.00146	32.0	0.023	ND	0.023	ND	0.023	ND	0.023	ND	0.023	ND	0.023	ND	0.023	ND	0.023	ND	0.023	ND	0.023	ND
1,2,4-Trichlorobenzene	NA	ug/l		1.51	80.0	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND
1,2,4-Trimethylbenzene	NA	ug/l				2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
1,2-Dibromo-3-chloropropane (DBCP)	NA	ug/l		0.0547	1.60	0.10	ND	0.10	ND	0.10	ND	10	ND	0.10	ND	0.10	ND	0.10	ND	10	ND	10	ND	0.10	ND
1,2-Dibromoethane (EDB)	NA	ug/l	0.0100	0.0219	72.0	0.010	ND	0.010	ND	0.010	ND	0.010	ND	0.010	ND	0.010	ND	0.010	ND	0.010	ND	0.010	ND	0.010	ND
1,2-Dichlorobenzene	NA	ug/l			720	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
1,2-Dichloroethane	NA	ug/l	5.00	0.481	48.0	0.014	ND	0.014	ND	0.014	ND	2.0	ND	0.014	ND	0.014	ND	0.014	ND	2.0	ND	2.0	ND	0.014	ND
1,2-Dichloroethylene, cis	NA	ug/l			16.0	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
1,2-Dichloroethylene, trans	NA	ug/l			160	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
1,2-Dichloropropane	NA	ug/l		1.22	720	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND
1,3,5-Trimethylbenzene	NA	ug/l			80.0	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
1,3-Dichlorobenzene	NA	ug/l				2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
1,3-Dichloropropane	NA	ug/l				2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
1,3-Dichloropropene, cis	NA	ug/l		0.438	240	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
1,3-Dichloropropene, trans	NA	ug/l		0.438	240	0.058	ND	0.058	ND	0.058	ND	2.0	ND	0.058	ND	0.058	ND	0.058	ND	2.0	ND	2.0	ND	0.058	ND
1,4-Dichlorobenzene	NA	ug/l		8.10	560	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
2,2-Dichloropropane	NA	ug/l				2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
2-Hexanone	NA	ug/l				10	ND	10	ND	10	ND	10	ND	10	ND	10	ND	10	ND	10	ND	10	ND	10	ND
Acetone	NA	ug/l			7200	25	ND	25	ND	25	ND	25	ND	25	ND	25	ND	25	ND	25	ND	25	ND	25	ND
Acrylonitrile	NA	ug/l		0.0810	320	0.057	ND	0.057	ND	0.057	ND	10	ND	0.057	ND	0.057	ND	0.057	ND	10	ND	10	ND	0.057	ND
Benzene	NA	ug/l	5.00	0.795	32.0	0.028	ND	0.028	ND	0.028	ND	2.0	ND	0.028	ND	0.028	ND	0.028	ND	2.0	ND	2.0	ND	0.028	ND
Bromobenzene	NA	ug/l				2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
Bromochloromethane	NA	ug/l				2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
Bromodichloromethane	NA	ug/l		0.706	160	0.059	ND	0.059	ND	0.059	ND	0.059	ND	0.059	ND	0.059	ND	0.059	ND	0.059	ND	0.059	ND	0.059	ND
Bromoform	NA	ug/l		5.54	160	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
Bromomethane	NA	ug/l			11.2	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
Butylbenzene	NA	ug/l			400	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
Butylbenzene, sec	NA	ug/l			800	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
Butylbenzene, tert	NA	ug/l			800	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
Carbon disulfide	NA	ug/l			800	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
Carbon tetrachloride	NA	ug/l		0.625	32.0	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND
Chlorobenzene	NA	ug/l			160	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	2.8
Chlorodibromomethane	NA	ug/l		0.521	160	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND
Chloroethane	NA	ug/l				2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
Chloroform	NA	ug/l		1.41	80.0	0.14	ND	0.14	ND	0.14	ND	0.10	ND	0.14	ND	0.14	ND	0.14	ND	0.10	ND	0.10	ND	0.14	ND
Chloromethane	NA	ug/l				2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
Chlorotoluene, o	NA	ug/l			160	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
Chlorotoluene, p	NA	ug/l				2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
Cumene (isopropyl benzene)	NA	ug/l			800	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
Cymene p- (toluene isopropyl p-)	NA	ug/l				2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
Dibromomethane (methylene bromide)	NA	ug/l			80.0	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
Dichlorodifluoromethane (Freon-12)	NA	ug/l			1600	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
Ethyl benzene	NA	ug/l	700		800	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
Hexachlorobutadiene	NA	ug/l		0.561	8.00	0.069	ND	0.069	ND	0.069	ND	2.0	ND	0.069	ND	0.069	ND	0.069	ND	2.0	ND	2.0	ND	0.069	ND
Hexane (C6)	NA	ug/l			480	--	--	--	--	2.0	ND	--	--	--	--	--	--	2.0	ND	--	--	--	--	--	--
Methyl ethyl ketone (2-butanone)	NA	ug/l			4800	10	ND	10	ND	10	ND	10	ND	10	ND	10	ND	10	ND	10	ND	10	ND	10	ND
Methyl isobutyl ketone (MIBK)	NA	ug/l			640	10	ND	10	ND	10	ND	10	ND	10	ND	10	ND	10	ND	10	ND	10	ND	10	ND
Methyl tertiary butyl ether (MTBE)	NA	ug/l	20.0	24.3		2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND

Table 2
Historical Groundwater Data - 2015 Landau PQLs vs. MTCA Cleanup Levels
Yakima Mill Site

Location						MW-104		MW-104		MW-104		MW-105		MW-105		MW-105		MW-105		MW-106		MW-106		MW-106	
Date						12/16/2014		3/24/2015		6/24/2015		9/15/2014		12/16/2014		3/24/2015		6/25/2015		9/16/2014		9/16/2014		12/19/2014	
Sample Type						N		N		N		N		N		N		N		N		FD		N	
Result Type						PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result
Data Status						SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource
Parameter	Total or Dissolved	Units	Washington GW Method A	Washington Groundwater Method B Cancer	Washington Groundwater Method B Noncancer																				
Effective Date			07/01/2015	07/01/2015	07/01/2015																				
Exceedance Key			No Exceedances	Shade	Border																				
Methylene chloride	NA	ug/l	5.00	21.9	48.0	0.68	ND	0.68	ND	0.68	ND	5.0	ND	0.68	ND	0.68	ND	0.68	ND	5.0	ND	5.0	ND	0.68	ND
Naphthalene	NA	ug/l	160		160	--	--	--	--	--	--	2.0	ND	--	--	--	--	--	--	2.0	ND	2.0	ND	--	--
Propylbenzene	NA	ug/l			800	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
Styrene	NA	ug/l			1600	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
Tetrachloroethylene	NA	ug/l	5.00	20.8	48.0	0.023	ND	0.023	ND	0.023	ND	2.0	ND	0.023	ND	0.023	ND	0.023	ND	2.0	ND	2.0	ND	0.023	ND
Toluene	NA	ug/l	1000		640	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
Trichloroethylene (TCE)	NA	ug/l	5.00	0.540	4.00	0.054	ND	0.054	ND	0.054	ND	0.020	ND	0.054	ND	0.054	ND	0.054	ND	0.020	ND	0.020	ND	0.054	ND
Trichlorofluoromethane (Freon-11)	NA	ug/l			2400	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
Vinyl chloride	NA	ug/l	0.200		24.0	0.031	ND	0.031	ND	0.031	ND	0.20	ND	0.031	ND	0.031	ND	0.031	ND	0.20	ND	0.20	ND	0.031	0.38
Xylene, m & p	NA	ug/l			1600	4.0	ND	4.0	ND	4.0	ND	4.0	ND	4.0	ND	4.0	ND	4.0	ND	4.0	ND	4.0	ND	4.0	ND
Xylene, o	NA	ug/l			1600	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
Pesticides																									
4,4'-DDD	NA	ug/l		0.365		0.011	ND	0.010	ND	0.010	ND	0.011	ND	0.011	ND	0.010	ND	0.010	ND	0.011	ND	0.011	ND	0.010	ND
4,4'-DDE	NA	ug/l		0.257		0.011	ND	0.010	ND	0.010	ND	0.011	ND	0.011	ND	0.010	ND	0.010	ND	0.011	ND	0.011	ND	0.010	ND
4,4'-DDT	NA	ug/l	0.300	0.257	8.00	0.011	ND	0.010	ND	0.010	ND	0.011	ND	0.011	ND	0.010	ND	0.010	ND	0.011	ND	0.011	ND	0.010	ND
a-BHC	NA	ug/l		0.0139	128	0.011	ND	0.010	ND	0.010	ND	0.011	ND	0.011	ND	0.010	ND	0.010	ND	0.011	ND	0.011	ND	0.010	ND
Aldrin	NA	ug/l		0.00257	0.240	0.011	ND	0.010	ND	0.010	ND	0.011	ND	0.011	ND	0.010	ND	0.010	ND	0.011	ND	0.011	ND	0.010	ND
b-BHC	NA	ug/l		0.0486		0.011	ND	0.010	ND	0.010	ND	0.011	ND	0.011	ND	0.010	ND	0.010	ND	0.011	ND	0.011	ND	0.010	ND
Chlordane, alpha & gamma	NA	ug/l		0.250	8.00	0.011	ND	0.010	ND	0.010	ND	0.011	ND	0.011	ND	0.010	ND	0.010	ND	0.011	ND	0.011	ND	0.010	ND
d-BHC	NA	ug/l				0.011	ND	0.010	ND	0.010	ND	0.011	ND	0.011	ND	0.010	ND	0.010	ND	0.011	ND	0.011	ND	0.010	ND
Dieldrin	NA	ug/l		0.00547	0.800	0.011	ND	0.010	ND	0.010	ND	0.011	ND	0.011	ND	0.010	ND	0.010	ND	0.011	ND	0.011	ND	0.010	ND
Endosulfan I	NA	ug/l			96.0	0.011	ND	0.010	ND	0.010	ND	0.011	ND	0.011	ND	0.010	ND	0.010	ND	0.011	ND	0.011	ND	0.010	ND
Endosulfan II	NA	ug/l			96.0	0.011	ND	0.010	0.011	0.010	ND	0.014	ND	0.011	ND	0.010	ND	0.010	0.012	0.011	ND	0.011	ND	0.010	ND
Endosulfan sulfate	NA	ug/l			96.0	0.011	ND	0.010	ND	0.010	ND	0.011	ND	0.011	ND	0.010	ND	0.010	ND	0.011	ND	0.011	ND	0.010	ND
Endrin	NA	ug/l			4.80	0.011	ND	0.010	ND	0.010	ND	0.011	ND	0.011	ND	0.010	ND	0.010	ND	0.011	ND	0.011	ND	0.010	ND
Endrin aldehyde	NA	ug/l				0.011	ND	0.010	ND	0.010	ND	0.011	ND	0.011	ND	0.010	ND	0.010	ND	0.011	ND	0.011	ND	0.010	ND
g-BHC (Lindane)	NA	ug/l	0.200	0.0795	4.80	0.011	ND	0.010	ND	0.010	ND	0.011	ND	0.011	ND	0.010	ND	0.010	ND	0.011	ND	0.011	ND	0.010	ND
Heptachlor	NA	ug/l		0.0194	8.00	0.011	ND	0.010	ND	0.010	ND	0.011	ND	0.011	ND	0.010	ND	0.010	ND	0.011	ND	0.011	ND	0.010	ND
Heptachlor epoxide	NA	ug/l		0.00481	0.104	0.011	ND	0.010	ND	0.010	ND	0.011	ND	0.011	ND	0.010	ND	0.010	ND	0.011	ND	0.011	ND	0.010	ND
Hexachlorobenzene	NA	ug/l		0.0547	12.8	0.011	ND	0.010	ND	0.010	ND	--	--	0.011	ND	0.010	ND	0.010	ND	--	--	--	--	0.010	ND
Methoxychlor	NA	ug/l			80.0	0.011	ND	0.010	ND	0.010	ND	0.011	ND	0.011	ND	0.010	ND	0.010	ND	0.011	ND	0.011	ND	0.010	ND
Toxaphene	NA	ug/l		0.0795		0.52	ND	0.50	ND	0.50	ND	0.52	ND	0.52	ND	0.50	ND	0.50	ND	0.51	ND	0.52	ND	0.50	ND
PCBs																									
Aroclor 1016	NA	ug/l		1.25	1.12	0.0052	ND	0.0050	ND	0.0050	ND	0.0052	ND	0.0052	ND	0.0050	ND	0.0050	ND	0.0051	ND	0.0052	ND	0.0050	ND
Aroclor 1221	NA	ug/l				0.011	ND	0.010	ND	0.010	ND	0.011	ND	0.011	ND	0.010	ND	0.010	ND	0.011	ND	0.011	ND	0.010	ND
Aroclor 1232	NA	ug/l				0.0052	ND	0.0050	ND	0.005	0.042	0.0052	ND	0.0052	ND	0.0050	ND	0.005	0.013	0.0051	ND	0.0052	ND	0.0050	ND
Aroclor 1242	NA	ug/l				0.0052	0.040	0.005	0.025	0.0050	ND	0.0052	0.031	0.0052	0.015	0.005	0.014	0.0050	ND	0.0051	0.035	0.0052	0.036	0.005	0.023 J
Aroclor 1248	NA	ug/l				0.0052	ND	0.0050	ND	0.0050	ND	0.0052	ND	0.0052	ND	0.0050	ND	0.0050	ND	0.0051	ND	0.0052	ND	0.0050	ND
Aroclor 1254	NA	ug/l		0.0438	0.320	0.0052	ND	0.0050	ND	0.0050	ND	0.0052	ND	0.0052	ND	0.0050	ND	0.0050	ND	0.0051	ND	0.0052	ND	0.0050	ND
Aroclor 1260	NA	ug/l		0.0438		0.0052	ND	0.0050	ND	0.0050	ND	0.0052	ND	0.0052	ND	0.0050	ND	0.0050	ND	0.0051	ND	0.0052	ND	0.0050	ND
Total Petroleum Hydrocarbons																									
Total Petroleum Hydrocarbons (as diesel)	NA	ug/l	500			310	ND	310	ND	310	ND	310	ND	310	ND	310	ND	310	ND	310	ND	310	ND	130 310	670 ND
Total Petroleum Hydrocarbons (as diesel), silica gel	NA	ug/l	500			--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	130	170
Total Petroleum Hydrocarbons (as gasoline)	NA	ug/l	800			130	ND	130	ND	130	ND	130	ND	130	ND	130	ND	130	ND	130	ND	130	ND	130	ND
Total Petroleum Hydrocarbons (as motor oil)	NA	ug/l	500			310	ND	310	ND	310	ND	310	ND	310	ND	310	ND	310	ND	310	ND	310	ND	250 310	300 ND
Total Petroleum Hydrocarbons (as motor oil), silica gel	NA	ug/l	500			--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	250	ND

Landau qualifier - J: Indicates the analyte was positively identified; the associated numerical value is the approximate concentration of the analyte in the sample.
Landau qualifier - UJ: The analyte was not detected in the sample; the reported sample reporting limit is an estimate.
N: Normal Sample.
FD: Field Duplicate Sample.
ND: Not detected.
PQL: Practical Quantitation Limit.
SSource: Laboratory and/or field data obtained from a secondary source external to Barr. Second source QA/QC evaluation procedures may or may not have been performed beyond the original data generator.
Table was updated (items in red) after original submittal to add Landau qualifiers to be consistent with the memo.

Table 2
Historical Groundwater Data - 2015 Landau PQLs vs. MTCA Cleanup Levels
Yakima Mill Site

					Location	MW-106		MW-106		MW-106		MW-106		MW-106		MW-107		MW-107		MW-107		MW-107		MW-108	
					Date	12/19/2014		3/24/2015		3/24/2015		6/25/2015		6/25/2015		9/17/2014		12/16/2014		3/26/2015		6/25/2015		9/17/2014	
					Sample Type	FD		N		FD		N		FD		N		N		N		N		N	
					Result Type	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result
					Data Status	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource
Parameter	Total or Dissolved	Units	Washington GW Method A	Washington Groundwater Method B Cancer	Washington Groundwater Method B Noncancer																				
Effective Date			07/01/2015	07/01/2015	07/01/2015																				
Exceedance Key			No Exceedances	Shade	Border																				
General Parameters																									
Alkalinity, bicarbonate, as CaCO3	NA	mg/l				15	400	0.0	250	0.0	260	15	190	15	200	15	220	15	200	0.0	200	15	200	15	210
Alkalinity, total, as CaCO3	NA	mg/l				15	400	0.0	250	0.0	260	15	190	15	200	15	220	15	200	0.0	200	15	200	15	210
Carbon, total organic	NA	mg/l				1.0	11	0.50	6.8	0.50	6.7	0.50	4.1	0.50	4.2	0.50	4.6	0.50	3.5	0.50	4.1	0.50	3.8	0.50	5.2
Chloride	NA	mg/l				0.092	19	0.092	18	0.092	18	0.92	12	0.92	12	0.92	32	0.46	18	0.092	19	0.092	19	0.092	19
Fluoride	NA	mg/l			0.64	0.16	0.24	0.16	0.17	0.16	0.25	0.16	ND	0.16	ND	0.16	ND	0.16	0.22	0.16	ND	0.16	ND	0.16	0.23
Nitrogen, ammonia, as N	NA	mg/l				0.050	9.0	0.25	10	0.25	10	0.25	8.4	0.25	8.4	0.050	4	0.050	3.6	0.050	3.6	0.050	3.3	0.050	3
Nitrogen, nitrate, as N	NA	mg/l			25.6	0.034	ND	0.034	ND	0.034	ND	0.034	0.088 J	0.034	ND	0.034	ND	0.034	ND	0.034	ND	0.034	ND	0.034	0.059
Nitrogen, nitrite, as N	NA	mg/l			1.6	0.043	ND	0.043	ND	0.043	ND	0.043	ND	0.043	ND	0.043	ND	0.043	ND	0.043	ND	0.043	ND	0.043	ND
Solids, total dissolved	NA	mg/l				5.0	490	5.0	290	5.0	270	5.0	200 J	5.0	250 J	5.0	180	5.0	280	5.0	220	5.0	240	5.0	260
Sulfate, as SO4	NA	mg/l				0.26	0.31	0.26	ND	0.26	0.33	2.6	2.9	2.6	3.0	0.26	ND	0.26	ND	0.26	ND	0.26	ND	0.26	ND
Metals																									
Arsenic	Dissolved	ug/l	5.00	0.0583	4.80	0.45	7.9	0.45	8.7	0.45	8.5	0.45	6.7 J	0.45	8.3 J	1.0	3.6	0.45	2.7	0.45	3.3	0.45	4.1	1.0	4.8
Arsenic	Total	ug/l	5.00	0.0583	4.80	0.45	8.0	0.45	7.2	0.45	8.8	0.45	7.0	0.45	6.6	1.0	3.5	0.45	3.4	0.45	2.5	0.45	3.5	1.0	4.5
Barium	Dissolved	ug/l			3200	1.0	140	1.0	97	1.0	97	1.0	62	1.0	61	1.0	62	1.0	56	1.0	60	1.0	56	1.0	53
Barium	Total	ug/l			3200	1.0	140	1.0	98	1.0	100	1.0	64	1.0	63	1.0	63	1.0	60	1.0	62	1.0	57	1.0	53
Cadmium	Dissolved	ug/l	5.00		8.00	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND
Cadmium	Total	ug/l	5.00		8.00	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND
Calcium	Dissolved	ug/l				100	77000	100	46000	100	46000	100	32000	100	33000	100	38000	100	36000	100	39000	100	35000	100	36000
Calcium	Total	ug/l				100	76000	100	47000	100	47000	100	32000	100	32000	100	39000	100	38000	100	39000	100	36000	100	37000
Chromium	Dissolved	ug/l	50.0			2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
Chromium	Total	ug/l	50.0			2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
Chromium, hexavalent	Dissolved	ug/l			48.0	--	--	--	--	--	--	--	--	--	--	10	ND	--	--	--	--	--	--	10	ND
Chromium, hexavalent	Total	ug/l			48.0	--	--	--	--	--	--	--	--	--	--	10	ND	--	--	--	--	--	--	10	ND
Iron	Dissolved	ug/l			11200	50	56000	50	40000	50	40000	50	28000	50	28000	50	24000	50	22000	50	24000	50	22000	50	29000
Iron	Total	ug/l			11200	50	55000	50	41000	50	41000	50	28000	50	29000	50	24000	50	24000	50	24000	50	23000	50	29000
Lead	Dissolved	ug/l	15.0			0.28	ND	0.28	ND	0.28	ND	0.28	ND	0.28	ND	1.0	ND	0.28	ND	0.28	ND	0.28	ND	1.0	ND
Lead	Total	ug/l	15.0			0.28	ND	0.28	ND	0.28	ND	0.28	ND	0.28	ND	1.0	ND	0.28	ND	0.28	ND	0.28	ND	1.0	ND
Magnesium	Dissolved	ug/l				50	23000	50	14000	50	14000	50	9700	50	9700	50	13000	50	13000	50	13000	50	12000	50	12000
Magnesium	Total	ug/l				50	23000	50	14000	50	14000	50	9600	50	9500	50	14000	50	13000	50	13000	50	13000	50	13000
Manganese	Dissolved	ug/l			2240	10	5600	2.0	2900	2.0	2900	2.0	2100	2.0	2100	2.0	2400	2.0	1900	2.0	1900	2.0	2000	2.0	2300
Manganese	Total	ug/l			2240	10	5400	2.0	2800	2.0	2900	2.0	1900	2.0	1900	2.0	2400	2.0	2000	2.0	2000	2.0	2100	2.0	2400
Mercury	Dissolved	ug/l	2.00			0.11	ND	0.11	ND	0.11	ND	0.11	ND	0.11	ND	0.20	ND	0.11	ND	0.20	ND	0.11	ND	0.20	ND
Mercury	Total	ug/l	2.00			0.11	ND	0.11	ND	0.11	ND	0.11	ND	0.11	ND	0.20	ND	0.11	ND	0.11	ND	0.11	ND	0.20	ND
Potassium	Dissolved	ug/l				--	--	50	12000	50	12000	50	9800	50	9900	--	--	--	--	50	7400	50	6700	--	--
Potassium	Total	ug/l				--	--	50	13000	50	13000	50	9900	50	9900	--	--	--	--	50	7400	50	6900	--	--
Selenium	Dissolved	ug/l			80.0	4.0	ND	4.0	ND	4.0	ND	4.0	ND	4.0	ND	4.0	ND	4.0	ND	4.0	ND	4.0	ND	4.0	ND
Selenium	Total	ug/l			80.0	4.0	ND	4.0	ND	4.0	ND	4.0	ND	4.0	ND	4.0	ND	4.0	ND	4.0	ND	4.0	ND	4.0	ND
Silver	Dissolved	ug/l			80.0	0.20	ND	0.20	ND	0.20	ND	0.20	ND	0.20	ND	1.0	ND	0.20	ND	0.20	ND	0.20	ND	1.0	ND
Silver	Total	ug/l			80.0	0.20	ND	0.20	ND	0.20	ND	0.20	ND	0.20	ND	1.0	ND	0.20	ND	0.20	ND	0.20	ND	1.0	ND
Sodium	Dissolved	ug/l				50	30000	50	22000	50	22000	50	19000	50	19000	50	21000	50	20000	50	21000	50	18000	50	16000
Sodium	Total	ug/l				50	31000	50	23000	50	23000	50	20000	50	20000	50	22000	50	21000	50	21000	50	19000	50	17000
SVOCs																									
1,2,4-Trichlorobenzene	NA	ug/l		1.51	80.0	2.0	ND	--	--	--	--	--	--	--	--	2.0	ND	2.0	ND	--	--	--	--	2.0	ND
1,2-Dichlorobenzene	NA	ug/l			720	2.0	ND	--	--	--	--	--	--	--	--	2.0	ND	2.0	ND	--	--	--	--	2.0	ND
1,3-Dichlorobenzene	NA	ug/l				2.0	ND	--	--	--	--	--	--	--	--	2.0	ND	2.0	ND	--	--	--	--	2.0	ND
1,4-Dichlorobenzene	NA	ug/l		8.10	560	2.0	ND	--	--	--	--	--	--	--	--	2.0	ND	2.0	ND	--	--	--	--	2.0	ND
1-Methylnaphthalene	NA	ug/l		1.51	560	0.020	0.19	0.020	0.066	0.020	0.063	0.020	ND	0.020	ND	0.020	ND	0.020	ND	0.020	ND	0.020	ND	0.020	ND
2,2'-oxybis (1-chloropropane)	NA	ug/l		0.625	320	2.0	ND	2.0	ND	2.0	ND	2.0	ND UJ	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
2,3,4,6-Tetrachlorophenol	NA	ug/l			480	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
2,4,5-Trichlorophenol	NA	ug/l			800	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
2,4,6-Trichlorophenol	NA	ug/l		3.98	8.00	0.83	ND	0.83	ND	0.83	ND	0.84	ND	0.84	ND	2.0	ND	0.83	ND	0.85	ND	0.83	ND	2.0	ND
2,4-Dichlorophenol	NA	ug/l			24.0	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
2,4-Dimethylphenol	NA	ug/l			160	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
2,4-Dinitrophenol	NA	ug/l			32.0	10	ND	10	ND	10	ND	10	ND	10	ND	10	ND	10	ND	10	ND	10	ND	10	ND
2,4-Dinitrotoluene	NA	ug/l		0.282	32.0	0.72	ND	0.72	ND	0.72	ND	0.73	ND UJ	0.73	ND	0.78	ND	0.72	ND	0.73	ND	0.72	ND	0.78	ND
2,6-Dichlorophenol	NA	ug/l				2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND

Table 2
Historical Groundwater Data - 2015 Landau PQLs vs. MTCA Cleanup Levels
Yakima Mill Site

					Location	MW-106		MW-106		MW-106		MW-106		MW-106		MW-107		MW-107		MW-107		MW-107		MW-108	
					Date	12/19/2014		3/24/2015		3/24/2015		6/25/2015		6/25/2015		9/17/2014		12/16/2014		3/26/2015		6/25/2015		9/17/2014	
					Sample Type	FD		N		FD		N		FD		N		N		N		N		N	
					Result Type	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result
					Data Status	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource
Parameter	Total or Dissolved	Units	Washington GW Method A	Washington Groundwater Method B Cancer	Washington Groundwater Method B Noncancer																				
Effective Date			07/01/2015	07/01/2015	07/01/2015																				
Exceedance Key			No Exceedances	Shade	Border																				
2,6-Dinitrotoluene	NA	ug/l		0.0583	4.80	1.7	ND	1.7	ND	1.7	ND	1.7	ND UJ	1.7	ND	1.8	ND	1.7	ND	1.7	ND	1.7	ND	1.8	ND
2-Chloronaphthalene	NA	ug/l			640	2.0	ND	2.0	ND	2.0	ND	2.0	ND UJ	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
2-Chlorophenol	NA	ug/l			40.0	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
2-Methyl-4,6-dinitrophenol	NA	ug/l				2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
2-Methylnaphthalene	NA	ug/l			32.0	0.020	0.045	0.020	ND	0.020	ND	0.020	ND	0.020	ND	0.020	ND	0.020	ND	0.020	ND	0.020	ND	0.020	ND
2-Methylphenol (o-cresol)	NA	ug/l			400	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
2-Nitroaniline	NA	ug/l			160	2.0	ND	2.0	ND	2.0	ND	2.0	ND UJ	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
2-Nitrophenol	NA	ug/l				2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
3,3`-Dichlorobenzidine	NA	ug/l		0.194		1.9	ND	1.9	ND	1.9	ND	1.9	ND UJ	1.9	ND	2.0	ND	1.9	ND	1.9	ND	1.9	ND	2.0	ND
3,4-Methylphenol (m,p cresols)	NA	ug/l				2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
3-Nitroaniline	NA	ug/l				5.0	ND	5.0	ND	5.0	ND	5.0	ND UJ	5.0	ND	5.0	ND	5.0	ND	5.0	ND	5.0	ND	5.0	ND
4-Bromophenyl phenyl ether	NA	ug/l				2.0	ND	2.0	ND	2.0	ND	2.0	ND UJ	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
4-Chloro-3-methylphenol	NA	ug/l				2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
4-Chloroaniline	NA	ug/l		0.219	32.0	1.8	ND	1.8	ND	1.8	ND	1.8	ND UJ	1.8	ND	2.0	ND	1.8	ND	1.8	ND	1.8	ND	2.0	ND
4-Chlorophenyl phenyl ether	NA	ug/l				2.0	ND	2.0	ND	2.0	ND	2.0	ND UJ	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
4-Nitroaniline	NA	ug/l				2.0	ND	2.0	ND	2.0	ND	2.0	ND UJ	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
4-Nitrophenol	NA	ug/l				2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
Acenaphthene	NA	ug/l			960	0.014	0.10	0.014	0.13 J	0.014	0.1 J	0.014	0.034	0.014	0.031	0.020	ND	0.014	ND	0.014	ND	0.014	ND	0.020	ND
Acenaphthylene	NA	ug/l				0.020	ND	0.020	ND	0.020	ND	0.020	ND	0.020	ND	0.020	ND	0.020	ND	0.020	ND	0.020	ND	0.020	ND
Aniline	NA	ug/l		7.68	56.0	2.0	ND	2.0	ND	2.0	ND	2.0	ND UJ	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
Anthracene	NA	ug/l			4800	0.010	ND	0.010	ND	0.010	ND	0.010	ND	0.010	0.015	0.020	ND	0.010	0.015	0.010	0.016	0.010	0.011	0.020	ND
Azobenzene	NA	ug/l		0.795		1.5	ND	1.5	ND	1.5	ND	1.5	ND UJ	1.5	ND	2.0	ND	1.5	ND	1.5	ND	1.5	ND	2.0	ND
Benz(a)anthracene	NA	ug/l		0.120		0.017	ND	0.017	ND	0.017	ND	0.017	ND	0.017	ND	0.020	ND	0.017	ND	0.017	ND	0.017	ND	0.020	ND
Benzo(a)pyrene	NA	ug/l	0.100	0.0120		0.027	ND	0.027	ND	0.027	ND	0.027	ND	0.027	ND	0.029	ND	0.027	ND	0.027	ND	0.027	ND	0.029	ND
Benzo(b)fluoranthene	NA	ug/l		0.120		0.0068	ND	0.0068	ND	0.0068	ND	0.0068	ND	0.0068	ND	0.020	ND	0.0068	ND	0.0068	ND	0.0068	ND	0.020	ND
Benzo(g,h,i)perylene	NA	ug/l				0.019	ND	0.019	ND	0.019	ND	0.019	ND	0.019	ND	0.020	ND	0.019	ND	0.019	ND	0.019	ND	0.020	ND
Benzo(k)fluoranthene	NA	ug/l		1.20		0.013	ND	0.013	ND	0.013	ND	0.013	ND	0.013	ND	0.020	ND	0.013	ND	0.013	ND	0.013	ND	0.020	ND
Benzoic acid	NA	ug/l			64000	10	ND	10	ND	10	ND	10	ND	10	ND	10	ND	10	ND	10	ND	10	ND	10	ND
Benzyl alcohol	NA	ug/l			800	2.0	ND	2.0	ND	2.0	ND	2.0	ND UJ	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
Bis(2-chloroethoxy)methane	NA	ug/l				2.0	ND	2.0	ND	2.0	ND	2.0	ND UJ	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
Bis(2-chloroethyl)ether	NA	ug/l		0.0398		0.87	ND	0.87	ND	0.87	ND	0.88	ND UJ	0.88	ND	0.94	ND	0.87	ND	0.89	ND	0.87	ND	0.94	ND
Bis(2-ethylhexyl)phthalate	NA	ug/l		6.25	320	0.75	81	0.75	ND	0.75	ND	0.75	ND UJ	0.75	ND	2.0	ND	0.75	ND	0.76	ND	0.75	ND	2.0	ND
Butyl benzyl phthalate	NA	ug/l		46.1	3200	2.0	ND	2.0	ND	2.0	ND	2.0	ND UJ	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
Carbazole	NA	ug/l				2.0	ND	2.0	ND	2.0	ND	2.0	ND UJ	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
Chrysene	NA	ug/l		12.0		0.018	ND	0.018	ND	0.018	ND	0.018	ND	0.018	ND	0.020	ND	0.018	ND	0.018	ND	0.018	ND	0.020	ND
Dibenz(a,h)anthracene	NA	ug/l		0.0120		0.011	ND	0.011	ND	0.011	ND	0.011	ND	0.011	ND	0.012	ND	0.011	ND	0.011	ND	0.011	ND	0.012	ND
Dibenzofuran	NA	ug/l			16.0	2.0	ND	2.0	ND	2.0	ND	2.0	ND UJ	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
Diethyl phthalate	NA	ug/l			12800	2.0	ND	2.0	ND	2.0	ND	2.0	ND UJ	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
Dimethyl phthalate	NA	ug/l				2.0	ND	2.0	ND	2.0	ND	2.0	ND UJ	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
Di-n-butyl phthalate	NA	ug/l			1600	2.0	ND	2.0	ND	2.0	ND	2.0	ND UJ	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
Di-n-octyl phthalate	NA	ug/l			160	2.0	ND	2.0	ND	2.0	ND	2.0	ND UJ	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
Fluoranthene	NA	ug/l			640	0.0092	0.012	0.0092	ND	0.0092	ND	0.0092	ND	0.0092	ND	0.020	ND	0.0092	ND	0.0093	ND	0.0092	ND	0.020	ND
Fluorene	NA	ug/l			640	0.0090	ND	0.0090	ND	0.0090	ND	0.0091	ND	0.0091	ND	0.020	ND	0.0090	ND	0.0092	0.017	0.0090	ND	0.020	ND
Hexachlorobenzene	NA	ug/l		0.0547	12.8	0.59	ND	--	--	--	--	--	--	--	--	2.0	ND	0.59	ND	--	--	--	--	2.0	ND
Hexachlorobutadiene	NA	ug/l		0.561	8.00	--	--	--	--	--	--	--	--	--	--	2.0	ND	--	--	--	--	--	--	2.0	ND
Hexachlorocyclopentadiene	NA	ug/l			48.0	2.0	ND	2.0	ND	2.0	ND	2.0	ND UJ	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
Hexachloroethane	NA	ug/l		1.09	5.60	1.9	ND	1.9	ND	1.9	ND	1.9	ND UJ	1.9	ND	2.0	ND	1.9	ND	1.9	ND	1.9	ND	2.0	ND
Indeno(1,2,3-cd)pyrene	NA	ug/l		0.120		0.014	ND	0.014	ND	0.014	ND	0.014	ND	0.014	ND	0.020	ND	0.014	ND	0.014	ND	0.014	ND	0.020	ND
Isophorone	NA	ug/l		46.1	1600	2.0	ND	2.0	ND	2.0	ND	2.0	ND UJ	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
Naphthalene	NA	ug/l	160		160	0.013	ND	0.013	0.08 J	0.013	0.039 J	0.013	0.059 J	0.013	0.013 J	0.020	ND	0.013	0.060	0.014	ND	0.013	ND	0.020	ND
Nitrobenzene	NA	ug/l			16.0	2.0	ND	2.0	ND	2.0	ND	2.0	ND UJ	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
n-Nitrosodimethylamine	NA	ug/l		0.000858	0.0640	1.4	ND	1.4	ND	1.4	ND	1.4	ND UJ	1.4	ND	1.5	ND	1.4	ND	1.4	ND	1.4	ND	1.5	ND
n-Nitrosodi-n-propylamine	NA	ug/l		0.0125		1.9	ND	1.9	ND	1.9	ND	1.9	ND UJ	1.9	ND	2.0	ND	1.9	ND	1.9	ND	1.9	ND	2.0	ND
n-Nitrosodiphenylamine	NA	ug/l		17.9		2.0	3.6	2.0	ND	2.0	ND	2.0	ND UJ	2.0	5.8 J	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
Pentachlorophenol	NA	ug/l		0.219	80.0	0.12	ND	0.12	ND	0.12	ND	0.12	ND	0.12	ND	0.13	ND	0.12	ND	0.12	ND	0.12	ND	0.13	ND
Phenanthrene	NA	ug/l				0.013	0.025	0.013	0.023	0.013	0.02	0.013	0.013	0.013	ND	0.020	ND	0.013	0.015	0.014	0.015	0.013	ND	0.020	ND
Phenol	NA	ug/l			2400	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
Pyrene	NA	ug/l			480	0.010	0.011	0.010	0.015	0.010	ND	0.011	ND	0.011	ND	0.020	ND	0.010	ND	0.011	ND	0.010	ND	0.020	ND

Table 2
Historical Groundwater Data - 2015 Landau PQLs vs. MTCA Cleanup Levels
Yakima Mill Site

					Location	MW-106		MW-106		MW-106		MW-106		MW-106		MW-107		MW-107		MW-107		MW-107		MW-108	
					Date	12/19/2014		3/24/2015		3/24/2015		6/25/2015		6/25/2015		9/17/2014		12/16/2014		3/26/2015		6/25/2015		9/17/2014	
					Sample Type	FD		N		FD		N		FD		N		N		N		N		N	
					Result Type	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result
					Data Status	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource
Parameter	Total or Dissolved	Units	Washington GW Method A	Washington Groundwater Method B Cancer	Washington Groundwater Method B Noncancer																				
Effective Date			07/01/2015	07/01/2015	07/01/2015																				
Exceedance Key			No Exceedances	Shade	Border																				
Pyridine	NA	ug/l			8.00	2.0	ND	2.0	ND	2.0	ND	2.0	ND UJ	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
VOCs						--		--		--		--		--		--		--		--		--		--	
1,1,1,2-Tetrachloroethane	NA	ug/l		1.68	240	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND
1,1,1-Trichloroethane	NA	ug/l	200		16000	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
1,1,2,2-Tetrachloroethane	NA	ug/l		0.219	160	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND
1,1,2-Trichloroethane	NA	ug/l		0.768	32.0	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND
1,1-Dichloroethane	NA	ug/l		7.68	1600	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
1,1-Dichloroethylene	NA	ug/l			400	0.014	ND	0.014	ND	0.014	ND	0.014	ND	0.014	ND	2.0	ND	0.014	ND	0.014	ND	0.014	ND	2.0	ND
1,1-Dichloropropene	NA	ug/l				2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
1,2,3-Trichlorobenzene	NA	ug/l				2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
1,2,3-Trichloropropane	NA	ug/l		0.00146	32.0	0.023	ND	0.023	ND	0.023	ND	0.023	ND	0.023	ND	0.023	ND	0.023	ND	0.023	ND	0.023	ND	0.023	ND
1,2,4-Trichlorobenzene	NA	ug/l		1.51	80.0	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND
1,2,4-Trimethylbenzene	NA	ug/l				2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
1,2-Dibromo-3-chloropropane (DBCP)	NA	ug/l		0.0547	1.60	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND	10	ND	0.10	ND	0.10	ND	0.10	ND	10	ND
1,2-Dibromoethane (EDB)	NA	ug/l	0.0100	0.0219	72.0	0.010	ND	0.010	ND	0.010	ND	0.010	ND	0.010	ND	0.010	ND	0.010	ND	0.010	ND	0.010	ND	0.010	ND
1,2-Dichlorobenzene	NA	ug/l			720	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
1,2-Dichloroethane	NA	ug/l	5.00	0.481	48.0	0.014	ND	0.014	ND	0.014	ND	0.014	ND	0.014	ND	2.0	ND	0.014	ND	0.014	ND	0.014	ND	2.0	ND
1,2-Dichloroethylene, cis	NA	ug/l			16.0	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
1,2-Dichloroethylene, trans	NA	ug/l			160	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
1,2-Dichloropropane	NA	ug/l		1.22	720	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND
1,3,5-Trimethylbenzene	NA	ug/l			80.0	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
1,3-Dichlorobenzene	NA	ug/l				2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
1,3-Dichloropropane	NA	ug/l				2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
1,3-Dichloropropene, cis	NA	ug/l		0.438	240	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
1,3-Dichloropropene, trans	NA	ug/l		0.438	240	0.058	ND	0.058	ND	0.058	ND	0.058	ND	0.058	ND	2.0	ND	0.058	ND	0.058	ND	0.058	ND	2.0	ND
1,4-Dichlorobenzene	NA	ug/l		8.10	560	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
2,2-Dichloropropane	NA	ug/l				2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
2-Hexanone	NA	ug/l				10	ND	10	ND	10	ND	10	ND	10	ND	10	ND	10	ND	10	ND	10	ND	10	ND
Acetone	NA	ug/l			7200	25	ND	25	ND	25	ND	25	ND	25	ND	25	ND	25	ND	25	ND	25	ND	25	ND
Acrylonitrile	NA	ug/l		0.0810	320	0.057	ND	0.057	ND	0.057	ND	0.057	ND	0.057	ND	10	ND	0.057	ND	0.057	ND	0.057	ND	10	ND
Benzene	NA	ug/l	5.00	0.795	32.0	0.028	ND	0.028	ND	0.028	ND	0.028	ND	0.028	ND	2.0	ND	0.028	ND	0.028	ND	0.028	ND	2.0	ND
Bromobenzene	NA	ug/l				2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
Bromochloromethane	NA	ug/l				2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
Bromodichloromethane	NA	ug/l		0.706	160	0.059	ND	0.059	ND	0.059	ND	0.059	ND	0.059	ND	0.059	ND	0.059	ND	0.059	ND	0.059	ND	0.059	ND
Bromoform	NA	ug/l		5.54	160	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
Bromomethane	NA	ug/l			11.2	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
Butylbenzene	NA	ug/l			400	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
Butylbenzene, sec	NA	ug/l			800	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
Butylbenzene, tert	NA	ug/l			800	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
Carbon disulfide	NA	ug/l			800	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
Carbon tetrachloride	NA	ug/l		0.625	32.0	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND
Chlorobenzene	NA	ug/l			160	2.0	3.0	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
Chlorodibromomethane	NA	ug/l		0.521	160	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND
Chloroethane	NA	ug/l				2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
Chloroform	NA	ug/l		1.41	80.0	0.14	ND	0.14	ND	0.14	ND	0.14	ND	0.14	ND	0.10	ND	0.14	ND	0.14	ND	0.14	ND	0.10	ND
Chloromethane	NA	ug/l				2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
Chlorotoluene, o	NA	ug/l			160	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
Chlorotoluene, p	NA	ug/l				2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
Cumene (isopropyl benzene)	NA	ug/l			800	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
Cymene p- (toluene isopropyl p-)	NA	ug/l				2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
Dibromomethane (methylene bromide)	NA	ug/l			80.0	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
Dichlorodifluoromethane (Freon-12)	NA	ug/l			1600	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
Ethyl benzene	NA	ug/l	700		800	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
Hexachlorobutadiene	NA	ug/l		0.561	8.00	0.069	ND	0.069	ND	0.069	ND	0.069	ND	0.069	ND	2.0	ND	0.069	ND	0.069	ND	0.069	ND	2.0	ND
Hexane (C6)	NA	ug/l			480	--	--	--	--	--	--	2.0	ND	2.0	ND	--	--	--	--	--	--	2.0	ND	--	--
Methyl ethyl ketone (2-butanone)	NA	ug/l			4800	10	ND	10	ND	10	ND	10	ND	10	ND	10	ND	10	ND	10	ND	10	ND	10	ND
Methyl isobutyl ketone (MIBK)	NA	ug/l			640	10	ND	10	ND	10	ND	10	ND	10	ND	10	ND	10	ND	10	ND	10	ND	10	ND
Methyl tertiary butyl ether (MTBE)	NA	ug/l	20.0	24.3		2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND

Table 2
Historical Groundwater Data - 2015 Landau PQLs vs. MTCA Cleanup Levels
Yakima Mill Site

					Location	MW-106		MW-106		MW-106		MW-106		MW-106		MW-107		MW-107		MW-107		MW-107		MW-108	
					Date	12/19/2014		3/24/2015		3/24/2015		6/25/2015		6/25/2015		9/17/2014		12/16/2014		3/26/2015		6/25/2015		9/17/2014	
					Sample Type	FD		N		FD		N		FD		N		N		N		N		N	
					Result Type	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result
					Data Status	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource
Parameter	Total or Dissolved	Units	Washington GW Method A	Washington Groundwater Method B Cancer	Washington Groundwater Method B Noncancer																				
Effective Date			07/01/2015	07/01/2015	07/01/2015																				
Exceedance Key			No Exceedances	Shade	Border																				
Methylene chloride	NA	ug/l	5.00	21.9	48.0	0.68	ND	0.68	ND	0.68	ND	0.68	ND	0.68	ND	5.0	ND	0.68	ND	0.68	ND	0.68	ND	5.0	ND
Naphthalene	NA	ug/l	160		160	--	--	--	--	--	--	--	--	--	--	2.0	ND	--	--	--	--	--	--	2.0	ND
Propylbenzene	NA	ug/l			800	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
Styrene	NA	ug/l			1600	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
Tetrachloroethylene	NA	ug/l	5.00	20.8	48.0	0.023	ND	0.023	ND	0.023	ND	0.023	ND	0.023	ND	2.0	ND	0.023	ND	0.023	ND	0.023	ND	2.0	ND
Toluene	NA	ug/l	1000		640	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
Trichloroethylene (TCE)	NA	ug/l	5.00	0.540	4.00	0.054	ND	0.054	ND	0.054	ND	0.054	ND	0.054	ND	0.020	ND	0.054	ND	0.054	ND	0.054	ND	0.020	ND
Trichlorofluoromethane (Freon-11)	NA	ug/l			2400	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
Vinyl chloride	NA	ug/l	0.200		24.0	0.031	0.39	0.031	ND	0.031	ND	0.031	ND	0.031	ND	0.20	ND	0.031	ND	0.031	ND	0.031	ND	0.20	ND
Xylene, m & p	NA	ug/l			1600	4.0	ND	4.0	ND	4.0	ND	4.0	ND	4.0	ND	4.0	ND	4.0	ND	4.0	ND	4.0	ND	4.0	ND
Xylene, o	NA	ug/l			1600	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
Pesticides																									
4,4'-DDD	NA	ug/l		0.365		0.010	ND	0.010	ND	0.010	ND	0.0099	ND	0.010	ND	0.010	ND	0.010	ND	0.010	ND	0.010	ND	0.011	ND
4,4'-DDE	NA	ug/l		0.257		0.010	ND	0.010	ND	0.010	ND	0.0099	ND	0.010	ND	0.010	ND	0.010	ND	0.010	ND	0.010	ND	0.011	ND
4,4'-DDT	NA	ug/l	0.300	0.257	8.00	0.010	ND	0.010	ND	0.010	ND	0.0099	ND	0.010	ND	0.010	ND	0.010	ND	0.010	ND	0.010	ND	0.011	ND
a-BHC	NA	ug/l		0.0139	128	0.010	ND	0.010	ND	0.010	ND	0.0099	ND	0.010	ND	0.010	ND	0.010	ND	0.010	ND	0.010	ND	0.011	ND
Aldrin	NA	ug/l		0.00257	0.240	0.010	ND	0.010	ND	0.010	ND	0.0099	ND	0.010	ND	0.010	ND	0.010	ND	0.010	ND	0.010	ND	0.011	ND
b-BHC	NA	ug/l		0.0486		0.010	ND	0.010	ND	0.010	ND	0.0099	ND	0.010	ND	0.010	ND	0.010	ND	0.010	ND	0.010	ND	0.011	ND
Chlordane, alpha & gamma	NA	ug/l		0.250	8.00	0.010	ND	0.010	ND	0.010	ND	0.0099	ND	0.010	ND	0.010	ND	0.010	ND	0.010	ND	0.010	ND	0.011	ND
d-BHC	NA	ug/l				0.010	ND	0.010	ND	0.010	ND	0.0099	ND	0.010	ND	0.010	ND	0.010	ND	0.010	ND	0.010	ND	0.011	ND
Dieldrin	NA	ug/l		0.00547	0.800	0.010	ND	0.010	ND	0.010	ND	0.0099	ND	0.010	ND	0.010	ND	0.010	ND	0.010	ND	0.010	ND	0.011	ND
Endosulfan I	NA	ug/l			96.0	0.010	ND	0.010	ND	0.010	ND	0.0099	ND	0.010	ND	0.010	ND	0.010	ND	0.010	ND	0.010	ND	0.011	ND
Endosulfan II	NA	ug/l			96.0	0.010	ND	0.010	ND	0.010	ND	0.0099	ND	0.010	ND	0.013	ND	0.010	ND	0.010	0.026	0.010	0.019	0.011	ND
Endosulfan sulfate	NA	ug/l			96.0	0.010	ND	0.010	ND	0.010	ND	0.0099	ND	0.010	ND	0.010	ND	0.010	ND	0.010	ND	0.010	ND	0.011	ND
Endrin	NA	ug/l			4.80	0.010	ND	0.010	ND	0.010	ND	0.0099	ND	0.010	ND	0.010	ND	0.010	ND	0.010	ND	0.010	ND	0.011	ND
Endrin aldehyde	NA	ug/l				0.010	ND	0.010	ND	0.010	ND	0.0099	ND	0.010	ND	0.010	ND	0.010	ND	0.010	ND	0.010	ND	0.011	ND
g-BHC (Lindane)	NA	ug/l	0.200	0.0795	4.80	0.010	ND	0.010	ND	0.010	ND	0.0099	ND	0.010	ND	0.010	ND	0.010	ND	0.010	ND	0.010	ND	0.011	ND
Heptachlor	NA	ug/l		0.0194	8.00	0.010	ND	0.010	ND	0.010	ND	0.0099	ND	0.010	ND	0.010	ND	0.010	ND	0.010	ND	0.010	ND	0.011	ND
Heptachlor epoxide	NA	ug/l		0.00481	0.104	0.010	ND	0.010	ND	0.010	ND	0.0099	ND	0.010	ND	0.010	ND	0.010	ND	0.010	ND	0.010	ND	0.011	ND
Hexachlorobenzene	NA	ug/l		0.0547	12.8	0.010	ND	0.010	ND	0.010	ND	0.0099	ND	0.010	ND	--	--	0.010	ND	0.010	ND	0.010	ND	--	--
Methoxychlor	NA	ug/l			80.0	0.010	ND	0.010	ND	0.010	ND	0.0099	ND	0.010	ND	0.010	ND	0.010	ND	0.010	ND	0.010	ND	0.011	ND
Toxaphene	NA	ug/l		0.0795		0.50	ND	0.50	ND	0.50	ND	0.50	ND	0.50	ND	0.50	ND	0.50	ND	0.50	ND	0.50	ND	0.51	ND
PCBs																									
Aroclor 1016	NA	ug/l		1.25	1.12	0.0050	ND	0.013	ND	0.015	ND	0.0050	ND	0.0050	ND	0.0050	ND	0.0050	ND	0.0050	ND	0.0050	ND	0.0051	ND
Aroclor 1221	NA	ug/l				0.010	ND	0.010	ND	0.068	ND	0.010	ND	0.010	ND	0.010	ND	0.010	ND	0.010	ND	0.010	ND	0.011	ND
Aroclor 1232	NA	ug/l				0.0050	ND	0.036	ND	0.072	ND	0.005	0.022 J	0.005	0.0095 J	0.0050	ND	0.0050	ND	0.0050	ND	0.005	0.017	0.0051	ND
Aroclor 1242	NA	ug/l				0.005	0.017 J	0.022	ND	0.023	ND	0.0050	ND	0.0050	ND	0.005	0.021	0.005	0.018	0.005	0.0092	0.0050	ND	0.0051	0.035
Aroclor 1248	NA	ug/l				0.0050	ND	0.015	ND	0.019	ND	0.0050	ND	0.0050	ND	0.0050	ND	0.0050	ND	0.0050	ND	0.0050	ND	0.0051	ND
Aroclor 1254	NA	ug/l		0.0438	0.320	0.0050	ND	0.0050	ND	0.0050	ND	0.0050	ND	0.0050	ND	0.0050	ND	0.0050	ND	0.0050	ND	0.0050	ND	0.0051	ND
Aroclor 1260	NA	ug/l		0.0438		0.0050	ND	0.0050	ND	0.0050	ND	0.0050	ND	0.0050	ND	0.0050	ND	0.0050	ND	0.0050	ND	0.0050	ND	0.0051	ND
Total Petroleum Hydrocarbons																									
Total Petroleum Hydrocarbons (as diesel)	NA	ug/l	500			130 310	640 190	130	180	130	200	130	160	130	180	310	ND	310	ND	310	ND	310	ND	310	ND
Total Petroleum Hydrocarbons (as diesel), silica gel	NA	ug/l	500			130	ND	130	ND	130	ND	130	ND	130	ND	--	--	--	--	--	--	--	--	--	--
Total Petroleum Hydrocarbons (as gasoline)	NA	ug/l	800			130	ND	--	--	--	--	--	--	--	--	130	ND	130	ND	130	ND	130	ND	130	ND
Total Petroleum Hydrocarbons (as motor oil)	NA	ug/l	500			250 310	310 ND	250	ND	250	ND	250	ND	250	ND	310	ND	310	ND	310	ND	310	ND	310	ND
Total Petroleum Hydrocarbons (as motor oil), silica gel	NA	ug/l	500			250	ND	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--

Landau qualifier - J: Indicates the analyte was positively identified; the associated numerical value is the approximate concentration of the analyte in the sample.

Landau qualifier - UJ: The analyte was not detected in the sample; the reported sample reporting limit is an estimate.

N: Normal Sample.

FD: Field Duplicate Sample.

ND: Not detected.

PQL: Practical Quantitation Limit.

SSource: Laboratory and/or field data obtained from a secondary source external to Barr. Second source QA/QC evaluation procedures may or may not have been performed beyond the original data generator.

Table was updated (items in red) after original submittal to add Landau qualifiers to be consistent with the memo.

Table 2
Historical Groundwater Data - 2015 Landau PQLs vs. MTCA Cleanup Levels
Yakima Mill Site

Location						MW-108		MW-108		MW-108		MW-108		MW-109		MW-109		MW-109		MW-109		MW-11	
Date						12/16/2014		12/17/2014		3/25/2015		6/25/2015		9/16/2014		12/19/2014	12/19/2014	3/23/2015		6/23/2015		9/15/2014	
Sample Type						N		N		N		N		N		N		N		N		N	
Result Type						PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result
Data Status						SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource
Parameter	Total or Dissolved	Units	Washington GW Method A	Washington Groundwater Method B Cancer	Washington Groundwater Method B Noncancer																		
Effective Date			07/01/2015	07/01/2015	07/01/2015																		
Exceedance Key			No Exceedances	Shade	Border																		
General Parameters																							
Alkalinity, bicarbonate, as CaCO3	NA	mg/l				15	210	--	--	0.0	220	15	200	15	130	15	110	0.0	140	15	110	15	190
Alkalinity, total, as CaCO3	NA	mg/l				15	210	--	--	0.0	220	15	200	15	130	15	110	0.0	140	15	110	15	190
Carbon, total organic	NA	mg/l				0.50	4.7	--	--	0.50	4.8	0.50	5.3	0.50	1.1	0.50	1.2	0.50	1.4	0.50	0.97	0.50	5
Chloride	NA	mg/l				0.092	18	--	--	0.092	17	0.092	18	0.092	10	0.092	9.5	0.092	11	0.092	11	0.092	16
Fluoride	NA	mg/l			0.64	0.16	0.25	--	--	0.16	ND	0.16	ND	0.16	0.28	0.16	ND	0.16	ND	0.16	ND	0.16	ND
Nitrogen, ammonia, as N	NA	mg/l				0.050	2.8	--	--	0.050	2.7	0.050	2.6	0.050	0.18	0.050	0.15	0.050	0.29	0.050	0.056	0.050	1.3
Nitrogen, nitrate, as N	NA	mg/l			25.6	0.034	ND	--	--	0.034	ND	0.034	ND	0.034	0.94	0.034	0.29	0.034	0.5	0.034	1.7	0.034	0.045
Nitrogen, nitrite, as N	NA	mg/l			1.6	0.043	ND	--	--	0.043	ND	0.043	ND	0.043	0.14	0.043	ND	0.043	ND	0.043	ND	0.043	ND
Solids, total dissolved	NA	mg/l				5.0	300	--	--	5.0	260	5.0	220	5.0	200	5.0	140	5.0	170	5.0	210	5.0	210
Sulfate, as SO4	NA	mg/l				0.26	ND	--	--	0.26	ND	0.26	ND	0.26	13	0.26	16	0.26	7.6	0.26	14	0.26	ND
Metals																							
Arsenic	Dissolved	ug/l	5.00	0.0583	4.80	0.45	5.1	--	--	0.50	6.6	0.45	5.2	1.0	ND	0.45	ND	0.45	ND	0.45	ND	1.0	3.6
Arsenic	Total	ug/l	5.00	0.0583	4.80	0.45	4.8	--	--	0.50	6.6	0.45	3.9	1.0	ND	0.45	ND	0.45	0.51	0.45	ND	1.0	3.7
Barium	Dissolved	ug/l			3200	1.0	59	--	--	1.0	60	1.0	53	1.0	11	1.0	11	1.0	11	1.0	9.1	1.0	46
Barium	Total	ug/l			3200	1.0	55	--	--	1.0	61	1.0	53	1.0	13	1.0	11	1.0	12	1.0	9.0	1.0	52
Cadmium	Dissolved	ug/l	5.00		8.00	1.0	ND	--	--	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND
Cadmium	Total	ug/l	5.00		8.00	1.0	ND	--	--	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND
Calcium	Dissolved	ug/l				100	40000	--	--	100	43000	100	37000	100	26000	100	28000	100	31000	100	25000	100	34000
Calcium	Total	ug/l				100	39000	--	--	100	44000	100	38000	100	27000	100	29000	100	32000	100	25000	100	36000
Chromium	Dissolved	ug/l	50.0			2.0	ND	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
Chromium	Total	ug/l	50.0			2.0	ND	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
Chromium, hexavalent	Dissolved	ug/l			48.0	--	--	--	--	--	--	--	--	10	ND	--	--	--	--	--	--	10	ND
Chromium, hexavalent	Total	ug/l			48.0	--	--	--	--	--	--	--	--	10	ND	--	--	--	--	--	--	10	ND
Iron	Dissolved	ug/l			11200	50	32000	--	--	50	35000	50	31000	50	ND	50	ND	50	92	50	ND	50	29000
Iron	Total	ug/l			11200	50	30000	--	--	50	35000	50	31000	50	280	50	92	50	150	50	ND	50	30000
Lead	Dissolved	ug/l	15.0			0.28	ND	--	--	0.28	ND	0.28	ND	1.0	ND	0.28	ND	0.28	ND	0.28	ND	1.0	ND
Lead	Total	ug/l	15.0			0.28	ND	--	--	0.28	ND	0.28	ND	1.0	ND	0.28	ND	0.28	ND	0.28	ND	1.0	ND
Magnesium	Dissolved	ug/l				50	14000	--	--	50	15000	50	13000	50	9900	50	9500	50	11000	50	8800	50	11000
Magnesium	Total	ug/l				50	14000	--	--	50	16000	50	13000	50	10000	50	9600	50	11000	50	8400	50	12000
Manganese	Dissolved	ug/l			2240	2.0	2200	--	--	2.0	2400	2.0	2200	2.0	860	2.0	110	2.0	390	2.0	57	2.0	2000
Manganese	Total	ug/l			2240	2.0	2100	--	--	2.0	2400	2.0	2100	2.0	890	2.0	150	2.0	400	2.0	58	2.0	2100
Mercury	Dissolved	ug/l	2.00			0.11	ND	--	--	0.11	ND	0.11	ND	0.20	ND	0.11	ND	0.11	ND	0.11	ND	0.20	ND
Mercury	Total	ug/l	2.00			0.11	ND	--	--	0.11	ND	0.11	ND	0.20	ND	0.11	ND	0.11	ND	0.11	ND	0.20	ND
Potassium	Dissolved	ug/l				--	--	--	--	50	7700	50	6900	--	--	--	--	50	4800	50	3800	--	--
Potassium	Total	ug/l				--	--	--	--	50	7800	50	7000	--	--	--	--	50	4800	50	3700	--	--
Selenium	Dissolved	ug/l			80.0	4.0	ND	--	--	4.0	ND	4.0	ND	4.0	ND	4.0	ND	4.0	ND	4.0	ND	4.0	ND
Selenium	Total	ug/l			80.0	4.0	ND	--	--	4.0	ND	4.0	ND	4.0	ND	4.0	ND	4.0	ND	4.0	ND	4.0	ND
Silver	Dissolved	ug/l			80.0	0.20	ND	--	--	0.20	ND	0.20	ND	1.0	ND	0.20	ND	0.20	ND	0.20	ND	1.0	ND
Silver	Total	ug/l			80.0	0.20	ND	--	--	0.20	ND	0.20	ND	1.0	ND	0.20	ND	0.20	ND	0.20	ND	1.0	ND
Sodium	Dissolved	ug/l				50	18000	--	--	50	18000	50	16000	50	14000	50	13000	50	14000	50	12000	50	16000
Sodium	Total	ug/l				50	18000	--	--	50	18000	50	16000	50	15000	50	13000	50	14000	50	12000	50	16000
SVOCs																							
1,2,4-Trichlorobenzene	NA	ug/l		1.51	80.0	2.0	ND	--	--	--	--	--	--	2.0	ND	2.0	ND	--	--	--	--	2.0	ND
1,2-Dichlorobenzene	NA	ug/l			720	2.0	ND	--	--	--	--	--	--	2.0	ND	2.0	ND	--	--	--	--	2.0	ND
1,3-Dichlorobenzene	NA	ug/l				2.0	ND	--	--	--	--	--	--	2.0	ND	2.0	ND	--	--	--	--	2.0	ND
1,4-Dichlorobenzene	NA	ug/l		8.10	560	2.0	ND	--	--	--	--	--	--	2.0	ND	2.0	ND	--	--	--	--	2.0	ND
1-Methylnaphthalene	NA	ug/l		1.51	560	0.020	ND	--	--	0.020	ND	0.020	ND	0.020	ND	0.020	ND	0.020	ND	0.020	0.036	0.020	ND
2,2'-oxybis (1-chloropropane)	NA	ug/l		0.625	320	2.0	ND	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
2,3,4,6-Tetrachlorophenol	NA	ug/l			480	2.0	ND	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
2,4,5-Trichlorophenol	NA	ug/l			800	2.0	ND	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
2,4,6-Trichlorophenol	NA	ug/l		3.98	8.00	0.83	ND	--	--	0.83	ND	0.83	ND	2.0	ND	0.85	ND	0.85	ND	0.83	ND	2.0	ND
2,4-Dichlorophenol	NA	ug/l			24.0	2.0	ND	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
2,4-Dimethylphenol	NA	ug/l			160	2.0	ND	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
2,4-Dinitrophenol	NA	ug/l			32.0	10	ND	--	--	10	ND	10	ND	10	ND	10	ND	10	ND	10	ND	10	ND
2,4-Dinitrotoluene	NA	ug/l		0.282	32.0	0.72	ND	--	--	0.72	ND	0.72	ND	0.78	ND	0.73	ND	0.73	ND	0.72	ND	0.78	ND
2,6-Dichlorophenol	NA	ug/l				2.0	ND	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND

Table 2
Historical Groundwater Data - 2015 Landau PQLs vs. MTCA Cleanup Levels
Yakima Mill Site

					Location	MW-108		MW-108		MW-108		MW-108		MW-109		MW-109		MW-109		MW-109		MW-11	
					Date	12/16/2014		12/17/2014		3/25/2015		6/25/2015		9/16/2014		12/19/2014	12/19/2014	3/23/2015		6/23/2015		9/15/2014	
					Sample Type	N		N		N		N		N		N		N		N		N	
					Result Type	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result
					Data Status	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource
Parameter	Total or Dissolved	Units	Washington GW Method A	Washington Groundwater Method B Cancer	Washington Groundwater Method B Noncancer																		
Effective Date			07/01/2015	07/01/2015	07/01/2015																		
Exceedance Key			No Exceedances	Shade	Border																		
2,6-Dinitrotoluene	NA	ug/l		0.0583	4.80	1.7	ND	--	--	1.7	ND	1.7	ND	1.8	ND	1.7	ND	1.7	ND	1.7	ND	1.8	ND
2-Chloronaphthalene	NA	ug/l			640	2.0	ND	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
2-Chlorophenol	NA	ug/l			40.0	2.0	ND	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
2-Methyl-4,6-dinitrophenol	NA	ug/l				2.0	ND	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
2-Methylnaphthalene	NA	ug/l			32.0	0.020	ND	--	--	0.020	ND	0.020	ND	0.020	ND	0.020	ND	0.020	ND	0.020	0.11	0.020	ND
2-Methylphenol (o-cresol)	NA	ug/l			400	2.0	ND	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
2-Nitroaniline	NA	ug/l			160	2.0	ND	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
2-Nitrophenol	NA	ug/l				2.0	ND	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
3,3`-Dichlorobenzidine	NA	ug/l		0.194		1.9	ND	--	--	1.9	ND	1.9	ND	2.0	ND	1.9	ND	1.9	ND	1.9	ND	2.0	ND
3,4-Methylphenol (m,p cresols)	NA	ug/l				2.0	ND	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
3-Nitroaniline	NA	ug/l				5.0	ND	--	--	5.0	ND	5.0	ND	5.0	ND	5.0	ND	5.0	ND	5.0	ND	5.0	ND
4-Bromophenyl phenyl ether	NA	ug/l				2.0	ND	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
4-Chloro-3-methylphenol	NA	ug/l				2.0	ND	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
4-Chloroaniline	NA	ug/l		0.219	32.0	1.8	ND	--	--	1.8	ND	1.8	ND	2.0	ND	1.8	ND	1.8	ND	1.8	ND	2.0	ND
4-Chlorophenyl phenyl ether	NA	ug/l				2.0	ND	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
4-Nitroaniline	NA	ug/l				2.0	ND	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
4-Nitrophenol	NA	ug/l				2.0	ND	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
Acenaphthene	NA	ug/l			960	0.014	ND	--	--	0.014	ND	0.014	ND	0.020	ND	0.014	ND	0.014	ND	0.014	ND	0.020	ND
Acenaphthylene	NA	ug/l				0.020	ND	--	--	0.020	ND	0.020	ND	0.020	ND	0.020	ND	0.020	ND	0.020	ND	0.020	ND
Aniline	NA	ug/l		7.68	56.0	2.0	ND	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
Anthracene	NA	ug/l			4800	0.010	0.013	--	--	0.010	0.011	0.010	ND	0.020	ND	0.010	0.012	0.010	ND	0.010	ND	0.020	ND
Azobenzene	NA	ug/l		0.795		1.5	ND	--	--	1.5	ND	1.5	ND	2.0	ND	1.5	ND	1.5	ND	1.5	ND	2.0	ND
Benz(a)anthracene	NA	ug/l		0.120		0.017	ND	--	--	0.017	ND	0.017	ND	0.020	ND	0.017	ND	0.017	ND	0.017	ND	0.020	ND
Benzo(a)pyrene	NA	ug/l	0.100	0.0120		0.027	ND	--	--	0.027	ND	0.027	ND	0.029	ND	0.027	ND	0.027	ND	0.027	ND	0.029	ND
Benzo(b)fluoranthene	NA	ug/l		0.120		0.0068	ND	--	--	0.0068	ND	0.0068	ND	0.020	ND	0.0068	ND	0.0068	ND	0.0068	ND	0.020	ND
Benzo(g,h,i)perylene	NA	ug/l				0.019	ND	--	--	0.019	ND	0.019	ND	0.020	ND	0.019	ND	0.019	ND	0.019	ND	0.020	ND
Benzo(k)fluoranthene	NA	ug/l		1.20		0.013	ND	--	--	0.013	ND	0.013	ND	0.020	ND	0.013	ND	0.013	ND	0.013	ND	0.020	ND
Benzoic acid	NA	ug/l			64000	10	ND	--	--	10	ND	10	ND	10	ND	10	ND	10	ND	10	ND	10	ND
Benzyl alcohol	NA	ug/l			800	2.0	ND	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
Bis(2-chloroethoxy)methane	NA	ug/l				2.0	ND	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
Bis(2-chloroethyl)ether	NA	ug/l		0.0398		0.87	ND	--	--	0.87	ND	0.87	ND	0.94	ND	0.89	ND	0.89	ND	0.87	ND	0.94	ND
Bis(2-ethylhexyl)phthalate	NA	ug/l		6.25	320	0.75	ND	--	--	0.75	ND	0.75	ND	2.0	ND	0.76	ND	0.76	ND	0.75	ND	2.0	ND
Butyl benzyl phthalate	NA	ug/l		46.1	3200	2.0	ND	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
Carbazole	NA	ug/l				2.0	ND	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
Chrysene	NA	ug/l		12.0		0.018	ND	--	--	0.018	ND	0.018	ND	0.020	ND	0.018	ND	0.018	ND	0.018	ND	0.020	ND
Dibenz(a,h)anthracene	NA	ug/l		0.0120		0.011	ND	--	--	0.011	ND	0.011	ND	0.012	ND	0.011	ND	0.011	ND	0.011	ND	0.012	ND
Dibenzofuran	NA	ug/l			16.0	2.0	ND	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
Diethyl phthalate	NA	ug/l			12800	2.0	ND	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
Dimethyl phthalate	NA	ug/l				2.0	ND	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
Di-n-butyl phthalate	NA	ug/l			1600	2.0	ND	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
Di-n-octyl phthalate	NA	ug/l			160	2.0	ND	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
Fluoranthene	NA	ug/l			640	0.0092	ND	--	--	0.0092	ND	0.0092	ND	0.020	ND	0.0093	ND	0.0093	ND	0.0092	ND	0.020	ND
Fluorene	NA	ug/l			640	0.009	0.018	--	--	0.009	0.016	0.0090	ND	0.020	ND	0.0092	ND	0.0092	ND	0.0090	ND	0.020	ND
Hexachlorobenzene	NA	ug/l		0.0547	12.8	0.59	ND	--	--	--	--	--	--	2.0	ND	0.60	ND	--	--	--	--	2.0	ND
Hexachlorobutadiene	NA	ug/l		0.561	8.00	--	--	--	--	--	--	--	--	2.0	ND	--	--	--	--	--	--	2.0	ND
Hexachlorocyclopentadiene	NA	ug/l			48.0	2.0	ND	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
Hexachloroethane	NA	ug/l		1.09	5.60	1.9	ND	--	--	1.9	ND	1.9	ND	2.0	ND	1.9	ND	1.9	ND	1.9	ND	2.0	ND
Indeno(1,2,3-cd)pyrene	NA	ug/l		0.120		0.014	ND	--	--	0.014	ND	0.014	ND	0.020	ND	0.014	ND	0.014	ND	0.014	ND	0.020	ND
Isophorone	NA	ug/l		46.1	1600	2.0	ND	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
Naphthalene	NA	ug/l	160		160	0.013	0.053	--	--	0.013	0.016	0.013	ND	0.020	ND	0.014	ND	0.014	0.03	0.013	0.11	0.020	ND
Nitrobenzene	NA	ug/l			16.0	2.0	ND	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
n-Nitrosodimethylamine	NA	ug/l		0.000858	0.0640	1.4	ND	--	--	1.4	ND	1.4	ND	1.5	ND	1.4	ND	1.4	ND	1.4	ND	1.5	ND
n-Nitrosodi-n-propylamine	NA	ug/l		0.0125		1.9	ND	--	--	1.9	ND	1.9	ND	2.0	ND	1.9	ND	1.9	ND	1.9	ND	2.0	ND
n-Nitrosodiphenylamine	NA	ug/l		17.9		2.0	ND	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
Pentachlorophenol	NA	ug/l		0.219	80.0	0.12	ND	--	--	0.12	ND	0.12	ND	0.13	ND	0.12	ND	0.12	ND	0.12	ND	0.13	ND
Phenanthrene	NA	ug/l				0.013	ND	--	--	0.013	ND	0.013	ND	0.020	ND	0.014	ND	0.014	ND	0.013	ND	0.020	ND
Phenol	NA	ug/l			2400	2.0	ND	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
Pyrene	NA	ug/l			480	0.010	ND	--	--	0.010	ND	0.010	ND	0.020	ND	0.011	ND	0.011	ND	0.010	ND	0.020	ND

Table 2
Historical Groundwater Data - 2015 Landau PQLs vs. MTCA Cleanup Levels
Yakima Mill Site

					Location	MW-108		MW-108		MW-108		MW-108		MW-109		MW-109		MW-109		MW-109		MW-11	
					Date	12/16/2014		12/17/2014		3/25/2015		6/25/2015		9/16/2014		12/19/2014	12/19/2014	3/23/2015		6/23/2015		9/15/2014	
					Sample Type	N		N		N		N		N		N		N		N		N	
					Result Type	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result
					Data Status	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource
Parameter	Total or Dissolved	Units	Washington GW Method A	Washington Groundwater Method B Cancer	Washington Groundwater Method B Noncancer																		
Effective Date			07/01/2015	07/01/2015	07/01/2015																		
Exceedance Key			No Exceedances	Shade	Border																		
Pyridine	NA	ug/l			8.00	2.0	ND	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
VOCs						--		--		--		--		--		--		--		--		--	
1,1,1,2-Tetrachloroethane	NA	ug/l		1.68	240	0.10	ND	--	--	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND
1,1,1-Trichloroethane	NA	ug/l	200		16000	2.0	ND	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
1,1,2,2-Tetrachloroethane	NA	ug/l		0.219	160	0.10	ND	--	--	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND
1,1,2-Trichloroethane	NA	ug/l		0.768	32.0	0.10	ND	--	--	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND
1,1-Dichloroethane	NA	ug/l		7.68	1600	2.0	ND	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
1,1-Dichloroethylene	NA	ug/l			400	0.014	ND	--	--	0.014	ND	0.014	ND	2.0	ND	0.014	ND	0.014	ND	0.014	ND	2.0	ND
1,1-Dichloropropene	NA	ug/l				2.0	ND	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
1,2,3-Trichlorobenzene	NA	ug/l				2.0	ND	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
1,2,3-Trichloropropane	NA	ug/l		0.00146	32.0	0.023	ND	--	--	0.023	ND	0.023	ND	0.023	ND	0.023	ND	0.023	ND	0.023	ND	0.023	ND
1,2,4-Trichlorobenzene	NA	ug/l		1.51	80.0	0.10	ND	--	--	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND
1,2,4-Trimethylbenzene	NA	ug/l				2.0	ND	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
1,2-Dibromo-3-chloropropane (DBCP)	NA	ug/l		0.0547	1.60	0.10	ND	--	--	0.10	ND	0.10	ND	10	ND	0.10	ND	0.10	ND	0.10	ND	10	ND
1,2-Dibromoethane (EDB)	NA	ug/l	0.0100	0.0219	72.0	0.010	ND	--	--	0.010	ND	0.010	ND	0.010	ND	0.010	ND	0.010	ND	0.010	ND	0.010	ND
1,2-Dichlorobenzene	NA	ug/l			720	2.0	ND	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
1,2-Dichloroethane	NA	ug/l	5.00	0.481	48.0	0.014	ND	--	--	0.014	ND	0.014	ND	2.0	ND	0.014	ND	0.014	ND	0.014	ND	2.0	ND
1,2-Dichloroethylene, cis	NA	ug/l			16.0	2.0	ND	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
1,2-Dichloroethylene, trans	NA	ug/l			160	2.0	ND	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
1,2-Dichloropropane	NA	ug/l		1.22	720	0.10	ND	--	--	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND
1,3,5-Trimethylbenzene	NA	ug/l			80.0	2.0	ND	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
1,3-Dichlorobenzene	NA	ug/l				2.0	ND	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
1,3-Dichloropropane	NA	ug/l				2.0	ND	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
1,3-Dichloropropene, cis	NA	ug/l		0.438	240	2.0	ND	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
1,3-Dichloropropene, trans	NA	ug/l		0.438	240	0.058	ND	--	--	0.058	ND	0.058	ND	2.0	ND	0.058	ND	0.058	ND	0.058	ND	2.0	ND
1,4-Dichlorobenzene	NA	ug/l		8.10	560	2.0	ND	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
2,2-Dichloropropane	NA	ug/l				2.0	ND	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
2-Hexanone	NA	ug/l				10	ND	--	--	10	ND	10	ND	10	ND	10	ND	10	ND	10	ND	10	ND
Acetone	NA	ug/l			7200	25	ND	--	--	25	ND	25	ND	25	ND	25	ND	25	ND	25	ND	25	ND
Acrylonitrile	NA	ug/l		0.0810	320	0.057	ND	--	--	0.057	ND	0.057	ND	10	ND	0.057	ND	0.057	ND	0.057	ND	10	ND
Benzene	NA	ug/l	5.00	0.795	32.0	0.028	ND	--	--	0.028	ND	0.028	ND	2.0	ND	0.028	ND	0.028	ND	0.028	ND	2.0	ND
Bromobenzene	NA	ug/l				2.0	ND	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
Bromochloromethane	NA	ug/l				2.0	ND	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
Bromodichloromethane	NA	ug/l		0.706	160	0.059	ND	--	--	0.059	ND	0.059	ND	0.059	ND	0.059	ND	0.059	ND	0.059	ND	0.059	ND
Bromoform	NA	ug/l		5.54	160	2.0	ND	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
Bromomethane	NA	ug/l			11.2	2.0	ND	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
Butylbenzene	NA	ug/l			400	2.0	ND	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
Butylbenzene, sec	NA	ug/l			800	2.0	ND	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
Butylbenzene, tert	NA	ug/l			800	2.0	ND	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
Carbon disulfide	NA	ug/l			800	2.0	ND	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
Carbon tetrachloride	NA	ug/l		0.625	32.0	0.10	ND	--	--	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND
Chlorobenzene	NA	ug/l			160	2.0	ND	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
Chlorodibromomethane	NA	ug/l		0.521	160	0.10	ND	--	--	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND
Chloroethane	NA	ug/l				2.0	ND	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
Chloroform	NA	ug/l		1.41	80.0	0.14	ND	--	--	0.14	ND	0.14	ND	0.10	0.57	0.14	ND	0.14	ND	0.14	ND	0.10	ND
Chloromethane	NA	ug/l				2.0	ND	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
Chlorotoluene, o	NA	ug/l			160	2.0	ND	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
Chlorotoluene, p	NA	ug/l				2.0	ND	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
Cumene (isopropyl benzene)	NA	ug/l			800	2.0	ND	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
Cymene p- (toluene isopropyl p-)	NA	ug/l				2.0	ND	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
Dibromomethane (methylene bromide)	NA	ug/l			80.0	2.0	ND	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
Dichlorodifluoromethane (Freon-12)	NA	ug/l			1600	2.0	ND	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
Ethyl benzene	NA	ug/l	700		800	2.0	ND	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
Hexachlorobutadiene	NA	ug/l		0.561	8.00	0.069	ND	--	--	0.069	ND	0.069	ND	2.0	ND	0.069	ND	0.069	ND	0.069	ND	2.0	ND
Hexane (C6)	NA	ug/l			480	--	--	--	--	--	--	2.0	ND	--	--	--	--	--	--	2.0	ND	--	--
Methyl ethyl ketone (2-butanone)	NA	ug/l			4800	10	ND	--	--	10	ND	10	ND	10	ND	10	ND	10	ND	10	ND	10	ND
Methyl isobutyl ketone (MIBK)	NA	ug/l			640	10	ND	--	--	10	ND	10	ND	10	ND	10	ND	10	ND	10	ND	10	ND
Methyl tertiary butyl ether (MTBE)	NA	ug/l	20.0	24.3		2.0	ND	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND

Table 2
Historical Groundwater Data - 2015 Landau PQLs vs. MTCA Cleanup Levels
Yakima Mill Site

					Location	MW-108		MW-108		MW-108		MW-108		MW-109		MW-109		MW-109		MW-109		MW-11	
					Date	12/16/2014		12/17/2014		3/25/2015		6/25/2015		9/16/2014		12/19/2014	12/19/2014	3/23/2015		6/23/2015		9/15/2014	
					Sample Type	N		N		N		N		N		N		N		N		N	
					Result Type	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result
					Data Status	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource
Parameter	Total or Dissolved	Units	Washington GW Method A	Washington Groundwater Method B Cancer	Washington Groundwater Method B Noncancer																		
Effective Date			07/01/2015	07/01/2015	07/01/2015																		
Exceedance Key			No Exceedances	Shade	Border																		
Methylene chloride	NA	ug/l	5.00	21.9	48.0	0.68	ND	--	--	0.68	ND	0.68	ND	5.0	ND	0.68	ND	0.68	ND	0.68	ND	5.0	ND
Naphthalene	NA	ug/l	160		160	--	--	--	--	--	--	--	--	2.0	ND	--	--	--	--	--	--	2.0	ND
Propylbenzene	NA	ug/l			800	2.0	ND	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
Styrene	NA	ug/l			1600	2.0	ND	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
Tetrachloroethylene	NA	ug/l	5.00	20.8	48.0	0.023	ND	--	--	0.023	ND	0.023	ND	2.0	ND	0.023	ND	0.023	ND	0.023	ND	2.0	ND
Toluene	NA	ug/l	1000		640	2.0	ND	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
Trichloroethylene (TCE)	NA	ug/l	5.00	0.540	4.00	0.054	ND	--	--	0.054	ND	0.054	ND	0.020	ND	0.054	ND	0.054	ND	0.054	ND	0.020	ND
Trichlorofluoromethane (Freon-11)	NA	ug/l			2400	2.0	ND	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
Vinyl chloride	NA	ug/l	0.200		24.0	0.031	ND	--	--	0.031	ND	0.031	ND	0.20	ND	0.031	ND	0.031	ND	0.031	ND	0.20	ND
Xylene, m & p	NA	ug/l			1600	4.0	ND	--	--	4.0	ND	4.0	ND	4.0	ND	4.0	ND	4.0	ND	4.0	ND	4.0	ND
Xylene, o	NA	ug/l			1600	2.0	ND	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
Pesticides																							
4,4'-DDD	NA	ug/l		0.365		0.011	ND	--	--	0.010	ND	0.010	ND	0.011	ND	0.010	ND	0.0099	ND	0.011	ND	0.011	ND
4,4'-DDE	NA	ug/l		0.257		0.011	ND	--	--	0.010	ND	0.010	ND	0.011	ND	0.010	ND	0.0099	ND	0.011	ND	0.011	ND
4,4'-DDT	NA	ug/l	0.300	0.257	8.00	0.011	ND	--	--	0.010	ND	0.010	ND	0.011	ND	0.010	ND	0.0099	ND	0.011	ND	0.011	ND
a-BHC	NA	ug/l		0.0139	128	0.011	ND	--	--	0.010	ND	0.010	ND	0.011	ND	0.010	ND	0.0099	ND	0.011	ND	0.011	ND
Aldrin	NA	ug/l		0.00257	0.240	0.011	ND	--	--	0.010	ND	0.010	ND	0.011	ND	0.010	ND	0.0099	ND	0.011	ND	0.011	ND
b-BHC	NA	ug/l		0.0486		0.011	ND	--	--	0.010	ND	0.010	ND	0.011	ND	0.010	ND	0.0099	ND	0.011	ND	0.011	ND
Chlordane, alpha & gamma	NA	ug/l		0.250	8.00	0.011	ND	--	--	0.010	ND	0.010	ND	0.011	ND	0.010	ND	0.0099	ND	0.011	ND	0.011	ND
d-BHC	NA	ug/l				0.011	ND	--	--	0.010	ND	0.010	ND	0.011	ND	0.010	ND	0.0099	ND	0.011	ND	0.011	ND
Dieldrin	NA	ug/l		0.00547	0.800	0.011	ND	--	--	0.010	ND	0.010	ND	0.011	ND	0.010	ND	0.0099	ND	0.011	ND	0.011	ND
Endosulfan I	NA	ug/l			96.0	0.011	ND	--	--	0.010	ND	0.010	ND	0.011	ND	0.010	ND	0.0099	ND	0.011	ND	0.011	ND
Endosulfan II	NA	ug/l			96.0	0.011	ND	--	--	0.010	ND	0.010	0.011	0.018	ND	0.021	ND	0.0099	0.029	0.011	0.013	0.012	ND
Endosulfan sulfate	NA	ug/l			96.0	0.011	ND	--	--	0.010	ND	0.010	ND	0.011	ND	0.010	ND	0.0099	ND	0.011	ND	0.011	ND
Endrin	NA	ug/l			4.80	0.011	ND	--	--	0.010	ND	0.010	ND	0.011	ND	0.010	ND	0.0099	ND	0.011	ND	0.011	ND
Endrin aldehyde	NA	ug/l				0.011	ND	--	--	0.010	ND	0.010	ND	0.011	ND	0.010	ND	0.0099	ND	0.011	ND	0.011	ND
g-BHC (Lindane)	NA	ug/l	0.200	0.0795	4.80	0.011	ND	--	--	0.010	ND	0.010	ND	0.011	ND	0.010	ND	0.0099	ND	0.011	ND	0.011	ND
Heptachlor	NA	ug/l		0.0194	8.00	0.011	ND	--	--	0.010	ND	0.010	ND	0.011	ND	0.010	ND	0.0099	ND	0.011	ND	0.011	ND
Heptachlor epoxide	NA	ug/l		0.00481	0.104	0.011	ND	--	--	0.010	ND	0.010	ND	0.011	ND	0.010	ND	0.0099	ND	0.011	ND	0.011	ND
Hexachlorobenzene	NA	ug/l		0.0547	12.8	0.011	ND	--	--	0.010	ND	0.010	ND	--	--	0.010	ND	0.0099	ND	0.011	ND	--	--
Methoxychlor	NA	ug/l			80.0	0.011	ND	--	--	0.010	ND	0.010	ND	0.011	ND	0.010	ND	0.0099	ND	0.011	ND	0.011	ND
Toxaphene	NA	ug/l		0.0795		0.52	ND	--	--	0.50	ND	0.50	ND	0.52	ND	0.50	ND	0.50	ND	0.52	ND	0.51	ND
PCBs																							
Aroclor 1016	NA	ug/l		1.25	1.12	--	--	0.0051	ND	0.0050	ND	0.0050	ND	0.0052	ND	0.0050	ND	0.0050	ND	0.0052	ND	0.0051	ND
Aroclor 1221	NA	ug/l				--	--	0.011	ND	0.010	ND	0.010	ND	0.011	ND	0.010	ND	0.010	ND	0.011	ND	0.011	ND
Aroclor 1232	NA	ug/l				--	--	0.0051	ND	0.0050	ND	0.005	0.018	0.0052	ND	0.0050	ND	0.0050	ND	0.0052	ND	0.0051	ND
Aroclor 1242	NA	ug/l				--	--	0.0051	0.034	0.005	0.0099	0.0050	ND	0.0052	ND	0.0050	ND	0.0050	ND	0.0052	ND	0.0051	ND
Aroclor 1248	NA	ug/l				--	--	0.0051	ND	0.0050	ND	0.0050	ND	0.0052	ND	0.0050	ND	0.0050	ND	0.0052	ND	0.0051	ND
Aroclor 1254	NA	ug/l		0.0438	0.320	--	--	0.0051	ND	0.0050	ND	0.0050	ND	0.0052	ND	0.0050	ND	0.0050	ND	0.0052	ND	0.0051	ND
Aroclor 1260	NA	ug/l		0.0438		--	--	0.0051	ND	0.0050	ND	0.0050	ND	0.0052	ND	0.0050	ND	0.0050	ND	0.0052	ND	0.0051	ND
Total Petroleum Hydrocarbons																							
Total Petroleum Hydrocarbons (as diesel)	NA	ug/l	500			310	ND	--	--	310	ND	310	ND	310	ND	310	ND	310	ND	310	ND	310	ND
Total Petroleum Hydrocarbons (as diesel), silica gel	NA	ug/l	500			--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Total Petroleum Hydrocarbons (as gasoline)	NA	ug/l	800			130	ND	--	--	130	ND	130	ND	130	ND	130	ND	130	ND	130	ND	130	ND
Total Petroleum Hydrocarbons (as motor oil)	NA	ug/l	500			310	ND	--	--	310	ND	310	ND	310	ND	310	ND	310	ND	310	ND	310	ND
Total Petroleum Hydrocarbons (as motor oil), silica gel	NA	ug/l	500			--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--

Landau qualifier - J: Indicates the analyte was positively identified; the associated numerical value is the approximate concentration of the analyte in the sample.

Landau qualifier - UJ: The analyte was not detected in the sample; the reported sample reporting limit is an estimate.

N: Normal Sample.

FD: Field Duplicate Sample.

ND: Not detected.

PQL: Practical Quantitation Limit.

SSource: Laboratory and/or field data obtained from a secondary source external to Barr. Second source QA/QC evaluation procedures may or may not have been performed beyond the original data generator.

Table was updated (items in red) after original submittal to add Landau qualifiers to be consistent with the memo.

Table 2
Historical Groundwater Data - 2015 Landau PQLs vs. MTCA Cleanup Levels
Yakima Mill Site

					Location	MW-11		MW-11		MW-11		MW-12		MW-12		MW-12		MW-12		MW-14		MW-14	
					Date	12/19/2014		3/26/2015		6/24/2015		9/15/2014		12/18/2014		3/25/2015		6/25/2015		9/17/2014		12/18/2014	
					Sample Type	N		N		N		N		N		N		N		N		N	
					Result Type	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result
					Data Status	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource
Parameter	Total or Dissolved	Units	Washington GW Method A	Washington Groundwater Method B Cancer	Washington Groundwater Method B Noncancer																		
Effective Date			07/01/2015	07/01/2015	07/01/2015																		
Exceedance Key			No Exceedances	Shade	Border																		
General Parameters																							
Alkalinity, bicarbonate, as CaCO3	NA	mg/l				15	180	0.0	170	15	180	15	350	0.0	260	0.0	380	15	380	--	--	0.0	58
Alkalinity, total, as CaCO3	NA	mg/l				15	180	0.0	170	15	180	15	350	0.0	260	0.0	380	15	380	--	--	0.0	58
Carbon, total organic	NA	mg/l				0.50	4.0	0.50	4.1	0.50	5.2	1.0	16	1.0	7.0	0.50	13	2.0	12	--	--	0.50	0.72
Chloride	NA	mg/l				0.092	20	0.092	20	0.92	18	0.092	18	0.092	18	0.092	18	0.92	15	0.092	4.5	0.092	3.7
Fluoride	NA	mg/l			0.64	0.16	0.22	0.16	ND	0.16	ND	0.16	0.44	0.16	0.39	0.16	0.48	0.16	0.29	0.16	ND	0.16	ND
Nitrogen, ammonia, as N	NA	mg/l				0.050	1.3	0.050	0.97	0.050	0.91	0.050	1.5	0.050	1.4	0.050	1	0.050	1.0	--	--	0.050	ND
Nitrogen, nitrate, as N	NA	mg/l			25.6	0.034	ND	0.034	ND	0.034	ND	0.034	ND	0.034	0.041	0.034	0.23	0.034	ND	0.20	ND	0.034	0.22
Nitrogen, nitrite, as N	NA	mg/l			1.6	0.043	ND	0.043	ND	0.043	ND	0.043	ND	0.043	ND	0.043	ND	0.043	ND	0.043	ND UJ	0.043	ND
Solids, total dissolved	NA	mg/l				5.0	240	5.0	220	5.0	250	5.0	370	5.0	290	5.0	520	5.0	340	--	--	5.0	72
Sulfate, as SO4	NA	mg/l				0.26	0.29	0.26	ND	0.50	ND	0.26	18	0.26	0.35	2.6	45	2.6	11	0.26	3	0.26	3.3
Metals																							
Arsenic	Dissolved	ug/l	5.00	0.0583	4.80	0.45	4.1	0.45	3.7	0.45	2.5	1.0	1.2	0.45	ND	0.50	2.3	0.45	ND	1.0	ND	0.45	ND
Arsenic	Total	ug/l	5.00	0.0583	4.80	0.45	3.9	0.45	4.6	0.45	2.8	1.0	1.3	0.45	ND	0.50	1.1	0.45	ND	1.0	ND	0.45	ND
Barium	Dissolved	ug/l			3200	1.0	54	1.0	49	1.0	51	1.0	59	1.0	47	1.0	69	1.0	70	1.0	6	1.0	4.9
Barium	Total	ug/l			3200	1.0	52	1.0	49	1.0	50	1.0	70	1.0	45	1.0	69	1.0	74	1.0	5.7	1.0	5.0
Cadmium	Dissolved	ug/l	5.00		8.00	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND
Cadmium	Total	ug/l	5.00		8.00	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND
Calcium	Dissolved	ug/l				100	38000	100	35000	100	37000	100	40000	100	40000	100	65000	100	57000	100	13000	100	13000
Calcium	Total	ug/l				100	38000	100	35000	100	37000	100	45000	100	39000	100	65000	100	59000	100	13000	100	13000
Chromium	Dissolved	ug/l	50.0			2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
Chromium	Total	ug/l	50.0			2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
Chromium, hexavalent	Dissolved	ug/l			48.0	--	--	--	--	--	--	10	ND	--	--	--	--	--	--	--	--	--	--
Chromium, hexavalent	Total	ug/l			48.0	--	--	--	--	--	--	10	ND	--	--	--	--	--	--	--	--	--	--
Iron	Dissolved	ug/l			11200	50	32000	50	29000	50	31000	50	13000	50	11000	50	3100	50	21000	50	ND	50	ND
Iron	Total	ug/l			11200	50	31000	50	29000	50	31000	50	14000	50	10000	50	1600	50	22000	50	ND	50	ND
Lead	Dissolved	ug/l	15.0			0.28	ND	0.28	ND	0.28	ND	1.0	ND	0.28	ND	0.28	ND	0.28	ND	1.0	ND	0.28	ND
Lead	Total	ug/l	15.0			0.28	ND	0.28	ND	0.28	ND	1.0	ND	0.28	ND	0.28	ND	0.28	ND	1.0	ND	0.28	ND
Magnesium	Dissolved	ug/l				50	13000	50	12000	50	13000	50	13000	50	14000	50	23000	50	20000	50	4500	50	4600
Magnesium	Total	ug/l				50	13000	50	12000	50	13000	50	15000	50	14000	50	23000	50	21000	50	4500	50	4800
Manganese	Dissolved	ug/l			2240	2.0	1900	2.0	1700	2.0	2000	2.0	1800	2.0	1700	2.0	2500	10	2800	2.0	ND	2.0	2.9
Manganese	Total	ug/l			2240	2.0	1900	2.0	1700	2.0	1800	2.0	2100	2.0	1700	2.0	2300	10	2800	2.0	5.6	2.0	3.8
Mercury	Dissolved	ug/l	2.00			0.11	ND	0.20	ND	0.11	ND	0.20	ND	0.11	ND	0.11	ND	0.11	ND	0.20	ND	0.11	ND
Mercury	Total	ug/l	2.00			0.11	ND	0.11	ND	0.11	ND	0.20	ND	0.11	ND	0.11	ND	0.11	ND	0.20	ND	0.11	ND
Potassium	Dissolved	ug/l				--	--	50	5600	50	5500	--	--	--	--	50	6900	50	5700	--	--	--	--
Potassium	Total	ug/l				--	--	50	5600	50	5400	--	--	--	--	50	7000	50	5900	--	--	--	--
Selenium	Dissolved	ug/l			80.0	4.0	ND	4.0	ND	4.0	ND	4.0	ND	4.0	ND	4.0	ND	4.0	ND	4.0	ND	4.0	ND
Selenium	Total	ug/l			80.0	4.0	ND	4.0	ND	4.0	ND	4.0	ND	4.0	ND	4.0	ND	4.0	ND	4.0	ND	4.0	ND
Silver	Dissolved	ug/l			80.0	0.20	ND	0.20	ND	0.20	ND	1.0	ND	0.20	ND	0.20	ND	0.20	ND	1.0	ND	0.20	ND
Silver	Total	ug/l			80.0	0.20	ND	0.20	ND	0.20	ND	1.0	ND	0.20	ND	0.20	ND	0.20	ND	1.0	ND	0.20	ND
Sodium	Dissolved	ug/l				50	19000	50	18000	50	18000	50	69000	50	43000	50	77000	50	57000	50	5700	50	5100
Sodium	Total	ug/l				50	19000	50	18000	50	18000	50	80000	50	44000	50	79000	50	60000	50	5800	50	5400
SVOCs																							
1,2,4-Trichlorobenzene	NA	ug/l		1.51	80.0	2.0	ND	--	--	--	--	2.0	ND	2.0	ND	--	--	--	--	--	--	--	--
1,2-Dichlorobenzene	NA	ug/l			720	2.0	ND	--	--	--	--	2.0	ND	2.0	ND	--	--	--	--	--	--	--	--
1,3-Dichlorobenzene	NA	ug/l				2.0	ND	--	--	--	--	2.0	ND	2.0	ND	--	--	--	--	--	--	--	--
1,4-Dichlorobenzene	NA	ug/l		8.10	560	2.0	ND	--	--	--	--	2.0	ND	2.0	ND	--	--	--	--	--	--	--	--
1-Methylnaphthalene	NA	ug/l		1.51	560	0.020	ND	0.020	ND	0.020	ND	0.020	ND	0.020	ND	0.020	ND	0.020	ND	0.020	ND	--	--
2,2'-oxybis (1-chloropropane)	NA	ug/l		0.625	320	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--
2,3,4,6-Tetrachlorophenol	NA	ug/l			480	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--
2,4,5-Trichlorophenol	NA	ug/l			800	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--
2,4,6-Trichlorophenol	NA	ug/l		3.98	8.00	0.83	ND	0.83	ND	0.85	ND	2.0	ND	0.83	ND	0.92	ND	0.85	ND	--	--	--	--
2,4-Dichlorophenol	NA	ug/l			24.0	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--
2,4-Dimethylphenol	NA	ug/l			160	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--
2,4-Dinitrophenol	NA	ug/l			32.0	10	ND	10	ND	10	ND	10	ND	10	ND	10	ND	10	ND	--	--	--	--
2,4-Dinitrotoluene	NA	ug/l		0.282	32.0	0.72	ND	0.72	ND	0.73	ND	0.78	ND	0.72	ND	0.80	ND	0.73	ND	--	--	--	--
2,6-Dichlorophenol	NA	ug/l				2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--

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Table 2
Historical Groundwater Data - 2015 Landau PQLs vs. MTCA Cleanup Levels
Yakima Mill Site

					Location	MW-11		MW-11		MW-11		MW-12		MW-12		MW-12		MW-12		MW-14		MW-14	
					Date	12/19/2014		3/26/2015		6/24/2015		9/15/2014		12/18/2014		3/25/2015		6/25/2015		9/17/2014		12/18/2014	
					Sample Type	N		N		N		N		N		N		N		N		N	
					Result Type	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result
					Data Status	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource
Parameter	Total or Dissolved	Units	Washington GW Method A	Washington Groundwater Method B Cancer	Washington Groundwater Method B Noncancer																		
Effective Date			07/01/2015	07/01/2015	07/01/2015																		
Exceedance Key			No Exceedances	Shade	Border																		
2,6-Dinitrotoluene	NA	ug/l		0.0583	4.80	1.7	ND	1.7	ND	1.7	ND	1.8	ND	1.7	ND	1.9	ND	1.7	ND	--	--	--	--
2-Chloronaphthalene	NA	ug/l			640	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--
2-Chlorophenol	NA	ug/l			40.0	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--
2-Methyl-4,6-dinitrophenol	NA	ug/l				2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.1	ND	2.0	ND	--	--	--	--
2-Methylnaphthalene	NA	ug/l			32.0	0.020	ND	0.020	ND	0.020	ND	0.020	ND	0.020	ND	0.020	ND	0.020	ND	0.020	ND	--	--
2-Methylphenol (o-cresol)	NA	ug/l			400	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--
2-Nitroaniline	NA	ug/l			160	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--
2-Nitrophenol	NA	ug/l				2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--
3,3`-Dichlorobenzidine	NA	ug/l		0.194		1.9	ND	1.9	ND	1.9	ND	2.0	ND	1.9	ND	2.1	ND	1.9	ND	--	--	--	--
3,4-Methylphenol (m,p cresols)	NA	ug/l				2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--
3-Nitroaniline	NA	ug/l				5.0	ND	5.0	ND	5.0	ND	5.0	ND	5.0	ND	5.0	ND	5.0	ND	--	--	--	--
4-Bromophenyl phenyl ether	NA	ug/l				2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--
4-Chloro-3-methylphenol	NA	ug/l				2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--
4-Chloroaniline	NA	ug/l		0.219	32.0	1.8	ND	1.8	ND	1.8	ND	2.0	ND	1.8	ND	1.9	ND	1.8	ND	--	--	--	--
4-Chlorophenyl phenyl ether	NA	ug/l				2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--
4-Nitroaniline	NA	ug/l				2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.1	ND	2.0	ND	--	--	--	--
4-Nitrophenol	NA	ug/l				2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.1	ND	2.0	ND	--	--	--	--
Acenaphthene	NA	ug/l			960	0.014	ND	0.014	ND	0.014	ND	0.020	ND	0.014	0.017	0.015	ND	0.014	ND	0.020	ND	--	--
Acenaphthylene	NA	ug/l				0.020	ND	0.020	ND	0.020	ND	0.020	ND	0.020	ND	0.020	ND	0.020	ND	0.020	ND	--	--
Aniline	NA	ug/l		7.68	56.0	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.1	ND	2.0	ND	--	--	--	--
Anthracene	NA	ug/l			4800	0.010	ND	0.010	ND	0.010	ND	0.020	ND	0.010	ND	0.011	ND	0.010	0.013	0.020	ND	--	--
Azobenzene	NA	ug/l		0.795		1.5	ND	1.5	ND	1.5	ND	2.0	ND	1.5	ND	1.7	ND	1.5	ND	--	--	--	--
Benz(a)anthracene	NA	ug/l		0.120		0.017	ND	0.017	ND	0.017	ND	0.020	ND	0.017	ND	0.018	ND	0.017	ND	0.020	ND	--	--
Benzo(a)pyrene	NA	ug/l	0.100	0.0120		0.027	ND	0.027	ND	0.027	ND	0.029	ND	0.027	ND	0.030	ND	0.027	ND	0.029	ND	--	--
Benzo(b)fluoranthene	NA	ug/l		0.120		0.0068	ND	0.0068	ND	0.0068	ND	0.020	ND	0.0068	ND	0.0074	ND	0.0068	ND	0.020	ND	--	--
Benzo(g,h,i)perylene	NA	ug/l				0.019	ND	0.019	ND	0.019	ND	0.020	ND	0.019	ND	0.019	ND	0.019	ND	0.020	ND	--	--
Benzo(k)fluoranthene	NA	ug/l		1.20		0.013	ND	0.013	ND	0.013	ND	0.020	ND	0.013	ND	0.014	ND	0.013	ND	0.020	ND	--	--
Benzoic acid	NA	ug/l			64000	10	ND	10	ND	10	ND	10	ND	10	ND	10	ND	10	ND	--	--	--	--
Benzyl alcohol	NA	ug/l			800	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--
Bis(2-chloroethoxy)methane	NA	ug/l				2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--
Bis(2-chloroethyl)ether	NA	ug/l		0.0398		0.87	ND	0.87	ND	0.89	ND	0.94	ND	0.87	ND	0.96	ND	0.89	ND	--	--	--	--
Bis(2-ethylhexyl)phthalate	NA	ug/l		6.25	320	0.75	53	0.75	ND	0.76	ND	2.0	ND	0.75	ND	0.83	ND	0.76	ND	--	--	--	--
Butyl benzyl phthalate	NA	ug/l		46.1	3200	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--
Carbazole	NA	ug/l				2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--
Chrysene	NA	ug/l		12.0		0.018	ND	0.018	ND	0.018	ND	0.020	ND	0.018	ND	0.020	ND	0.018	ND	0.020	ND	--	--
Dibenz(a,h)anthracene	NA	ug/l		0.0120		0.011	ND	0.011	ND	0.011	ND	0.012	ND	0.011	ND	0.012	ND	0.011	ND	0.012	ND	--	--
Dibenzofuran	NA	ug/l			16.0	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--
Diethyl phthalate	NA	ug/l			12800	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--
Dimethyl phthalate	NA	ug/l				2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--
Di-n-butyl phthalate	NA	ug/l			1600	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--
Di-n-octyl phthalate	NA	ug/l			160	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--
Fluoranthene	NA	ug/l			640	0.0092	ND	0.0092	ND	0.0093	ND	0.020	ND	0.0092	ND	0.010	ND	0.0093	ND	0.020	ND	--	--
Fluorene	NA	ug/l			640	0.0090	ND	0.0090	ND	0.0092	ND	0.020	ND	0.0090	ND	0.010	ND	0.0092	ND	0.020	ND	--	--
Hexachlorobenzene	NA	ug/l		0.0547	12.8	0.59	ND	--	--	--	--	2.0	ND	0.59	ND	--	--	--	--	--	--	--	--
Hexachlorobutadiene	NA	ug/l		0.561	8.00	--	--	--	--	--	--	2.0	ND	--	--	--	--	--	--	--	--	--	--
Hexachlorocyclopentadiene	NA	ug/l			48.0	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.1	ND	2.0	ND	--	--	--	--
Hexachloroethane	NA	ug/l		1.09	5.60	1.9	ND	1.9	ND	1.9	ND	2.0	ND	1.9	ND	2.1	ND	1.9	ND	--	--	--	--
Indeno(1,2,3-cd)pyrene	NA	ug/l		0.120		0.014	ND	0.014	ND	0.014	ND	0.020	ND	0.014	ND	0.015	ND	0.014	ND	0.020	ND	--	--
Isophorone	NA	ug/l		46.1	1600	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--
Naphthalene	NA	ug/l	160		160	0.013	ND	0.013	ND	0.014	ND	0.020	0.034	0.013	0.11	0.015	ND	0.014	ND	0.020	0.024	--	--
Nitrobenzene	NA	ug/l			16.0	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--
n-Nitrosodimethylamine	NA	ug/l		0.000858	0.0640	1.4	ND	1.4	ND	1.4	ND	1.5	ND	1.4	ND	1.5	ND	1.4	ND	--	--	--	--
n-Nitrosodi-n-propylamine	NA	ug/l		0.0125		1.9	ND	1.9	ND	1.9	ND	2.0	ND	1.9	ND	2.1	ND	1.9	ND	--	--	--	--
n-Nitrosodiphenylamine	NA	ug/l		17.9		2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	4.3	--	--	--	--
Pentachlorophenol	NA	ug/l		0.219	80.0	0.12	ND	0.12	ND	0.12	ND	0.13	ND	0.12	ND	0.13	ND	0.12	ND	0.13	ND	--	--
Phenanthrene	NA	ug/l				0.013	ND	0.013	ND	0.014	ND	0.020	ND	0.013	ND	0.015	ND	0.014	ND	0.020	ND	--	--
Phenol	NA	ug/l			2400	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--
Pyrene	NA	ug/l			480	0.010	ND	0.010	ND	0.011	ND	0.020	ND	0.010	0.015	0.012	ND	0.011	ND	0.020	ND	--	--

11-30-2017

Table 2
Historical Groundwater Data - 2015 Landau PQLs vs. MTCA Cleanup Levels
Yakima Mill Site

					Location	MW-11		MW-11		MW-11		MW-12		MW-12		MW-12		MW-12		MW-14		MW-14	
					Date	12/19/2014		3/26/2015		6/24/2015		9/15/2014		12/18/2014		3/25/2015		6/25/2015		9/17/2014		12/18/2014	
					Sample Type	N		N		N		N		N		N		N		N		N	
					Result Type	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result
					Data Status	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource
Parameter	Total or Dissolved	Units	Washington GW Method A	Washington Groundwater Method B Cancer	Washington Groundwater Method B Noncancer																		
Effective Date			07/01/2015	07/01/2015	07/01/2015																		
Exceedance Key			No Exceedances	Shade	Border																		
Pyridine	NA	ug/l			8.00	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.1	ND	2.0	ND	--	--	--	--
VOCs						--		--		--		--		--		--		--		--		--	
1,1,1,2-Tetrachloroethane	NA	ug/l		1.68	240	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND	--	--	--	--
1,1,1-Trichloroethane	NA	ug/l	200		16000	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--
1,1,2,2-Tetrachloroethane	NA	ug/l		0.219	160	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND	--	--	--	--
1,1,2-Trichloroethane	NA	ug/l		0.768	32.0	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND	--	--	--	--
1,1-Dichloroethane	NA	ug/l		7.68	1600	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--
1,1-Dichloroethylene	NA	ug/l			400	0.014	ND	0.014	ND	0.014	ND	2.0	ND	0.014	ND	0.014	ND	0.014	ND	--	--	--	--
1,1-Dichloropropene	NA	ug/l				2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--
1,2,3-Trichlorobenzene	NA	ug/l				2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--
1,2,3-Trichloropropane	NA	ug/l		0.00146	32.0	0.023	ND	0.023	ND	0.023	ND	0.023	ND	0.023	ND	0.023	ND	0.023	ND	--	--	--	--
1,2,4-Trichlorobenzene	NA	ug/l		1.51	80.0	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND	--	--	--	--
1,2,4-Trimethylbenzene	NA	ug/l				2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--
1,2-Dibromo-3-chloropropane (DBCP)	NA	ug/l		0.0547	1.60	0.10	ND	0.10	ND	0.10	ND	10	ND	0.10	ND	0.10	ND	0.10	ND	--	--	--	--
1,2-Dibromoethane (EDB)	NA	ug/l	0.0100	0.0219	72.0	0.010	ND	0.010	ND	0.010	ND	0.010	ND	0.010	ND	0.010	ND	0.010	ND	--	--	--	--
1,2-Dichlorobenzene	NA	ug/l			720	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--
1,2-Dichloroethane	NA	ug/l	5.00	0.481	48.0	0.014	ND	0.014	ND	0.014	ND	2.0	ND	0.014	ND	0.014	ND	0.014	ND	--	--	--	--
1,2-Dichloroethylene, cis	NA	ug/l			16.0	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--
1,2-Dichloroethylene, trans	NA	ug/l			160	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--
1,2-Dichloropropane	NA	ug/l		1.22	720	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND	--	--	--	--
1,3,5-Trimethylbenzene	NA	ug/l			80.0	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--
1,3-Dichlorobenzene	NA	ug/l				2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--
1,3-Dichloropropane	NA	ug/l				2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--
1,3-Dichloropropene, cis	NA	ug/l		0.438	240	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--
1,3-Dichloropropene, trans	NA	ug/l		0.438	240	0.058	ND	0.058	ND	0.058	ND	2.0	ND	0.058	ND	0.058	ND	0.058	ND	--	--	--	--
1,4-Dichlorobenzene	NA	ug/l		8.10	560	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--
2,2-Dichloropropane	NA	ug/l				2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--
2-Hexanone	NA	ug/l				10	ND	10	ND	10	ND	10	ND	10	ND	10	ND	10	ND	--	--	--	--
Acetone	NA	ug/l			7200	25	ND	25	ND	25	ND	25	ND	25	ND	25	ND	25	ND	--	--	--	--
Acrylonitrile	NA	ug/l		0.0810	320	0.057	ND	0.057	ND	0.057	ND	10	ND	0.057	ND	0.057	ND	0.057	ND	--	--	--	--
Benzene	NA	ug/l	5.00	0.795	32.0	0.028	ND	0.028	ND	0.028	ND	2.0	ND	0.028	ND	0.028	ND	0.028	ND	--	--	--	--
Bromobenzene	NA	ug/l				2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--
Bromochloromethane	NA	ug/l				2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--
Bromodichloromethane	NA	ug/l		0.706	160	0.059	ND	0.059	ND	0.059	ND	0.059	ND	0.059	ND	0.059	ND	0.059	ND	--	--	--	--
Bromoform	NA	ug/l		5.54	160	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--
Bromomethane	NA	ug/l			11.2	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--
Butylbenzene	NA	ug/l			400	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--
Butylbenzene, sec	NA	ug/l			800	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--
Butylbenzene, tert	NA	ug/l			800	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--
Carbon disulfide	NA	ug/l			800	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--
Carbon tetrachloride	NA	ug/l		0.625	32.0	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND	--	--	--	--
Chlorobenzene	NA	ug/l			160	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--
Chlorodibromomethane	NA	ug/l		0.521	160	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND	--	--	--	--
Chloroethane	NA	ug/l				2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--
Chloroform	NA	ug/l		1.41	80.0	0.14	ND	0.14	ND	0.14	ND	0.10	ND	0.14	ND	0.14	ND	0.14	ND	--	--	--	--
Chloromethane	NA	ug/l				2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--
Chlorotoluene, o	NA	ug/l			160	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--
Chlorotoluene, p	NA	ug/l				2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--
Cumene (isopropyl benzene)	NA	ug/l			800	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--
Cymene p- (toluene isopropyl p-)	NA	ug/l				2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--
Dibromomethane (methylene bromide)	NA	ug/l			80.0	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--
Dichlorodifluoromethane (Freon-12)	NA	ug/l			1600	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--
Ethyl benzene	NA	ug/l	700		800	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--
Hexachlorobutadiene	NA	ug/l		0.561	8.00	0.069	ND	0.069	ND	0.069	ND	2.0	ND	0.069	ND	0.069	ND	0.069	ND	--	--	--	--
Hexane (C6)	NA	ug/l			480	--	--	--	--	2.0	ND	--	--	--	--	--	--	2.0	ND	--	--	--	--
Methyl ethyl ketone (2-butanone)	NA	ug/l			4800	10	ND	10	ND	10	ND	10	ND	10	ND	10	ND	10	ND	--	--	--	--
Methyl isobutyl ketone (MIBK)	NA	ug/l			640	10	ND	10	ND	10	ND	10	ND	10	ND	10	ND	10	ND	--	--	--	--
Methyl tertiary butyl ether (MTBE)	NA	ug/l	20.0	24.3		2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--

Table 2
Historical Groundwater Data - 2015 Landau PQLs vs. MTCA Cleanup Levels
Yakima Mill Site

					Location	MW-11		MW-11		MW-11		MW-12		MW-12		MW-12		MW-12		MW-14		MW-14	
					Date	12/19/2014		3/26/2015		6/24/2015		9/15/2014		12/18/2014		3/25/2015		6/25/2015		9/17/2014		12/18/2014	
					Sample Type	N		N		N		N		N		N		N		N		N	
					Result Type	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result
					Data Status	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource
Parameter	Total or Dissolved	Units	Washington GW Method A	Washington Groundwater Method B Cancer	Washington Groundwater Method B Noncancer																		
Effective Date			07/01/2015	07/01/2015	07/01/2015																		
Exceedance Key			No Exceedances	Shade	Border																		
Methylene chloride	NA	ug/l	5.00	21.9	48.0	0.68	ND	0.68	ND	0.68	ND	5.0	ND	0.68	ND	0.68	ND	0.68	ND	--	--	--	--
Naphthalene	NA	ug/l	160		160	--	--	--	--	--	--	2.0	ND	--	--	--	--	--	--	--	--	--	--
Propylbenzene	NA	ug/l			800	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--
Styrene	NA	ug/l			1600	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--
Tetrachloroethylene	NA	ug/l	5.00	20.8	48.0	0.023	ND	0.023	ND	0.023	ND	2.0	ND	0.023	ND	0.023	ND	0.023	ND	--	--	--	--
Toluene	NA	ug/l	1000		640	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--
Trichloroethylene (TCE)	NA	ug/l	5.00	0.540	4.00	0.054	ND	0.054	ND	0.054	ND	0.020	ND	0.054	ND	0.054	ND	0.054	ND	--	--	--	--
Trichlorofluoromethane (Freon-11)	NA	ug/l			2400	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--
Vinyl chloride	NA	ug/l	0.200		24.0	0.031	ND	0.031	ND	0.031	ND	0.20	ND	0.031	ND	0.031	ND	0.031	ND	--	--	--	--
Xylene, m & p	NA	ug/l			1600	4.0	ND	4.0	ND	4.0	ND	4.0	ND	4.0	ND	4.0	ND	4.0	ND	--	--	--	--
Xylene, o	NA	ug/l			1600	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--
Pesticides																							
4,4'-DDD	NA	ug/l		0.365		0.010	ND	0.010	ND UJ	0.010	ND	0.011	ND	0.011	ND	0.011	ND	0.010	ND	--	--	--	--
4,4'-DDE	NA	ug/l		0.257		0.010	ND	0.010	ND UJ	0.010	ND	0.011	ND	0.011	ND	0.011	ND	0.010	ND	--	--	--	--
4,4'-DDT	NA	ug/l	0.300	0.257	8.00	0.010	ND	0.010	ND UJ	0.010	ND	0.13	ND	0.011	ND	0.011	ND	0.010	ND	--	--	--	--
a-BHC	NA	ug/l		0.0139	128	0.010	ND	0.010	ND UJ	0.010	ND	0.011	ND	0.011	ND	0.011	ND	0.010	ND	--	--	--	--
Aldrin	NA	ug/l		0.00257	0.240	0.010	ND	0.010	ND UJ	0.010	ND	0.011	ND	0.011	ND	0.011	ND	0.010	ND	--	--	--	--
b-BHC	NA	ug/l		0.0486		0.010	ND	0.010	ND UJ	0.010	ND	0.011	ND	0.011	ND	0.011	ND	0.010	ND	--	--	--	--
Chlordane, alpha & gamma	NA	ug/l		0.250	8.00	0.010	ND	0.010	ND UJ	0.010	ND	0.047	ND	0.011	ND	0.011	ND	0.010	ND	--	--	--	--
d-BHC	NA	ug/l				0.010	ND	0.010	ND UJ	0.010	ND	0.011	ND	0.011	ND	0.011	ND	0.010	ND	--	--	--	--
Dieldrin	NA	ug/l		0.00547	0.800	0.010	ND	0.010	ND UJ	0.010	ND	0.011	ND	0.011	ND	0.011	ND	0.010	ND	--	--	--	--
Endosulfan I	NA	ug/l			96.0	0.010	ND	0.010	ND UJ	0.010	ND	0.011	ND	0.011	ND	0.011	ND	0.010	ND	--	--	--	--
Endosulfan II	NA	ug/l			96.0	0.017	ND	0.010	0.011 J	0.010	0.014	0.056	ND	0.011	ND	0.011	ND	0.010	ND	--	--	--	--
Endosulfan sulfate	NA	ug/l			96.0	0.010	ND	0.010	ND UJ	0.010	ND	0.023	ND	0.011	ND	0.011	ND	0.010	ND	--	--	--	--
Endrin	NA	ug/l			4.80	0.010	ND	0.010	ND UJ	0.010	ND	0.011	ND	0.011	ND	0.011	ND	0.010	ND	--	--	--	--
Endrin aldehyde	NA	ug/l				0.010	ND	0.010	ND UJ	0.010	ND	0.071	ND	0.011	ND	0.011	ND	0.010	ND	--	--	--	--
g-BHC (Lindane)	NA	ug/l	0.200	0.0795	4.80	0.010	ND	0.010	ND UJ	0.010	ND	0.011	ND	0.011	ND	0.011	ND	0.010	ND	--	--	--	--
Heptachlor	NA	ug/l		0.0194	8.00	0.010	ND	0.010	ND UJ	0.010	ND	0.011	ND	0.011	ND	0.011	ND	0.010	ND	--	--	--	--
Heptachlor epoxide	NA	ug/l		0.00481	0.104	0.010	ND	0.010	ND UJ	0.010	ND	0.018	ND	0.011	ND	0.011	ND	0.010	ND	--	--	--	--
Hexachlorobenzene	NA	ug/l		0.0547	12.8	0.010	ND	0.010	ND UJ	0.010	ND	--	--	0.011	ND	0.011	ND	0.010	ND	--	--	--	--
Methoxychlor	NA	ug/l			80.0	0.010	ND	0.010	ND UJ	0.010	ND	0.040	ND	0.011	ND	0.017	ND	0.010	ND	--	--	--	--
Toxaphene	NA	ug/l		0.0795		0.50	ND	0.50	ND UJ	0.50	ND	2.5	ND	0.52	ND	0.53	ND	0.50	ND	--	--	--	--
PCBs																							
Aroclor 1016	NA	ug/l		1.25	1.12	0.0050	ND	0.0050	ND	0.0050	ND	0.0064	ND	0.0051	ND	0.0053	ND	0.0050	ND	--	--	--	--
Aroclor 1221	NA	ug/l				0.010	ND	0.010	ND	0.010	ND	0.011	ND	0.011	ND	0.011	ND	0.010	ND	--	--	--	--
Aroclor 1232	NA	ug/l				0.0050	ND	0.0050	ND	0.0050	ND	0.0056	ND	0.0051	ND	0.0053	ND	0.0050	ND	--	--	--	--
Aroclor 1242	NA	ug/l				0.0050	ND	0.0050	ND	0.0050	ND	0.0051	ND	0.0051	ND	0.0053	ND	0.0050	ND	--	--	--	--
Aroclor 1248	NA	ug/l				0.0050	ND	0.0050	ND	0.0050	ND	0.0051	ND	0.0051	ND	0.0073	ND	0.0050	ND	--	--	--	--
Aroclor 1254	NA	ug/l		0.0438	0.320	0.0050	ND	0.0050	ND	0.0050	ND	0.0051	ND	0.0051	ND	0.0053	ND	0.0050	ND	--	--	--	--
Aroclor 1260	NA	ug/l		0.0438		0.0050	ND	0.0050	ND	0.0050	ND	0.0051	ND	0.0051	ND	0.0053	ND	0.0050	ND	--	--	--	--
Total Petroleum Hydrocarbons																							
Total Petroleum Hydrocarbons (as diesel)	NA	ug/l	500			310	ND	310	ND	310	ND	130 310	3700 1200	130 310	990 ND	130	ND	130	940	310	ND	310	ND
Total Petroleum Hydrocarbons (as diesel), silica gel	NA	ug/l	500			--	--	--	--	--	--	130	310	130	390	--	--	130	360	--	--	--	--
Total Petroleum Hydrocarbons (as gasoline)	NA	ug/l	800			130	ND	130	ND	130	ND	130	ND	130	ND	--	--	--	--	130	ND	130	ND
Total Petroleum Hydrocarbons (as motor oil)	NA	ug/l	500			310	ND	310	ND	310	ND	250 310	1400 ND	250 310	1100 310	250	3100	250	560	310	ND	310	ND
Total Petroleum Hydrocarbons (as motor oil), silica gel	NA	ug/l	500			--	--	--	--	--	--	250	370	250	980	250	650	250	250	--	--	--	--

Landau qualifier - J: Indicates the analyte was positively identified; the associated numerical value is the approximate concentration of the analyte in the sample.
Landau qualifier - UJ: The analyte was not detected in the sample; the reported sample reporting limit is an estimate.
N: Normal Sample.
FD: Field Duplicate Sample.
ND: Not detected.
PQL: Practical Quantitation Limit.
SSource: Laboratory and/or field data obtained from a secondary source external to Barr. Second source QA/QC evaluation procedures may or may not have been performed beyond the original data generator.
Table was updated (items in red) after original submittal to add Landau qualifiers to be consistent with the memo.

Table 2
Historical Groundwater Data - 2015 Landau PQLs vs. MTCA Cleanup Levels
Yakima Mill Site

					Location	MW-14		MW-14		MW-15		MW-15		MW-15		MW-15		MW-16		MW-16		MW-16		MW-16	
					Date	3/23/2015		6/23/2015		9/17/2014		12/18/2014		3/23/2015		6/23/2015		9/17/2014		12/18/2014		3/23/2015		6/24/2015	
					Sample Type	N		N		N		N		N		N		N		N		N		N	
					Result Type	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result
					Data Status	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource
Parameter	Total or Dissolved	Units	Washington GW Method A	Washington Groundwater Method B Cancer	Washington Groundwater Method B Noncancer																				
Effective Date			07/01/2015	07/01/2015	07/01/2015																				
Exceedance Key			No Exceedances	Shade	Border																				
General Parameters																									
Alkalinity, bicarbonate, as CaCO3	NA	mg/l				0.0	47	15	63	15	110	0.0	110	0.0	90	15	88	--	--	0.0	190	0.0	210	15	250
Alkalinity, total, as CaCO3	NA	mg/l				0.0	47	15	63	15	110	0.0	110	0.0	90	15	88	--	--	0.0	190	0.0	210	15	250
Carbon, total organic	NA	mg/l				0.50	0.77	0.50	0.88	0.50	2.7	0.50	1.9	0.50	1.6	0.50	2.8	--	--	0.50	2.0	0.50	2.4	0.50	3.5
Chloride	NA	mg/l				0.092	4.8	0.092	6.2	0.092	12	0.092	13	0.092	10	0.092	7.2	1.8	22	0.092	20	0.092	20	0.92	21
Fluoride	NA	mg/l			0.64	0.16	ND	0.16	ND	0.16	ND	0.16	ND	0.16	ND	0.16	ND	0.16	ND	0.16	0.37	0.16	ND	0.16	ND
Nitrogen, ammonia, as N	NA	mg/l				0.050	ND	0.050	ND	0.050	3	0.050	0.63	0.050	0.093	0.050	0.22	--	--	0.050	ND	0.050	0.2	0.050	ND
Nitrogen, nitrate, as N	NA	mg/l			25.6	0.034	0.49	0.034	0.25	0.034	ND	0.034	ND	0.034	0.063	0.034	ND	2.8	ND	0.034	0.13	0.034	2.7	0.34	2.9
Nitrogen, nitrite, as N	NA	mg/l			1.6	0.043	ND	0.043	ND	0.043	ND	0.043	ND	0.043	ND	0.043	ND	0.043	ND UJ	0.043	ND	0.043	ND	0.043	ND
Solids, total dissolved	NA	mg/l				5.0	66	5.0	140	5.0	180	5.0	160	5.0	130	5.0	140	--	--	5.0	230	5.0	580	5.0	510
Sulfate, as SO4	NA	mg/l				0.26	4.5	0.26	3.8	0.26	1.2	0.26	0.90	0.26	1.9	0.26	3.2	5.2	170	0.26	15	0.26	6.2	2.6	160
Metals																									
Arsenic	Dissolved	ug/l	5.00	0.0583	4.80	0.45	ND	0.45	ND	1.0	1.1	0.45	ND	0.45	ND	0.45	0.93	1.0	ND	0.45	ND	0.45	ND	0.45	ND
Arsenic	Total	ug/l	5.00	0.0583	4.80	0.45	ND	0.45	ND	1.0	1.3	0.45	ND	0.45	0.85	0.45	0.91	1.0	ND	0.45	0.97	0.45	ND	0.94	ND
Barium	Dissolved	ug/l			3200	1.0	3.4	1.0	6.1	1.0	23	1.0	28	1.0	21	1.0	18	1.0	45	1.0	19	1.0	22	1.0	47
Barium	Total	ug/l			3200	1.0	4.3	1.0	6.5	1.0	25	1.0	28	1.0	21	1.0	18	1.0	47	1.0	21	1.0	22	1.0	47
Cadmium	Dissolved	ug/l	5.00		8.00	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND
Cadmium	Total	ug/l	5.00		8.00	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND
Calcium	Dissolved	ug/l				100	11000	100	14000	100	20000	100	24000	100	20000	100	17000	100	87000	100	41000	100	50000	100	95000
Calcium	Total	ug/l				100	11000	100	14000	100	21000	100	23000	100	20000	100	17000	100	89000	100	42000	100	50000	100	90000
Chromium	Dissolved	ug/l	50.0			2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	2.1	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
Chromium	Total	ug/l	50.0			2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
Chromium, hexavalent	Dissolved	ug/l			48.0	--	--	--	--	10	ND	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Chromium, hexavalent	Total	ug/l			48.0	--	--	--	--	10	ND	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Iron	Dissolved	ug/l			11200	50	ND	50	ND	50	6300	50	5500	50	2700	50	5100	50	ND	50	ND	50	ND	50	ND
Iron	Total	ug/l			11200	50	70	50	ND	50	7900	50	6400	50	3600	50	5500	50	320	50	190	50	170	50	470
Lead	Dissolved	ug/l	15.0			0.28	ND	0.28	ND	1.0	ND	0.28	ND	0.28	ND	0.28	ND	1.0	ND	0.28	ND	0.28	ND	0.28	ND
Lead	Total	ug/l	15.0			0.28	ND	0.28	ND	1.0	ND	0.28	ND	0.28	ND	0.28	ND	1.0	ND	0.28	ND	0.28	ND	0.36	ND
Magnesium	Dissolved	ug/l				50	3900	50	5000	50	7900	50	9600	50	7800	50	6900	50	12000	50	11000	50	15000	50	18000
Magnesium	Total	ug/l				50	3900	50	4800	50	8500	50	9000	50	7900	50	6700	50	13000	50	11000	50	16000	50	16000
Manganese	Dissolved	ug/l			2240	2.0	ND	2.0	ND	2.0	890	2.0	850	2.0	560	2.0	630	2.0	110	2.0	210	2.0	630	2.0	140
Manganese	Total	ug/l			2240	2.0	3.7	2.0	2.6	2.0	910	2.0	830	2.0	590	2.0	630	2.0	120	2.0	190	2.0	630	2.0	140
Mercury	Dissolved	ug/l	2.00			0.11	ND	0.11	ND	0.20	ND	0.11	ND	0.11	ND	0.11	ND	0.20	ND	0.11	ND	0.11	ND	0.11	ND
Mercury	Total	ug/l	2.00			0.11	ND	0.11	ND	0.20	ND	0.11	ND	0.11	ND	0.11	ND	0.20	ND	0.11	ND	0.11	ND	0.11	ND
Potassium	Dissolved	ug/l				50	1300	50	1700	--	--	--	--	50	3000	50	2800	--	--	--	--	50	10000	50	18000
Potassium	Total	ug/l				50	1300	50	1700	--	--	--	--	50	3100	50	2700	--	--	--	--	50	10000	50	16000
Selenium	Dissolved	ug/l			80.0	4.0	ND	4.0	ND	4.0	ND	4.0	ND	4.0	ND	4.0	ND	4.0	ND	4.0	ND	4.0	ND	4.0	ND
Selenium	Total	ug/l			80.0	4.0	ND	4.0	ND	4.0	ND	4.0	ND	4.0	ND	4.0	ND	4.0	ND	4.0	ND	4.0	ND	4.0	ND
Silver	Dissolved	ug/l			80.0	0.20	ND	0.20	ND	1.0	ND	0.20	ND	0.20	ND	0.20	ND	1.0	ND	0.20	ND	0.20	ND	0.20	ND
Silver	Total	ug/l			80.0	0.20	ND	0.20	ND	1.0	ND	0.20	ND	0.20	ND	0.20	ND	1.0	ND	0.20	ND	0.20	ND	0.20	ND
Sodium	Dissolved	ug/l				50	6200	50	5900	50	8900	50	10000	50	8900	50	8400	50	36000	50	20000	50	20000	50	42000
Sodium	Total	ug/l				50	6300	50	5700	50	9500	50	9900	50	9100	50	8200	50	38000	50	20000	50	20000	50	38000
SVOCs																									
1,2,4-Trichlorobenzene	NA	ug/l		1.51	80.0	--	--	--	--	2.0	ND	2.0	ND	--	--	--	--	--	--	--	--	--	--	--	--
1,2-Dichlorobenzene	NA	ug/l			720	--	--	--	--	2.0	ND	2.0	ND	--	--	--	--	--	--	--	--	--	--	--	--
1,3-Dichlorobenzene	NA	ug/l				--	--	--	--	2.0	ND	2.0	ND	--	--	--	--	--	--	--	--	--	--	--	--
1,4-Dichlorobenzene	NA	ug/l		8.10	560	--	--	--	--	2.0	ND	2.0	ND	--	--	--	--	--	--	--	--	--	--	--	--
1-Methylnaphthalene	NA	ug/l		1.51	560	--	--	--	--	0.020	ND	0.020	ND	0.020	ND	0.020	ND	0.020	ND	--	--	--	--	--	--
2,2'-oxybis (1-chloropropane)	NA	ug/l		0.625	320	--	--	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	--	--	--	--
2,3,4,6-Tetrachlorophenol	NA	ug/l			480	--	--	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	--	--	--	--
2,4,5-Trichlorophenol	NA	ug/l			800	--	--	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	--	--	--	--
2,4,6-Trichlorophenol	NA	ug/l		3.98	8.00	--	--	--	--	2.0	ND	0.83	ND	0.85	ND	0.85	ND	--	--	--	--	--	--	--	--
2,4-Dichlorophenol	NA	ug/l			24.0	--	--	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	--	--	--	--
2,4-Dimethylphenol	NA	ug/l			160	--	--	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	--	--	--	--
2,4-Dinitrophenol	NA	ug/l			32.0	--	--	--	--	10	ND	10	ND	10	ND	10	ND	--	--	--	--	--	--	--	--
2,4-Dinitrotoluene	NA	ug/l		0.282	32.0	--	--	--	--	0.78	ND	0.72	ND	0.73	ND	0.73	ND	--	--	--	--	--	--	--	--
2,6-Dichlorophenol	NA	ug/l				--	--	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	--	--	--	--

Table 2
Historical Groundwater Data - 2015 Landau PQLs vs. MTCA Cleanup Levels
Yakima Mill Site

					Location	MW-14		MW-14		MW-15		MW-15		MW-15		MW-15		MW-16		MW-16		MW-16		MW-16	
					Date	3/23/2015		6/23/2015		9/17/2014		12/18/2014		3/23/2015		6/23/2015		9/17/2014		12/18/2014		3/23/2015		6/24/2015	
					Sample Type	N		N		N		N		N		N		N		N		N		N	
					Result Type	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result
					Data Status	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource
Parameter	Total or Dissolved	Units	Washington GW Method A	Washington Groundwater Method B Cancer	Washington Groundwater Method B Noncancer																				
Effective Date			07/01/2015	07/01/2015	07/01/2015																				
Exceedance Key			No Exceedances	Shade	Border																				
2,6-Dinitrotoluene	NA	ug/l		0.0583	4.80	--	--	--	--	1.8	ND	1.7	ND	1.7	ND	1.7	ND	--	--	--	--	--	--	--	--
2-Chloronaphthalene	NA	ug/l			640	--	--	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	--	--	--	--
2-Chlorophenol	NA	ug/l			40.0	--	--	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	--	--	--	--
2-Methyl-4,6-dinitrophenol	NA	ug/l				--	--	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	--	--	--	--
2-Methylnaphthalene	NA	ug/l			32.0	--	--	--	--	0.020	ND	0.020	ND	0.020	ND	0.020	ND	0.020	ND	--	--	--	--	--	--
2-Methylphenol (o-cresol)	NA	ug/l			400	--	--	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	--	--	--	--
2-Nitroaniline	NA	ug/l			160	--	--	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	--	--	--	--
2-Nitrophenol	NA	ug/l				--	--	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	--	--	--	--
3,3`-Dichlorobenzidine	NA	ug/l		0.194		--	--	--	--	2.0	13	1.9	ND	1.9	ND	1.9	ND	--	--	--	--	--	--	--	--
3,4-Methylphenol (m,p cresols)	NA	ug/l				--	--	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	--	--	--	--
3-Nitroaniline	NA	ug/l				--	--	--	--	5.0	ND	5.0	ND	5.0	ND	5.0	ND	--	--	--	--	--	--	--	--
4-Bromophenyl phenyl ether	NA	ug/l				--	--	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	--	--	--	--
4-Chloro-3-methylphenol	NA	ug/l				--	--	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	--	--	--	--
4-Chloroaniline	NA	ug/l		0.219	32.0	--	--	--	--	2.0	ND	1.8	ND	1.8	ND	1.8	ND	--	--	--	--	--	--	--	--
4-Chlorophenyl phenyl ether	NA	ug/l				--	--	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	--	--	--	--
4-Nitroaniline	NA	ug/l				--	--	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	--	--	--	--
4-Nitrophenol	NA	ug/l				--	--	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	--	--	--	--
Acenaphthene	NA	ug/l			960	--	--	--	--	0.020	ND	0.014	ND	0.014	ND	0.014	ND	0.020	ND	--	--	--	--	--	--
Acenaphthylene	NA	ug/l				--	--	--	--	0.020	ND	0.020	ND	0.020	ND	0.020	ND	0.020	ND	--	--	--	--	--	--
Aniline	NA	ug/l		7.68	56.0	--	--	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	--	--	--	--
Anthracene	NA	ug/l			4800	--	--	--	--	0.020	ND	0.010	ND	0.010	ND	0.010	ND	0.020	ND	--	--	--	--	--	--
Azobenzene	NA	ug/l		0.795		--	--	--	--	2.0	ND	1.5	ND	1.5	ND	1.5	ND	--	--	--	--	--	--	--	--
Benz(a)anthracene	NA	ug/l		0.120		--	--	--	--	0.020	ND	0.017	ND	0.017	ND	0.017	ND	0.020	ND	--	--	--	--	--	--
Benzo(a)pyrene	NA	ug/l	0.100	0.0120		--	--	--	--	0.029	ND	0.027	ND	0.027	ND	0.027	ND	0.029	ND	--	--	--	--	--	--
Benzo(b)fluoranthene	NA	ug/l		0.120		--	--	--	--	0.020	ND	0.0068	ND	0.0068	ND	0.0068	ND	0.020	ND	--	--	--	--	--	--
Benzo(g,h,i)perylene	NA	ug/l				--	--	--	--	0.020	ND	0.019	ND	0.019	ND	0.019	ND	0.020	ND	--	--	--	--	--	--
Benzo(k)fluoranthene	NA	ug/l		1.20		--	--	--	--	0.020	ND	0.013	ND	0.013	ND	0.013	ND	0.020	ND	--	--	--	--	--	--
Benzoic acid	NA	ug/l			64000	--	--	--	--	10	ND	10	ND	10	ND	10	ND	--	--	--	--	--	--	--	--
Benzyl alcohol	NA	ug/l			800	--	--	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	--	--	--	--
Bis(2-chloroethoxy)methane	NA	ug/l				--	--	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	--	--	--	--
Bis(2-chloroethyl)ether	NA	ug/l		0.0398		--	--	--	--	0.94	ND	0.87	ND	0.89	ND	0.89	ND	--	--	--	--	--	--	--	--
Bis(2-ethylhexyl)phthalate	NA	ug/l		6.25	320	--	--	--	--	2.0	ND	0.75	ND	0.76	ND	0.76	ND	--	--	--	--	--	--	--	--
Butyl benzyl phthalate	NA	ug/l		46.1	3200	--	--	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	--	--	--	--
Carbazole	NA	ug/l				--	--	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	--	--	--	--
Chrysene	NA	ug/l		12.0		--	--	--	--	0.020	ND	0.018	ND	0.018	ND	0.018	ND	0.020	ND	--	--	--	--	--	--
Dibenz(a,h)anthracene	NA	ug/l		0.0120		--	--	--	--	0.012	ND	0.011	ND	0.011	ND	0.011	ND	0.012	ND	--	--	--	--	--	--
Dibenzofuran	NA	ug/l			16.0	--	--	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	--	--	--	--
Diethyl phthalate	NA	ug/l			12800	--	--	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	--	--	--	--
Dimethyl phthalate	NA	ug/l				--	--	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	--	--	--	--
Di-n-butyl phthalate	NA	ug/l			1600	--	--	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	--	--	--	--
Di-n-octyl phthalate	NA	ug/l			160	--	--	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	--	--	--	--
Fluoranthene	NA	ug/l			640	--	--	--	--	0.020	ND	0.0092	ND	0.0093	ND	0.0093	ND	0.020	ND	--	--	--	--	--	--
Fluorene	NA	ug/l			640	--	--	--	--	0.020	ND	0.0090	ND	0.0092	ND	0.0092	ND	0.020	ND	--	--	--	--	--	--
Hexachlorobenzene	NA	ug/l		0.0547	12.8	--	--	--	--	2.0	ND	0.59	ND	--	--	--	--	--	--	--	--	--	--	--	--
Hexachlorobutadiene	NA	ug/l		0.561	8.00	--	--	--	--	2.0	ND	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Hexachlorocyclopentadiene	NA	ug/l			48.0	--	--	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	--	--	--	--
Hexachloroethane	NA	ug/l		1.09	5.60	--	--	--	--	2.0	ND	1.9	ND	1.9	ND	1.9	ND	--	--	--	--	--	--	--	--
Indeno(1,2,3-cd)pyrene	NA	ug/l		0.120		--	--	--	--	0.020	ND	0.014	ND	0.014	ND	0.014	ND	0.020	ND	--	--	--	--	--	--
Isophorone	NA	ug/l		46.1	1600	--	--	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	--	--	--	--
Naphthalene	NA	ug/l	160		160	--	--	--	--	0.020	ND	0.013	0.037	0.014	ND	0.014	0.016	0.020	0.051	--	--	--	--	--	--
Nitrobenzene	NA	ug/l			16.0	--	--	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	--	--	--	--
n-Nitrosodimethylamine	NA	ug/l		0.000858	0.0640	--	--	--	--	1.5	ND	1.4	ND	1.4	ND	1.4	ND	--	--	--	--	--	--	--	--
n-Nitrosodi-n-propylamine	NA	ug/l		0.0125		--	--	--	--	2.0	ND	1.9	ND	1.9	ND	1.9	ND	--	--	--	--	--	--	--	--
n-Nitrosodiphenylamine	NA	ug/l		17.9		--	--	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	--	--	--	--
Pentachlorophenol	NA	ug/l		0.219	80.0	--	--	--	--	0.13	ND	0.12	ND	0.12	ND	0.12	ND	0.13	ND	--	--	--	--	--	--
Phenanthrene	NA	ug/l				--	--	--	--	0.020	ND	0.013	ND	0.014	ND	0.014	ND	0.020	ND	--	--	--	--	--	--
Phenol	NA	ug/l			2400	--	--	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	--	--	--	--
Pyrene	NA	ug/l			480	--	--	--	--	0.020	ND	0.010	0.028	0.011	ND	0.011	ND	0.020	ND	--	--	--	--	--	--

Table 2
Historical Groundwater Data - 2015 Landau PQLs vs. MTCA Cleanup Levels
Yakima Mill Site

					Location	MW-14		MW-14		MW-15		MW-15		MW-15		MW-15		MW-16		MW-16		MW-16		MW-16	
					Date	3/23/2015		6/23/2015		9/17/2014		12/18/2014		3/23/2015		6/23/2015		9/17/2014		12/18/2014		3/23/2015		6/24/2015	
					Sample Type	N		N		N		N		N		N		N		N		N		N	
					Result Type	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result
					Data Status	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource
Parameter	Total or Dissolved	Units	Washington GW Method A	Washington Groundwater Method B Cancer	Washington Groundwater Method B Noncancer																				
Effective Date			07/01/2015	07/01/2015	07/01/2015																				
Exceedance Key			No Exceedances	Shade	Border																				
Pyridine	NA	ug/l			8.00	--	--	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	--	--	--	--
VOCs						--		--		--		--		--		--		--		--		--		--	
1,1,1,2-Tetrachloroethane	NA	ug/l		1.68	240	--	--	--	--	0.10	ND	0.10	ND	0.10	ND	0.10	ND	--	--	--	--	--	--	--	--
1,1,1-Trichloroethane	NA	ug/l	200		16000	--	--	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	--	--	--	--
1,1,2,2-Tetrachloroethane	NA	ug/l		0.219	160	--	--	--	--	0.10	ND	0.10	ND	0.10	ND	0.10	ND	--	--	--	--	--	--	--	--
1,1,2-Trichloroethane	NA	ug/l		0.768	32.0	--	--	--	--	0.10	ND	0.10	ND	0.10	ND	0.10	ND	--	--	--	--	--	--	--	--
1,1-Dichloroethane	NA	ug/l		7.68	1600	--	--	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	--	--	--	--
1,1-Dichloroethylene	NA	ug/l			400	--	--	--	--	2.0	ND	0.014	ND	0.014	ND	0.014	ND	--	--	--	--	--	--	--	--
1,1-Dichloropropene	NA	ug/l				--	--	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	--	--	--	--
1,2,3-Trichlorobenzene	NA	ug/l				--	--	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	--	--	--	--
1,2,3-Trichloropropane	NA	ug/l		0.00146	32.0	--	--	--	--	0.023	ND	0.023	ND	0.023	ND	0.023	ND	--	--	--	--	--	--	--	--
1,2,4-Trichlorobenzene	NA	ug/l		1.51	80.0	--	--	--	--	0.10	ND	0.10	ND	0.10	ND	0.10	ND	--	--	--	--	--	--	--	--
1,2,4-Trimethylbenzene	NA	ug/l				--	--	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	--	--	--	--
1,2-Dibromo-3-chloropropane (DBCP)	NA	ug/l		0.0547	1.60	--	--	--	--	10	ND	0.10	ND	0.10	ND	0.10	ND	--	--	--	--	--	--	--	--
1,2-Dibromoethane (EDB)	NA	ug/l	0.0100	0.0219	72.0	--	--	--	--	0.010	ND	0.010	ND	0.010	ND	0.010	ND	--	--	--	--	--	--	--	--
1,2-Dichlorobenzene	NA	ug/l			720	--	--	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	--	--	--	--
1,2-Dichloroethane	NA	ug/l	5.00	0.481	48.0	--	--	--	--	2.0	ND	0.014	ND	0.014	ND	0.014	ND	--	--	--	--	--	--	--	--
1,2-Dichloroethylene, cis	NA	ug/l			16.0	--	--	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	--	--	--	--
1,2-Dichloroethylene, trans	NA	ug/l			160	--	--	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	--	--	--	--
1,2-Dichloropropane	NA	ug/l		1.22	720	--	--	--	--	0.10	ND	0.10	ND	0.10	ND	0.10	ND	--	--	--	--	--	--	--	--
1,3,5-Trimethylbenzene	NA	ug/l			80.0	--	--	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	--	--	--	--
1,3-Dichlorobenzene	NA	ug/l				--	--	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	--	--	--	--
1,3-Dichloropropane	NA	ug/l				--	--	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	--	--	--	--
1,3-Dichloropropene, cis	NA	ug/l		0.438	240	--	--	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	--	--	--	--
1,3-Dichloropropene, trans	NA	ug/l		0.438	240	--	--	--	--	2.0	ND	0.058	ND	0.058	ND	0.058	ND	--	--	--	--	--	--	--	--
1,4-Dichlorobenzene	NA	ug/l		8.10	560	--	--	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	--	--	--	--
2,2-Dichloropropane	NA	ug/l				--	--	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	--	--	--	--
2-Hexanone	NA	ug/l				--	--	--	--	10	ND	10	ND	10	ND	10	ND	--	--	--	--	--	--	--	--
Acetone	NA	ug/l			7200	--	--	--	--	25	ND	25	ND	25	ND	25	ND	--	--	--	--	--	--	--	--
Acrylonitrile	NA	ug/l		0.0810	320	--	--	--	--	10	ND	0.057	ND	0.057	ND	0.057	ND	--	--	--	--	--	--	--	--
Benzene	NA	ug/l	5.00	0.795	32.0	--	--	--	--	2.0	ND	0.028	ND	0.028	ND	0.028	ND	--	--	--	--	--	--	--	--
Bromobenzene	NA	ug/l				--	--	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	--	--	--	--
Bromochloromethane	NA	ug/l				--	--	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	--	--	--	--
Bromodichloromethane	NA	ug/l		0.706	160	--	--	--	--	0.059	ND	0.059	ND	0.059	ND	0.059	ND	--	--	--	--	--	--	--	--
Bromoform	NA	ug/l		5.54	160	--	--	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	--	--	--	--
Bromomethane	NA	ug/l			11.2	--	--	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	--	--	--	--
Butylbenzene	NA	ug/l			400	--	--	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	--	--	--	--
Butylbenzene, sec	NA	ug/l			800	--	--	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	--	--	--	--
Butylbenzene, tert	NA	ug/l			800	--	--	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	--	--	--	--
Carbon disulfide	NA	ug/l			800	--	--	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	--	--	--	--
Carbon tetrachloride	NA	ug/l		0.625	32.0	--	--	--	--	0.10	ND	0.10	ND	0.10	ND	0.10	ND	--	--	--	--	--	--	--	--
Chlorobenzene	NA	ug/l			160	--	--	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	--	--	--	--
Chlorodibromomethane	NA	ug/l		0.521	160	--	--	--	--	0.10	ND	0.10	ND	0.10	ND	0.10	ND	--	--	--	--	--	--	--	--
Chloroethane	NA	ug/l				--	--	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	--	--	--	--
Chloroform	NA	ug/l		1.41	80.0	--	--	--	--	0.10	ND	0.14	ND	0.14	ND	0.14	ND	--	--	--	--	--	--	--	--
Chloromethane	NA	ug/l				--	--	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	--	--	--	--
Chlorotoluene, o	NA	ug/l			160	--	--	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	--	--	--	--
Chlorotoluene, p	NA	ug/l				--	--	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	--	--	--	--
Cumene (isopropyl benzene)	NA	ug/l			800	--	--	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	--	--	--	--
Cymene p- (toluene isopropyl p-)	NA	ug/l				--	--	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	--	--	--	--
Dibromomethane (methylene bromide)	NA	ug/l			80.0	--	--	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	--	--	--	--
Dichlorodifluoromethane (Freon-12)	NA	ug/l			1600	--	--	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	--	--	--	--
Ethyl benzene	NA	ug/l	700		800	--	--	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	--	--	--	--
Hexachlorobutadiene	NA	ug/l		0.561	8.00	--	--	--	--	2.0	ND	0.069	ND	0.069	ND	0.069	ND	--	--	--	--	--	--	--	--
Hexane (C6)	NA	ug/l			480	--	--	--	--	--	--	--	--	--	--	2.0	ND	--	--	--	--	--	--	--	--
Methyl ethyl ketone (2-butanone)	NA	ug/l			4800	--	--	--	--	10	ND	10	ND	10	ND	10	ND	--	--	--	--	--	--	--	--
Methyl isobutyl ketone (MIBK)	NA	ug/l			640	--	--	--	--	10	ND	10	ND	10	ND	10	ND	--	--	--	--	--	--	--	--
Methyl tertiary butyl ether (MTBE)	NA	ug/l	20.0	24.3		--	--	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	--	--	--	--

Table 2
Historical Groundwater Data - 2015 Landau PQLs vs. MTCA Cleanup Levels
Yakima Mill Site

					Location	MW-14		MW-14		MW-15		MW-15		MW-15		MW-15		MW-16		MW-16		MW-16		MW-16	
					Date	3/23/2015		6/23/2015		9/17/2014		12/18/2014		3/23/2015		6/23/2015		9/17/2014		12/18/2014		3/23/2015		6/24/2015	
					Sample Type	N		N		N		N		N		N		N		N		N		N	
					Result Type	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result
					Data Status	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource
Parameter	Total or Dissolved	Units	Washington GW Method A	Washington Groundwater Method B Cancer	Washington Groundwater Method B Noncancer																				
Effective Date			07/01/2015	07/01/2015	07/01/2015																				
Exceedance Key			No Exceedances	Shade	Border																				
Methylene chloride	NA	ug/l	5.00	21.9	48.0	--	--	--	--	5.0	ND	0.68	ND	0.68	ND	0.68	ND	--	--	--	--	--	--	--	--
Naphthalene	NA	ug/l	160		160	--	--	--	--	2.0	ND	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Propylbenzene	NA	ug/l			800	--	--	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	--	--	--	--
Styrene	NA	ug/l			1600	--	--	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	--	--	--	--
Tetrachloroethylene	NA	ug/l	5.00	20.8	48.0	--	--	--	--	2.0	ND	0.023	ND	0.023	ND	0.023	ND	--	--	--	--	--	--	--	--
Toluene	NA	ug/l	1000		640	--	--	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	--	--	--	--
Trichloroethylene (TCE)	NA	ug/l	5.00	0.540	4.00	--	--	--	--	0.020	ND	0.054	ND	0.054	ND	0.054	ND	--	--	--	--	--	--	--	--
Trichlorofluoromethane (Freon-11)	NA	ug/l			2400	--	--	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	--	--	--	--
Vinyl chloride	NA	ug/l	0.200		24.0	--	--	--	--	0.20	ND	0.031	ND	0.031	ND	0.031	ND	--	--	--	--	--	--	--	--
Xylene, m & p	NA	ug/l			1600	--	--	--	--	4.0	ND	4.0	ND	4.0	ND	4.0	ND	--	--	--	--	--	--	--	--
Xylene, o	NA	ug/l			1600	--	--	--	--	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--	--	--	--	--	--	--
Pesticides																									
4,4'-DDD	NA	ug/l		0.365		--	--	--	--	0.010	ND	0.011	ND	0.010	ND	0.010	ND	--	--	--	--	--	--	--	--
4,4'-DDE	NA	ug/l		0.257		--	--	--	--	0.010	ND	0.011	ND	0.010	ND	0.010	ND	--	--	--	--	--	--	--	--
4,4'-DDT	NA	ug/l	0.300	0.257	8.00	--	--	--	--	0.010	ND	0.011	ND	0.010	ND	0.010	ND	--	--	--	--	--	--	--	--
a-BHC	NA	ug/l		0.0139	128	--	--	--	--	0.010	ND	0.011	ND	0.010	ND	0.010	ND	--	--	--	--	--	--	--	--
Aldrin	NA	ug/l		0.00257	0.240	--	--	--	--	0.010	ND	0.011	ND	0.010	ND	0.010	ND	--	--	--	--	--	--	--	--
b-BHC	NA	ug/l		0.0486		--	--	--	--	0.010	ND	0.011	ND	0.010	ND	0.010	ND	--	--	--	--	--	--	--	--
Chlordane, alpha & gamma	NA	ug/l		0.250	8.00	--	--	--	--	0.010	ND	0.011	ND	0.010	ND	0.010	ND	--	--	--	--	--	--	--	--
d-BHC	NA	ug/l				--	--	--	--	0.010	ND	0.011	ND	0.010	ND	0.010	ND	--	--	--	--	--	--	--	--
Dieldrin	NA	ug/l		0.00547	0.800	--	--	--	--	0.010	ND	0.011	ND	0.010	ND	0.010	ND	--	--	--	--	--	--	--	--
Endosulfan I	NA	ug/l			96.0	--	--	--	--	0.010	ND	0.011	ND	0.010	ND	0.010	ND	--	--	--	--	--	--	--	--
Endosulfan II	NA	ug/l			96.0	--	--	--	--	0.012	ND	0.011	ND	0.010	0.017	0.010	ND	--	--	--	--	--	--	--	--
Endosulfan sulfate	NA	ug/l			96.0	--	--	--	--	0.010	ND	0.011	ND	0.010	ND	0.010	ND	--	--	--	--	--	--	--	--
Endrin	NA	ug/l			4.80	--	--	--	--	0.010	ND	0.011	ND	0.010	ND	0.010	ND	--	--	--	--	--	--	--	--
Endrin aldehyde	NA	ug/l				--	--	--	--	0.010	ND	0.011	ND	0.010	ND	0.010	ND	--	--	--	--	--	--	--	--
g-BHC (Lindane)	NA	ug/l	0.200	0.0795	4.80	--	--	--	--	0.010	ND	0.011	ND	0.010	ND	0.010	ND	--	--	--	--	--	--	--	--
Heptachlor	NA	ug/l		0.0194	8.00	--	--	--	--	0.010	ND	0.011	ND	0.010	ND	0.010	ND	--	--	--	--	--	--	--	--
Heptachlor epoxide	NA	ug/l		0.00481	0.104	--	--	--	--	0.010	ND	0.011	ND	0.010	ND	0.010	ND	--	--	--	--	--	--	--	--
Hexachlorobenzene	NA	ug/l		0.0547	12.8	--	--	--	--	--	--	0.011	ND	0.010	ND	0.010	ND	--	--	--	--	--	--	--	--
Methoxychlor	NA	ug/l			80.0	--	--	--	--	0.010	ND	0.011	ND	0.010	ND	0.010	ND	--	--	--	--	--	--	--	--
Toxaphene	NA	ug/l		0.0795		--	--	--	--	0.50	ND	0.52	ND	0.50	ND	0.50	ND	--	--	--	--	--	--	--	--
PCBs																									
Aroclor 1016	NA	ug/l		1.25	1.12	0.0050	ND	0.0050	ND	0.0050	ND	0.0051	ND	0.0050	ND	0.0050	ND	--	--	--	--	0.0050	ND	0.0050	ND
Aroclor 1221	NA	ug/l				0.010	ND	0.010	ND	0.010	ND	0.011	ND	0.010	ND	0.010	ND	--	--	--	--	0.010	ND	0.010	ND
Aroclor 1232	NA	ug/l				0.0050	ND	0.0050	ND	0.0050	ND	0.0051	ND	0.0050	ND	0.0050	ND	--	--	--	--	0.0065	ND	0.0050	ND
Aroclor 1242	NA	ug/l				0.0050	ND	0.0050	ND	0.0050	ND	0.0051	ND	0.0050	ND	0.005	0.0063	--	--	--	--	0.0050	ND	0.0050	ND
Aroclor 1248	NA	ug/l				0.0050	ND	0.0050	ND	0.0050	ND	0.0051	ND	0.0050	ND	0.0050	ND	--	--	--	--	0.0050	ND	0.0050	ND
Aroclor 1254	NA	ug/l		0.0438	0.320	0.0050	ND	0.0050	ND	0.0050	ND	0.0051	ND	0.0050	ND	0.0050	ND	--	--	--	--	0.0050	ND	0.0050	ND
Aroclor 1260	NA	ug/l		0.0438		0.0050	ND	0.0050	ND	0.0050	ND	0.0051	ND	0.0050	ND	0.0050	ND	--	--	--	--	0.0050	ND	0.0050	ND
Total Petroleum Hydrocarbons																									
Total Petroleum Hydrocarbons (as diesel)	NA	ug/l	500			310	ND	310	ND	310	ND	310	ND	310	ND	310	ND	310	ND	310	ND	310	ND	310	ND
Total Petroleum Hydrocarbons (as diesel), silica gel	NA	ug/l	500			--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Total Petroleum Hydrocarbons (as gasoline)	NA	ug/l	800			130	ND	130	ND	130	ND	130	ND	130	ND	130	ND	130	ND	130	ND	130	ND	130	ND
Total Petroleum Hydrocarbons (as motor oil)	NA	ug/l	500			310	ND	310	ND	310	ND	310	ND	310	ND	310	ND	310	ND	310	ND	310	ND	310	ND
Total Petroleum Hydrocarbons (as motor oil), silica gel	NA	ug/l	500			--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--

Landau qualifier - J: Indicates the analyte was positively identified; the associated numerical value is the approximate concentration of the analyte in the sample.

Landau qualifier - UJ: The analyte was not detected in the sample; the reported sample reporting limit is an estimate.

N: Normal Sample.

FD: Field Duplicate Sample.

ND: Not detected.

PQL: Practical Quantitation Limit.

SSource: Laboratory and/or field data obtained from a secondary source external to Barr. Second source QA/QC evaluation procedures may or may not have been performed beyond the original data generator.

Table was updated (items in red) after original submittal to add Landau qualifiers to be consistent with the memo.

Table 2
Historical Groundwater Data - 2015 Landau PQLs vs. MTCA Cleanup Levels
Yakima Mill Site

					Location	MW-17		MW-17		MW-17		MW-17		MW-18		MW-18		MW-18		MW-18		TP-MW-01	
					Date	9/17/2014		12/18/2014		3/23/2015		6/24/2015		9/15/2014		12/19/2014		3/26/2015		6/25/2015		9/17/2014	
					Sample Type	N		N		N		N		N		N		N		N		N	
					Result Type	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result
					Data Status	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource
Parameter	Total or Dissolved	Units	Washington GW Method A	Washington Groundwater Method B Cancer	Washington Groundwater Method B Noncancer																		
Effective Date			07/01/2015	07/01/2015	07/01/2015																		
Exceedance Key			No Exceedances	Shade	Border																		
General Parameters																							
Alkalinity, bicarbonate, as CaCO3	NA	mg/l				15	210	0.0	230	0.0	240	15	240	15	260	15	220	0.0	210	15	260	--	--
Alkalinity, total, as CaCO3	NA	mg/l				15	210	0.0	230	0.0	240	15	240	15	260	15	220	0.0	210	15	260	--	--
Carbon, total organic	NA	mg/l				0.50	4.3	0.50	4.2	0.50	4	0.50	4.1	0.50	8.2	0.50	5.7	0.50	6	0.50	8.6	--	--
Chloride	NA	mg/l				0.46	10	0.46	20	0.46	18	0.92	18	0.46	19	0.46	18	0.092	19	0.92	16	0.092	7.2
Fluoride	NA	mg/l			0.64	0.16	0.21	0.16	ND	0.16	0.17	0.16	ND	0.16	0.19	0.16	ND	0.16	ND	0.16	ND	0.16	ND
Nitrogen, ammonia, as N	NA	mg/l				0.050	3.1	0.050	3.0	0.050	2.6	0.050	2.8	0.050	1.2	0.050	0.65	0.050	0.53	0.050	0.50	--	--
Nitrogen, nitrate, as N	NA	mg/l			25.6	0.034	0.054	0.034	0.072	0.034	0.23	0.036	ND	0.034	ND	0.034	0.047	0.034	ND	0.034	ND	1.9	ND
Nitrogen, nitrite, as N	NA	mg/l			1.6	0.043	ND	0.043	ND	0.043	ND	0.043	ND	0.043	ND	0.043	ND	0.043	ND	0.043	ND	0.043	ND UJ
Solids, total dissolved	NA	mg/l				5.0	280	5.0	250	5.0	280	5.0	270	5.0	310	5.0	250	5.0	260	5.0	310	--	--
Sulfate, as SO4	NA	mg/l				0.26	3.5	0.26	ND	0.26	0.35	0.70	ND	0.26	0.36	0.26	ND	0.26	ND	0.26	ND	0.26	9
Metals																							
Arsenic	Dissolved	ug/l	5.00	0.0583	4.80	1.0	2.6	0.45	1.4	0.45	1.6	0.45	2.0	1.0	8	0.45	7.3	0.45	6.8	0.45	7.7	1.0	ND
Arsenic	Total	ug/l	5.00	0.0583	4.80	1.0	2.4	0.45	1.8	0.45	2.6	2.1	ND	1.0	8	0.45	7.5	0.45	6.8	0.45	7.7	1.0	ND
Barium	Dissolved	ug/l			3200	1.0	55	1.0	72	1.0	68	1.0	68	1.0	36	1.0	37	1.0	38	1.0	40	1.0	8.3
Barium	Total	ug/l			3200	1.0	57	1.0	74	1.0	69	1.0	65	1.0	39	1.0	42	1.0	39	1.0	41	1.0	9.2
Cadmium	Dissolved	ug/l	5.00		8.00	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND
Cadmium	Total	ug/l	5.00		8.00	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND
Calcium	Dissolved	ug/l				100	34000	100	43000	100	45000	100	44000	100	47000	100	42000	100	44000	100	51000	100	19000
Calcium	Total	ug/l				100	34000	100	46000	100	47000	100	41000	100	50000	100	46000	100	45000	100	53000	100	20000
Chromium	Dissolved	ug/l	50.0			2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
Chromium	Total	ug/l	50.0			2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND
Chromium, hexavalent	Dissolved	ug/l			48.0	10	ND	--	--	--	--	--	--	10	ND	--	--	--	--	--	--	--	--
Chromium, hexavalent	Total	ug/l			48.0	10	ND	--	--	--	--	--	--	10	ND	--	--	--	--	--	--	--	--
Iron	Dissolved	ug/l			11200	50	16000	50	21000	50	20000	50	22000	50	41000	50	37000	50	38000	50	44000	50	ND
Iron	Total	ug/l			11200	50	17000	50	22000	50	21000	50	21000	50	44000	50	40000	50	39000	50	46000	50	ND
Lead	Dissolved	ug/l	15.0			1.0	ND	0.28	ND	0.28	ND	0.28	ND	1.0	ND	0.28	ND	0.28	ND	0.28	ND	1.0	ND
Lead	Total	ug/l	15.0			1.0	ND	0.28	ND	0.28	ND	0.28	ND	1.0	ND	0.28	ND	0.28	ND	0.28	ND	1.0	ND
Magnesium	Dissolved	ug/l				50	11000	50	15000	50	16000	50	16000	50	19000	50	16000	50	17000	50	21000	50	6600
Magnesium	Total	ug/l				50	12000	50	16000	50	17000	50	14000	50	20000	50	17000	50	17000	50	22000	50	6700
Manganese	Dissolved	ug/l			2240	2.0	2000	2.0	2100	2.0	2200	2.0	2200	2.0	4400	2.0	3300	2.0	3400	10	4600	2.0	ND
Manganese	Total	ug/l			2240	2.0	2000	2.0	2300	2.0	2200	2.0	2000	2.0	4700	2.0	3600	2.0	3500	10	4900	2.0	5.8
Mercury	Dissolved	ug/l	2.00			0.20	ND	0.11	ND	0.11	ND	0.11	ND	0.20	ND	0.11	ND	0.20	ND	0.11	ND	0.20	ND
Mercury	Total	ug/l	2.00			0.20	ND	0.11	ND	0.11	ND	0.11	ND	0.20	ND	0.11	ND	0.11	ND	0.11	ND	0.20	ND
Potassium	Dissolved	ug/l				--	--	--	--	50	9500	50	9400	--	--	--	--	50	3700	50	3300	--	--
Potassium	Total	ug/l				--	--	--	--	50	9800	50	8600	--	--	--	--	50	3700	50	3300	--	--
Selenium	Dissolved	ug/l			80.0	4.0	ND	4.0	ND	4.0	ND	4.0	ND	4.0	ND	4.0	ND	4.0	ND	4.0	ND	4.0	ND
Selenium	Total	ug/l			80.0	4.0	ND	4.0	ND	4.0	ND	4.0	ND	4.0	ND	4.0	ND	4.0	ND	4.0	ND	4.0	ND
Silver	Dissolved	ug/l			80.0	1.0	ND	0.20	ND	0.20	ND	0.20	ND	1.0	ND	0.20	ND	0.20	ND	0.20	ND	1.0	ND
Silver	Total	ug/l			80.0	1.0	ND	0.20	ND	0.20	ND	0.20	ND	1.0	ND	0.20	ND	0.20	ND	0.20	ND	1.0	ND
Sodium	Dissolved	ug/l				50	22000	50	25000	50	25000	50	24000	50	14000	50	15000	50	15000	50	14000	50	11000
Sodium	Total	ug/l				50	23000	50	27000	50	26000	50	21000	50	15000	50	15000	50	15000	50	15000	50	11000
SVOCs																							
1,2,4-Trichlorobenzene	NA	ug/l		1.51	80.0	2.0	ND	2.0	ND	--	--	--	--	2.0	ND	2.0	ND	--	--	--	--	--	--
1,2-Dichlorobenzene	NA	ug/l			720	2.0	ND	2.0	ND	--	--	--	--	2.0	ND	2.0	ND	--	--	--	--	--	--
1,3-Dichlorobenzene	NA	ug/l				2.0	ND	2.0	ND	--	--	--	--	2.0	ND	2.0	ND	--	--	--	--	--	--
1,4-Dichlorobenzene	NA	ug/l		8.10	560	2.0	ND	2.0	ND	--	--	--	--	2.0	ND	2.0	ND	--	--	--	--	--	--
1-Methylnaphthalene	NA	ug/l		1.51	560	0.020	ND	0.020	ND	0.020	ND	0.020	ND	0.020	ND	0.020	ND	0.020	ND	0.020	ND	0.020	ND
2,2'-oxybis (1-chloropropane)	NA	ug/l		0.625	320	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--
2,3,4,6-Tetrachlorophenol	NA	ug/l			480	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--
2,4,5-Trichlorophenol	NA	ug/l			800	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--
2,4,6-Trichlorophenol	NA	ug/l		3.98	8.00	2.0	ND	0.83	ND	0.83	ND	0.84	ND	2.0	ND	0.83	ND	0.83	ND	0.84	ND	--	--
2,4-Dichlorophenol	NA	ug/l			24.0	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--
2,4-Dimethylphenol	NA	ug/l			160	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--
2,4-Dinitrophenol	NA	ug/l			32.0	10	ND	10	ND	10	ND	10	ND	10	ND	10	ND	10	ND	10	ND	--	--
2,4-Dinitrotoluene	NA	ug/l		0.282	32.0	0.78	ND	0.72	ND	0.72	ND	0.73	ND	0.78	ND	0.72	ND	0.72	ND	0.73	ND	--	--
2,6-Dichlorophenol	NA	ug/l				2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--

Table 2
Historical Groundwater Data - 2015 Landau PQLs vs. MTCA Cleanup Levels
Yakima Mill Site

					Location	MW-17		MW-17		MW-17		MW-17		MW-18		MW-18		MW-18		MW-18		TP-MW-01	
					Date	9/17/2014		12/18/2014		3/23/2015		6/24/2015		9/15/2014		12/19/2014		3/26/2015		6/25/2015		9/17/2014	
					Sample Type	N		N		N		N		N		N		N		N		N	
					Result Type	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result
					Data Status	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource
Parameter	Total or Dissolved	Units	Washington GW Method A	Washington Groundwater Method B Cancer	Washington Groundwater Method B Noncancer																		
Effective Date			07/01/2015	07/01/2015	07/01/2015																		
Exceedance Key			No Exceedances	Shade	Border																		
2,6-Dinitrotoluene	NA	ug/l		0.0583	4.80	1.8	ND	1.7	ND	1.7	ND	1.7	ND	1.8	ND	1.7	ND	1.7	ND	1.7	ND	--	--
2-Chloronaphthalene	NA	ug/l			640	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--
2-Chlorophenol	NA	ug/l			40.0	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--
2-Methyl-4,6-dinitrophenol	NA	ug/l				2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--
2-Methylnaphthalene	NA	ug/l			32.0	0.020	ND	0.020	ND	0.020	ND	0.020	ND	0.020	ND	0.020	ND	0.020	ND	0.020	ND	0.020	ND
2-Methylphenol (o-cresol)	NA	ug/l			400	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--
2-Nitroaniline	NA	ug/l			160	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--
2-Nitrophenol	NA	ug/l				2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--
3,3`-Dichlorobenzidine	NA	ug/l		0.194		2.0	ND	1.9	ND	1.9	ND	1.9	ND	2.0	ND	1.9	ND	1.9	ND	1.9	ND	--	--
3,4-Methylphenol (m,p cresols)	NA	ug/l				2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--
3-Nitroaniline	NA	ug/l				5.0	ND	5.0	ND	5.0	ND	5.0	ND	5.0	ND	5.0	ND	5.0	ND	5.0	ND	--	--
4-Bromophenyl phenyl ether	NA	ug/l				2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--
4-Chloro-3-methylphenol	NA	ug/l				2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--
4-Chloroaniline	NA	ug/l		0.219	32.0	2.0	ND	1.8	ND	1.8	ND	1.8	ND	2.0	ND	1.8	ND	1.8	ND	1.8	ND	--	--
4-Chlorophenyl phenyl ether	NA	ug/l				2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--
4-Nitroaniline	NA	ug/l				2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--
4-Nitrophenol	NA	ug/l				2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--
Acenaphthene	NA	ug/l			960	0.020	ND	0.014	ND	0.014	ND	0.014	ND	0.020	ND	0.014	ND	0.014	ND	0.014	0.019	0.020	ND
Acenaphthylene	NA	ug/l				0.020	ND	0.020	ND	0.020	ND	0.020	ND	0.020	ND	0.020	ND	0.020	ND	0.020	ND	0.020	ND
Aniline	NA	ug/l		7.68	56.0	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--
Anthracene	NA	ug/l			4800	0.020	ND	0.010	ND	0.010	ND	0.010	ND	0.020	ND	0.010	0.015	0.010	ND	0.010	ND	0.020	ND
Azobenzene	NA	ug/l		0.795		2.0	ND	1.5	ND	1.5	ND	1.5	ND	2.0	ND	1.5	ND	1.5	ND	1.5	ND	--	--
Benz(a)anthracene	NA	ug/l		0.120		0.020	ND	0.017	ND	0.017	ND	0.017	ND	0.020	ND	0.017	ND	0.017	ND	0.017	ND	0.020	ND
Benzo(a)pyrene	NA	ug/l	0.100	0.0120		0.029	ND	0.027	ND	0.027	ND	0.027	ND	0.029	ND	0.027	ND	0.027	ND	0.027	ND	0.029	ND
Benzo(b)fluoranthene	NA	ug/l		0.120		0.020	ND	0.0068	ND	0.0068	ND	0.0068	ND	0.020	ND	0.0068	ND	0.0068	ND	0.0068	ND	0.020	ND
Benzo(g,h,i)perylene	NA	ug/l				0.020	ND	0.019	ND	0.019	ND	0.019	ND	0.020	ND	0.019	ND	0.019	ND	0.019	ND	0.020	ND
Benzo(k)fluoranthene	NA	ug/l		1.20		0.020	ND	0.013	ND	0.013	ND	0.013	ND	0.020	ND	0.013	ND	0.013	ND	0.013	ND	0.020	ND
Benzoic acid	NA	ug/l			64000	10	ND	10	ND	10	ND	10	ND	10	ND	10	ND	10	ND	10	ND	--	--
Benzyl alcohol	NA	ug/l			800	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--
Bis(2-chloroethoxy)methane	NA	ug/l				2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--
Bis(2-chloroethyl)ether	NA	ug/l		0.0398		0.94	ND	0.87	ND	0.87	ND	0.88	ND	0.94	ND	0.87	ND	0.87	ND	0.88	ND	--	--
Bis(2-ethylhexyl)phthalate	NA	ug/l		6.25	320	2.0	ND	0.75	ND	0.75	ND	0.75	ND	2.0	ND	0.75	32	0.75	ND	0.76	ND	--	--
Butyl benzyl phthalate	NA	ug/l		46.1	3200	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--
Carbazole	NA	ug/l				2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--
Chrysene	NA	ug/l		12.0		0.020	ND	0.018	ND	0.018	ND	0.018	ND	0.020	ND	0.018	ND	0.018	ND	0.018	ND	0.020	ND
Dibenz(a,h)anthracene	NA	ug/l		0.0120		0.012	ND	0.011	ND	0.011	ND	0.011	ND	0.012	ND	0.011	ND	0.011	ND	0.011	ND	0.012	ND
Dibenzofuran	NA	ug/l			16.0	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--
Diethyl phthalate	NA	ug/l			12800	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--
Dimethyl phthalate	NA	ug/l				2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--
Di-n-butyl phthalate	NA	ug/l			1600	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--
Di-n-octyl phthalate	NA	ug/l			160	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--
Fluoranthene	NA	ug/l			640	0.020	ND	0.0092	ND	0.0092	ND	0.0092	ND	0.020	ND	0.0092	ND	0.0092	ND	0.0092	ND	0.020	ND
Fluorene	NA	ug/l			640	0.020	ND	0.009	0.010	0.009	0.014	0.0091	ND	0.020	ND	0.009	0.012	0.0090	ND	0.0091	ND	0.020	ND
Hexachlorobenzene	NA	ug/l		0.0547	12.8	2.0	ND	0.59	ND	--	--	--	--	2.0	ND	0.59	ND	--	--	--	--	--	--
Hexachlorobutadiene	NA	ug/l		0.561	8.00	2.0	ND	--	--	--	--	--	--	2.0	ND	--	--	--	--	--	--	--	--
Hexachlorocyclopentadiene	NA	ug/l			48.0	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--
Hexachloroethane	NA	ug/l		1.09	5.60	2.0	ND	1.9	ND	1.9	ND	1.9	ND	2.0	ND	1.9	ND	1.9	ND	1.9	ND	--	--
Indeno(1,2,3-cd)pyrene	NA	ug/l		0.120		0.020	ND	0.014	ND	0.014	ND	0.014	ND	0.020	ND	0.014	ND	0.014	ND	0.014	ND	0.020	ND
Isophorone	NA	ug/l		46.1	1600	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--
Naphthalene	NA	ug/l	160		160	0.020	0.025	0.013	ND	0.013	ND	0.013	ND	0.020	ND	0.013	ND	0.013	0.014	0.013	ND	0.020	0.029
Nitrobenzene	NA	ug/l			16.0	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--
n-Nitrosodimethylamine	NA	ug/l		0.000858	0.0640	1.5	ND	1.4	ND	1.4	ND	1.4	ND	1.5	ND	1.4	ND	1.4	ND	1.4	ND	--	--
n-Nitrosodi-n-propylamine	NA	ug/l		0.0125		2.0	ND	1.9	ND	1.9	ND	1.9	ND	2.0	ND	1.9	ND	1.9	ND	1.9	ND	--	--
n-Nitrosodiphenylamine	NA	ug/l		17.9		2.0	ND	2.0	ND	2.0	ND	2.0	2.1	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--
Pentachlorophenol	NA	ug/l		0.219	80.0	0.13	ND	0.12	ND	0.12	ND	0.12	ND	0.13	ND	0.12	ND	0.12	ND	0.12	ND	0.13	ND
Phenanthrene	NA	ug/l				0.020	ND	0.013	ND	0.013	ND	0.013	ND	0.020	ND	0.013	0.015	0.013	ND	0.013	ND	0.020	ND
Phenol	NA	ug/l			2400	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--
Pyrene	NA	ug/l			480	0.020	ND	0.010	0.016	0.010	ND	0.011	ND	0.020	ND	0.010	ND	0.010	ND	0.011	ND	0.020	ND

Table 2
Historical Groundwater Data - 2015 Landau PQLs vs. MTCA Cleanup Levels
Yakima Mill Site

					Location	MW-17		MW-17		MW-17		MW-17		MW-18		MW-18		MW-18		MW-18		TP-MW-01	
					Date	9/17/2014		12/18/2014		3/23/2015		6/24/2015		9/15/2014		12/19/2014		3/26/2015		6/25/2015		9/17/2014	
					Sample Type	N		N		N		N		N		N		N		N		N	
					Result Type	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result
					Data Status	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource
Parameter	Total or Dissolved	Units	Washington GW Method A	Washington Groundwater Method B Cancer	Washington Groundwater Method B Noncancer																		
Effective Date			07/01/2015	07/01/2015	07/01/2015																		
Exceedance Key			No Exceedances	Shade	Border																		
Pyridine	NA	ug/l			8.00	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--
VOCs						--		--		--		--		--		--		--		--		--	
1,1,1,2-Tetrachloroethane	NA	ug/l		1.68	240	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND	--	--
1,1,1-Trichloroethane	NA	ug/l	200		16000	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--
1,1,2,2-Tetrachloroethane	NA	ug/l		0.219	160	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND	--	--
1,1,2-Trichloroethane	NA	ug/l		0.768	32.0	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND	--	--
1,1-Dichloroethane	NA	ug/l		7.68	1600	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--
1,1-Dichloroethylene	NA	ug/l			400	2.0	ND	0.014	ND	0.014	ND	0.014	ND	2.0	ND	0.014	ND	0.014	ND	0.014	ND	--	--
1,1-Dichloropropene	NA	ug/l				2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--
1,2,3-Trichlorobenzene	NA	ug/l				2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--
1,2,3-Trichloropropane	NA	ug/l		0.00146	32.0	0.023	ND	0.023	ND	0.023	ND	0.023	ND	0.023	ND	0.023	ND	0.023	ND	0.023	ND	--	--
1,2,4-Trichlorobenzene	NA	ug/l		1.51	80.0	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND	--	--
1,2,4-Trimethylbenzene	NA	ug/l				2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--
1,2-Dibromo-3-chloropropane (DBCP)	NA	ug/l		0.0547	1.60	10	ND	0.10	ND	0.10	ND	0.10	ND	10	ND	0.10	ND	0.10	ND	0.10	ND	--	--
1,2-Dibromoethane (EDB)	NA	ug/l	0.0100	0.0219	72.0	0.010	ND	0.010	ND	0.010	ND	0.010	ND	0.010	ND	0.010	ND	0.010	ND	0.010	ND	--	--
1,2-Dichlorobenzene	NA	ug/l			720	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--
1,2-Dichloroethane	NA	ug/l	5.00	0.481	48.0	2.0	ND	0.014	ND	0.014	ND	0.014	ND	2.0	ND	0.014	ND	0.014	ND	0.014	ND	--	--
1,2-Dichloroethylene, cis	NA	ug/l			16.0	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--
1,2-Dichloroethylene, trans	NA	ug/l			160	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--
1,2-Dichloropropane	NA	ug/l		1.22	720	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND	--	--
1,3,5-Trimethylbenzene	NA	ug/l			80.0	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--
1,3-Dichlorobenzene	NA	ug/l				2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--
1,3-Dichloropropane	NA	ug/l				2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--
1,3-Dichloropropene, cis	NA	ug/l		0.438	240	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--
1,3-Dichloropropene, trans	NA	ug/l		0.438	240	2.0	ND	0.058	ND	0.058	ND	0.058	ND	2.0	ND	0.058	ND	0.058	ND	0.058	ND	--	--
1,4-Dichlorobenzene	NA	ug/l		8.10	560	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--
2,2-Dichloropropane	NA	ug/l				2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--
2-Hexanone	NA	ug/l				10	ND	10	ND	10	ND	10	ND	10	ND	10	ND	10	ND	10	ND	--	--
Acetone	NA	ug/l			7200	25	ND	25	ND	25	ND	25	ND	25	ND	25	ND	25	ND	25	ND	--	--
Acrylonitrile	NA	ug/l		0.0810	320	10	ND	0.057	ND	0.057	ND	0.057	ND	10	ND	0.057	ND	0.057	ND	0.057	ND	--	--
Benzene	NA	ug/l	5.00	0.795	32.0	2.0	ND	0.028	ND	0.028	ND	0.028	ND	2.0	ND	0.028	ND	0.028	ND	0.028	ND	--	--
Bromobenzene	NA	ug/l				2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--
Bromochloromethane	NA	ug/l				2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--
Bromodichloromethane	NA	ug/l		0.706	160	0.059	ND	0.059	ND	0.059	ND	0.059	ND	0.059	ND	0.059	ND	0.059	ND	0.059	ND	--	--
Bromoform	NA	ug/l		5.54	160	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--
Bromomethane	NA	ug/l			11.2	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--
Butylbenzene	NA	ug/l			400	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--
Butylbenzene, sec	NA	ug/l			800	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--
Butylbenzene, tert	NA	ug/l			800	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--
Carbon disulfide	NA	ug/l			800	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--
Carbon tetrachloride	NA	ug/l		0.625	32.0	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND	--	--
Chlorobenzene	NA	ug/l			160	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--
Chlorodibromomethane	NA	ug/l		0.521	160	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.10	ND	--	--
Chloroethane	NA	ug/l				2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--
Chloroform	NA	ug/l		1.41	80.0	0.10	ND	0.14	ND	0.14	ND	0.14	ND	0.10	ND	0.14	ND	0.14	ND	0.14	ND	--	--
Chloromethane	NA	ug/l				2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--
Chlorotoluene, o	NA	ug/l			160	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--
Chlorotoluene, p	NA	ug/l				2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--
Cumene (isopropyl benzene)	NA	ug/l			800	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--
Cymene p- (toluene isopropyl p-)	NA	ug/l				2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--
Dibromomethane (methylene bromide)	NA	ug/l			80.0	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--
Dichlorodifluoromethane (Freon-12)	NA	ug/l			1600	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--
Ethyl benzene	NA	ug/l	700		800	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--
Hexachlorobutadiene	NA	ug/l		0.561	8.00	2.0	ND	0.069	ND	0.069	ND	0.069	ND	2.0	ND	0.069	ND	0.069	ND	0.069	ND	--	--
Hexane (C6)	NA	ug/l			480	--	--	--	--	--	--	2.0	ND	--	--	--	--	--	--	2.0	ND	--	--
Methyl ethyl ketone (2-butanone)	NA	ug/l			4800	10	ND	10	ND	10	ND	10	ND	10	ND	10	ND	10	ND	10	ND	--	--
Methyl isobutyl ketone (MIBK)	NA	ug/l			640	10	ND	10	ND	10	ND	10	ND	10	ND	10	ND	10	ND	10	ND	--	--
Methyl tertiary butyl ether (MTBE)	NA	ug/l	20.0	24.3		2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--

Table 2
Historical Groundwater Data - 2015 Landau PQLs vs. MTCA Cleanup Levels
Yakima Mill Site

					Location	MW-17		MW-17		MW-17		MW-17		MW-18		MW-18		MW-18		MW-18		TP-MW-01	
					Date	9/17/2014		12/18/2014		3/23/2015		6/24/2015		9/15/2014		12/19/2014		3/26/2015		6/25/2015		9/17/2014	
					Sample Type	N		N		N		N		N		N		N		N		N	
					Result Type	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result
					Data Status	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource
Parameter	Total or Dissolved	Units	Washington GW Method A	Washington Groundwater Method B Cancer	Washington Groundwater Method B Noncancer																		
Effective Date			07/01/2015	07/01/2015	07/01/2015																		
Exceedance Key			No Exceedances	Shade	Border																		
Methylene chloride	NA	ug/l	5.00	21.9	48.0	5.0	ND	0.68	ND	0.68	ND	0.68	ND	5.0	ND	0.68	ND	0.68	ND	0.68	ND	--	--
Naphthalene	NA	ug/l	160		160	2.0	ND	--	--	--	--	--	--	2.0	ND	--	--	--	--	--	--	--	--
Propylbenzene	NA	ug/l			800	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--
Styrene	NA	ug/l			1600	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--
Tetrachloroethylene	NA	ug/l	5.00	20.8	48.0	2.0	ND	0.023	ND	0.023	ND	0.023	ND	2.0	ND	0.023	ND	0.023	ND	0.023	ND	--	--
Toluene	NA	ug/l	1000		640	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--
Trichloroethylene (TCE)	NA	ug/l	5.00	0.540	4.00	0.020	ND	0.054	ND	0.054	ND	0.054	ND	0.020	ND	0.054	ND	0.054	ND	0.054	ND	--	--
Trichlorofluoromethane (Freon-11)	NA	ug/l			2400	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--
Vinyl chloride	NA	ug/l	0.200		24.0	0.20	ND	0.031	ND	0.031	ND	0.031	ND	0.20	ND	0.031	ND	0.031	ND	0.031	ND	--	--
Xylene, m & p	NA	ug/l			1600	4.0	ND	4.0	ND	4.0	ND	4.0	ND	4.0	ND	4.0	ND	4.0	ND	4.0	ND	--	--
Xylene, o	NA	ug/l			1600	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	--	--
Pesticides																							
4,4'-DDD	NA	ug/l		0.365		0.010	ND	0.010	ND	0.0099	ND	0.010	ND	0.010	ND	0.010	ND	0.010	ND UJ	0.010	ND	--	--
4,4'-DDE	NA	ug/l		0.257		0.010	ND	0.010	ND	0.0099	ND	0.010	ND	0.010	ND	0.010	ND	0.010	ND UJ	0.010	ND	--	--
4,4'-DDT	NA	ug/l	0.300	0.257	8.00	0.010	ND	0.010	ND	0.0099	ND	0.010	ND	0.010	ND	0.010	ND	0.010	ND UJ	0.010	ND	--	--
a-BHC	NA	ug/l		0.0139	128	0.010	ND	0.010	ND	0.0099	ND	0.010	ND	0.010	ND	0.010	ND	0.010	ND UJ	0.010	ND	--	--
Aldrin	NA	ug/l		0.00257	0.240	0.010	ND	0.010	ND	0.0099	ND	0.010	ND	0.010	ND	0.010	ND	0.010	ND UJ	0.010	ND	--	--
b-BHC	NA	ug/l		0.0486		0.010	ND	0.010	ND	0.0099	ND	0.010	ND	0.010	ND	0.010	ND	0.010	ND UJ	0.010	ND	--	--
Chlordane, alpha & gamma	NA	ug/l		0.250	8.00	0.010	ND	0.010	ND	0.0099	ND	0.010	ND	0.010	ND	0.010	ND	0.010	ND UJ	0.010	ND	--	--
d-BHC	NA	ug/l				0.010	ND	0.010	ND	0.0099	ND	0.010	ND	0.010	ND	0.010	ND	0.010	ND UJ	0.010	ND	--	--
Dieldrin	NA	ug/l		0.00547	0.800	0.010	ND	0.010	ND	0.0099	ND	0.010	ND	0.010	ND	0.010	ND	0.010	ND UJ	0.010	ND	--	--
Endosulfan I	NA	ug/l			96.0	0.010	ND	0.010	ND	0.0099	ND	0.010	ND	0.010	ND	0.010	ND	0.010	ND UJ	0.010	ND	--	--
Endosulfan II	NA	ug/l			96.0	0.010	ND	0.010	ND	0.0099	ND	0.010	ND	0.022	ND	0.019	ND	0.010	0.016 J	0.010	0.036	--	--
Endosulfan sulfate	NA	ug/l			96.0	0.010	ND	0.010	ND	0.0099	ND	0.010	ND	0.010	ND	0.010	ND	0.010	ND UJ	0.010	ND	--	--
Endrin	NA	ug/l			4.80	0.010	ND	0.010	ND	0.0099	ND	0.010	ND	0.010	ND	0.010	ND	0.010	ND UJ	0.010	ND	--	--
Endrin aldehyde	NA	ug/l				0.010	ND	0.010	ND	0.0099	ND	0.010	ND	0.010	ND	0.010	ND	0.010	ND UJ	0.010	ND	--	--
g-BHC (Lindane)	NA	ug/l	0.200	0.0795	4.80	0.010	ND	0.010	ND	0.0099	ND	0.010	ND	0.010	ND	0.010	ND	0.010	ND UJ	0.010	ND	--	--
Heptachlor	NA	ug/l		0.0194	8.00	0.010	ND	0.010	ND	0.0099	ND	0.010	ND	0.010	ND	0.010	ND	0.010	ND UJ	0.010	ND	--	--
Heptachlor epoxide	NA	ug/l		0.00481	0.104	0.010	ND	0.010	ND	0.0099	ND	0.010	ND	0.010	ND	0.010	ND	0.010	ND UJ	0.010	ND	--	--
Hexachlorobenzene	NA	ug/l		0.0547	12.8	--	--	0.010	ND	0.0099	ND	0.010	ND	--	--	0.010	ND	0.010	ND UJ	0.010	ND	--	--
Methoxychlor	NA	ug/l			80.0	0.010	ND	0.010	ND	0.0099	ND	0.010	ND	0.010	ND	0.010	ND	0.010	ND UJ	0.010	ND	--	--
Toxaphene	NA	ug/l		0.0795		0.50	ND	0.50	ND	0.50	ND	0.50	ND	0.50	ND	0.50	ND	0.50	ND UJ	0.50	ND	--	--
PCBs																							
Aroclor 1016	NA	ug/l		1.25	1.12	0.0069	ND	0.0050	ND	0.0050	ND	0.0050	ND	0.0050	ND	0.0050	ND	0.0050	ND	0.0050	ND	--	--
Aroclor 1221	NA	ug/l				0.013	ND	0.010	ND	0.010	ND	0.016	ND	0.010	ND	0.010	ND	0.010	ND	0.010	ND	--	--
Aroclor 1232	NA	ug/l				0.0086	ND	0.0050	ND	0.0050	ND	0.0050	ND	0.0050	ND	0.0050	ND	0.0050	ND	0.0050	ND	--	--
Aroclor 1242	NA	ug/l				0.0062	ND	0.005	0.0082	0.005	0.012	0.0050	ND	0.0050	ND	0.0050	ND	0.0050	ND	0.0050	ND	--	--
Aroclor 1248	NA	ug/l				0.0050	ND	0.0050	ND	0.0050	ND	0.0050	ND	0.0050	ND	0.0050	ND	0.0050	ND	0.0050	ND	--	--
Aroclor 1254	NA	ug/l		0.0438	0.320	0.0050	ND	0.0050	ND	0.0050	ND	0.0050	ND	0.0050	ND	0.0050	ND	0.0050	ND	0.0050	ND	--	--
Aroclor 1260	NA	ug/l		0.0438		0.0050	ND	0.0050	ND	0.0050	ND	0.0050	ND	0.0050	ND	0.0050	ND	0.0050	ND	0.0050	ND	--	--
Total Petroleum Hydrocarbons																							
Total Petroleum Hydrocarbons (as diesel)	NA	ug/l	500			310	ND	310	ND	310	ND	310	ND	310	ND	310	ND	310	ND	310	ND	310	ND
Total Petroleum Hydrocarbons (as diesel), silica gel	NA	ug/l	500			--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Total Petroleum Hydrocarbons (as gasoline)	NA	ug/l	800			130	ND	130	ND	130	ND	130	ND	130	ND	130	ND	130	ND	130	ND	130	ND
Total Petroleum Hydrocarbons (as motor oil)	NA	ug/l	500			310	ND	310	ND	310	ND	310	ND	310	ND	310	ND	310	ND	310	ND	310	ND
Total Petroleum Hydrocarbons (as motor oil), silica gel	NA	ug/l	500			--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--

Landau qualifier - J: Indicates the analyte was positively identified; the associated numerical value is the approximate concentration of the analyte in the sample.

Landau qualifier - UJ: The analyte was not detected in the sample; the reported sample reporting limit is an estimate.

N: Normal Sample.

FD: Field Duplicate Sample.

ND: Not detected.

PQL: Practical Quantitation Limit.

SSource: Laboratory and/or field data obtained from a secondary source external to Barr. Second source QA/QC evaluation procedures may or may not have been performed beyond the original data generator.

Table was updated (items in red) after original submittal to add Landau qualifiers to be consistent with the memo.

Table 2
Historical Groundwater Data - 2015 Landau PQLs vs. MTCA Cleanup Levels
Yakima Mill Site

					Location	TP-MW-01		TP-MW-01		TP-MW-01		TP-MW-02		TP-MW-02		TP-MW-02		TP-MW-02	
					Date	12/19/2014		3/25/2015		6/24/2015		9/17/2014		12/19/2014		3/25/2015		6/25/2015	
					Sample Type	N		N		N		N		N		N		N	
					Result Type	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result
					Data Status	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource
Parameter	Total or Dissolved	Units	Washington GW Method A	Washington Groundwater Method B Cancer	Washington Groundwater Method B Noncancer														
Effective Date			07/01/2015	07/01/2015	07/01/2015														
Exceedance Key			No Exceedances	Shade	Border														
General Parameters																			
Alkalinity, bicarbonate, as CaCO3	NA	mg/l				15	64	0.0	180	15	100	--	--	15	170	0.0	470	15	280
Alkalinity, total, as CaCO3	NA	mg/l				15	64	0.0	180	15	100	--	--	15	170	0.0	470	15	280
Carbon, total organic	NA	mg/l				0.50	1.9	0.50	2.2	0.50	1.2	--	--	0.50	9.6	250	430	10	100
Chloride	NA	mg/l				0.092	5.5	0.46	17	0.92	9.0	0.092	14	0.092	9.0	0.092	14	0.92	10
Fluoride	NA	mg/l			0.64	0.16	0.34	0.16	0.21	0.16	ND	0.16	0.2	0.16	0.47	0.16	2.4	0.16	0.19
Nitrogen, ammonia, as N	NA	mg/l				0.050	ND	0.050	ND	0.050	ND	--	--	0.050	0.79	0.25	12	0.050	2.8
Nitrogen, nitrate, as N	NA	mg/l			25.6	0.034	0.16	0.034	1.2	0.34	2.6	0.034	ND UJ	0.034	ND	0.034	ND	0.034	ND
Nitrogen, nitrite, as N	NA	mg/l			1.6	0.043	ND	0.043	ND	0.043	ND	0.043	ND UJ	0.043	ND	0.043	ND	0.043	ND
Solids, total dissolved	NA	mg/l				5.0	150	5.0	260	5.0	150	--	--	5.0	270	5.0	1300	5.0	520
Sulfate, as SO4	NA	mg/l				0.26	5.5	0.26	12	2.6	12	0.26	6.8	0.26	1.2	0.26	ND	0.26	0.99
Metals																			
Arsenic	Dissolved	ug/l	5.00	0.0583	4.80	0.45	ND	0.50	0.97	0.45	0.49	1.0	3.9	0.45	2.7	0.50	12	0.45	5.5
Arsenic	Total	ug/l	5.00	0.0583	4.80	0.45	ND	0.50	0.56	0.63	ND	1.0	3.8	0.45	3.3	0.50	12	0.45	6.8
Barium	Dissolved	ug/l			3200	1.0	5.3	1.0	18	1.0	10	1.0	17	1.0	19	1.0	120	1.0	43
Barium	Total	ug/l			3200	1.0	6.7	1.0	18	1.0	9.6	1.0	18	1.0	21	1.0	130	1.0	55
Cadmium	Dissolved	ug/l	5.00		8.00	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND
Cadmium	Total	ug/l	5.00		8.00	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND	1.0	ND
Calcium	Dissolved	ug/l				100	14000	100	42000	100	25000	100	30000	100	33000	100	68000	100	38000
Calcium	Total	ug/l				100	13000	100	43000	100	22000	100	30000	100	32000	100	75000	100	41000
Chromium	Dissolved	ug/l	50.0			2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	15	2.0	3.3
Chromium	Total	ug/l	50.0			2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	ND	2.0	15	2.0	8.6
Chromium, hexavalent	Dissolved	ug/l			48.0	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Chromium, hexavalent	Total	ug/l			48.0	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Iron	Dissolved	ug/l			11200	50	ND	50	ND	50	ND	50	12000	50	12000	50	31000	50	15000
Iron	Total	ug/l			11200	50	130	50	ND	50	ND	50	12000	50	12000	50	34000	50	20000
Lead	Dissolved	ug/l	15.0			0.28	ND	0.28	ND	0.28	ND	1.0	ND	0.28	ND	0.28	1.7	0.28	0.75
Lead	Total	ug/l	15.0			0.28	ND	0.28	ND	0.28	ND	1.0	ND	0.28	ND	0.28	2.1	2.2	ND
Magnesium	Dissolved	ug/l				50	4600	50	16000	50	8700	50	10000	50	12000	50	18000	50	12000
Magnesium	Total	ug/l				50	4500	50	16000	50	7600	50	10000	50	11000	50	19000	50	12000
Manganese	Dissolved	ug/l			2240	2.0	2.5	2.0	9.3	2.0	2.3	2.0	1300	2.0	1500	2.0	1100	2.0	960
Manganese	Total	ug/l			2240	2.0	9.7	2.0	15	2.0	8.1	2.0	1300	2.0	1500	2.0	1200	2.0	1000
Mercury	Dissolved	ug/l	2.00			0.11	ND	0.11	ND	0.11	ND	0.20	ND	0.11	ND	0.11	ND	0.11	ND
Mercury	Total	ug/l	2.00			0.11	ND	0.11	ND	0.11	ND	0.20	ND	0.11	ND	0.11	ND	0.11	ND
Potassium	Dissolved	ug/l				--	--	50	4200	50	3300	--	--	--	--	50	11000	50	6500
Potassium	Total	ug/l				--	--	50	4300	50	3000	--	--	--	--	50	12000	50	6600
Selenium	Dissolved	ug/l			80.0	4.0	ND	4.0	ND	4.0	ND	4.0	ND	4.0	ND	4.0	ND	4.0	ND
Selenium	Total	ug/l			80.0	4.0	ND	4.0	ND	4.0	ND	4.0	ND	4.0	ND	4.0	ND	4.0	ND
Silver	Dissolved	ug/l			80.0	0.20	ND	0.20	ND	0.20	ND	1.0	ND	0.20	ND	0.20	ND	0.20	ND
Silver	Total	ug/l			80.0	0.20	ND	0.20	ND	0.20	ND	1.0	ND	0.20	ND	0.20	ND	0.20	ND
Sodium	Dissolved	ug/l				50	9700	50	23000	50	13000	50	21000	50	20000	250	130000	50	59000
Sodium	Total	ug/l				50	9300	50	23000	50	11000	50	21000	50	19000	250	140000	50	65000
SVOCs																			
1,2,4-Trichlorobenzene	NA	ug/l		1.51	80.0	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,2-Dichlorobenzene	NA	ug/l			720	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,3-Dichlorobenzene	NA	ug/l				--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,4-Dichlorobenzene	NA	ug/l		8.10	560	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1-Methylnaphthalene	NA	ug/l		1.51	560	--	--	--	--	--	--	0.020	ND	--	--	--	--	--	--
2,2'-oxybis (1-chloropropane)	NA	ug/l		0.625	320	--	--	--	--	--	--	--	--	--	--	--	--	--	--
2,3,4,6-Tetrachlorophenol	NA	ug/l			480	--	--	--	--	--	--	--	--	--	--	--	--	--	--
2,4,5-Trichlorophenol	NA	ug/l			800	--	--	--	--	--	--	--	--	--	--	--	--	--	--
2,4,6-Trichlorophenol	NA	ug/l		3.98	8.00	--	--	--	--	--	--	--	--	--	--	--	--	--	--
2,4-Dichlorophenol	NA	ug/l			24.0	--	--	--	--	--	--	--	--	--	--	--	--	--	--
2,4-Dimethylphenol	NA	ug/l			160	--	--	--	--	--	--	--	--	--	--	--	--	--	--
2,4-Dinitrophenol	NA	ug/l			32.0	--	--	--	--	--	--	--	--	--	--	--	--	--	--
2,4-Dinitrotoluene	NA	ug/l		0.282	32.0	--	--	--	--	--	--	--	--	--	--	--	--	--	--
2,6-Dichlorophenol	NA	ug/l				--	--	--	--	--	--	--	--	--	--	--	--	--	--

Table 2
Historical Groundwater Data - 2015 Landau PQLs vs. MTCA Cleanup Levels
Yakima Mill Site

					Location	TP-MW-01		TP-MW-01		TP-MW-01		TP-MW-02		TP-MW-02		TP-MW-02		TP-MW-02	
					Date	12/19/2014		3/25/2015		6/24/2015		9/17/2014		12/19/2014		3/25/2015		6/25/2015	
					Sample Type	N		N		N		N		N		N		N	
					Result Type	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result
					Data Status	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource
Parameter	Total or Dissolved	Units	Washington GW Method A	Washington Groundwater Method B Cancer	Washington Groundwater Method B Noncancer														
Effective Date			07/01/2015	07/01/2015	07/01/2015														
Exceedance Key			No Exceedances	Shade	Border														
2,6-Dinitrotoluene	NA	ug/l		0.0583	4.80	--	--	--	--	--	--	--	--	--	--	--	--	--	--
2-Chloronaphthalene	NA	ug/l			640	--	--	--	--	--	--	--	--	--	--	--	--	--	--
2-Chlorophenol	NA	ug/l			40.0	--	--	--	--	--	--	--	--	--	--	--	--	--	--
2-Methyl-4,6-dinitrophenol	NA	ug/l				--	--	--	--	--	--	--	--	--	--	--	--	--	--
2-Methylnaphthalene	NA	ug/l			32.0	--	--	--	--	--	--	0.020	ND	--	--	--	--	--	--
2-Methylphenol (o-cresol)	NA	ug/l			400	--	--	--	--	--	--	--	--	--	--	--	--	--	--
2-Nitroaniline	NA	ug/l			160	--	--	--	--	--	--	--	--	--	--	--	--	--	--
2-Nitrophenol	NA	ug/l				--	--	--	--	--	--	--	--	--	--	--	--	--	--
3,3`-Dichlorobenzidine	NA	ug/l		0.194		--	--	--	--	--	--	--	--	--	--	--	--	--	--
3,4-Methylphenol (m,p cresols)	NA	ug/l				--	--	--	--	--	--	--	--	--	--	--	--	--	--
3-Nitroaniline	NA	ug/l				--	--	--	--	--	--	--	--	--	--	--	--	--	--
4-Bromophenyl phenyl ether	NA	ug/l				--	--	--	--	--	--	--	--	--	--	--	--	--	--
4-Chloro-3-methylphenol	NA	ug/l				--	--	--	--	--	--	--	--	--	--	--	--	--	--
4-Chloroaniline	NA	ug/l		0.219	32.0	--	--	--	--	--	--	--	--	--	--	--	--	--	--
4-Chlorophenyl phenyl ether	NA	ug/l				--	--	--	--	--	--	--	--	--	--	--	--	--	--
4-Nitroaniline	NA	ug/l				--	--	--	--	--	--	--	--	--	--	--	--	--	--
4-Nitrophenol	NA	ug/l				--	--	--	--	--	--	--	--	--	--	--	--	--	--
Acenaphthene	NA	ug/l			960	--	--	--	--	--	--	0.020	ND	--	--	--	--	--	--
Acenaphthylene	NA	ug/l				--	--	--	--	--	--	0.020	ND	--	--	--	--	--	--
Aniline	NA	ug/l		7.68	56.0	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Anthracene	NA	ug/l			4800	--	--	--	--	--	--	0.020	ND	--	--	--	--	--	--
Azobenzene	NA	ug/l		0.795		--	--	--	--	--	--	--	--	--	--	--	--	--	--
Benz(a)anthracene	NA	ug/l		0.120		--	--	--	--	--	--	0.020	ND	--	--	--	--	--	--
Benzo(a)pyrene	NA	ug/l	0.100	0.0120		--	--	--	--	--	--	0.027	ND	--	--	--	--	--	--
Benzo(b)fluoranthene	NA	ug/l		0.120		--	--	--	--	--	--	0.020	ND	--	--	--	--	--	--
Benzo(g,h,i)perylene	NA	ug/l				--	--	--	--	--	--	0.020	ND	--	--	--	--	--	--
Benzo(k)fluoranthene	NA	ug/l		1.20		--	--	--	--	--	--	0.020	ND	--	--	--	--	--	--
Benzoic acid	NA	ug/l			64000	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Benzyl alcohol	NA	ug/l			800	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Bis(2-chloroethoxy)methane	NA	ug/l				--	--	--	--	--	--	--	--	--	--	--	--	--	--
Bis(2-chloroethyl)ether	NA	ug/l		0.0398		--	--	--	--	--	--	--	--	--	--	--	--	--	--
Bis(2-ethylhexyl)phthalate	NA	ug/l		6.25	320	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Butyl benzyl phthalate	NA	ug/l		46.1	3200	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Carbazole	NA	ug/l				--	--	--	--	--	--	--	--	--	--	--	--	--	--
Chrysene	NA	ug/l		12.0		--	--	--	--	--	--	0.020	ND	--	--	--	--	--	--
Dibenz(a,h)anthracene	NA	ug/l		0.0120		--	--	--	--	--	--	0.011	ND	--	--	--	--	--	--
Dibenzofuran	NA	ug/l			16.0	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Diethyl phthalate	NA	ug/l			12800	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Dimethyl phthalate	NA	ug/l				--	--	--	--	--	--	--	--	--	--	--	--	--	--
Di-n-butyl phthalate	NA	ug/l			1600	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Di-n-octyl phthalate	NA	ug/l			160	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Fluoranthene	NA	ug/l			640	--	--	--	--	--	--	0.020	ND	--	--	--	--	--	--
Fluorene	NA	ug/l			640	--	--	--	--	--	--	0.020	ND	--	--	--	--	--	--
Hexachlorobenzene	NA	ug/l		0.0547	12.8	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Hexachlorobutadiene	NA	ug/l		0.561	8.00	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Hexachlorocyclopentadiene	NA	ug/l			48.0	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Hexachloroethane	NA	ug/l		1.09	5.60	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Indeno(1,2,3-cd)pyrene	NA	ug/l		0.120		--	--	--	--	--	--	0.020	ND	--	--	--	--	--	--
Isophorone	NA	ug/l		46.1	1600	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Naphthalene	NA	ug/l	160		160	--	--	--	--	--	--	0.020	ND	--	--	--	--	--	--
Nitrobenzene	NA	ug/l			16.0	--	--	--	--	--	--	--	--	--	--	--	--	--	--
n-Nitrosodimethylamine	NA	ug/l		0.000858	0.0640	--	--	--	--	--	--	--	--	--	--	--	--	--	--
n-Nitrosodi-n-propylamine	NA	ug/l		0.0125		--	--	--	--	--	--	--	--	--	--	--	--	--	--
n-Nitrosodiphenylamine	NA	ug/l		17.9		--	--	--	--	--	--	--	--	--	--	--	--	--	--
Pentachlorophenol	NA	ug/l		0.219	80.0	--	--	--	--	--	--	0.13	ND	--	--	--	--	--	--
Phenanthrene	NA	ug/l				--	--	--	--	--	--	0.020	ND	--	--	--	--	--	--
Phenol	NA	ug/l			2400	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Pyrene	NA	ug/l			480	--	--	--	--	--	--	0.020	ND	--	--	--	--	--	--

Table 2
Historical Groundwater Data - 2015 Landau PQLs vs. MTCA Cleanup Levels
Yakima Mill Site

					Location	TP-MW-01		TP-MW-01		TP-MW-01		TP-MW-02		TP-MW-02		TP-MW-02		TP-MW-02	
					Date	12/19/2014		3/25/2015		6/24/2015		9/17/2014		12/19/2014		3/25/2015		6/25/2015	
					Sample Type	N		N		N		N		N		N		N	
					Result Type	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result	PQL	Result
					Data Status	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource	SSource
Parameter	Total or Dissolved	Units	Washington GW Method A	Washington Groundwater Method B Cancer	Washington Groundwater Method B Noncancer														
Effective Date			07/01/2015	07/01/2015	07/01/2015														
Exceedance Key			No Exceedances	Shade	Border														
Pyridine	NA	ug/l			8.00	--	--	--	--	--	--	--	--	--	--	--	--	--	--
VOCs						--		--		--		--		--		--		--	
1,1,1,2-Tetrachloroethane	NA	ug/l		1.68	240	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,1,1-Trichloroethane	NA	ug/l	200		16000	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,1,2,2-Tetrachloroethane	NA	ug/l		0.219	160	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,1,2-Trichloroethane	NA	ug/l		0.768	32.0	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,1-Dichloroethane	NA	ug/l		7.68	1600	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,1-Dichloroethylene	NA	ug/l			400	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,1-Dichloropropene	NA	ug/l				--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,2,3-Trichlorobenzene	NA	ug/l				--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,2,3-Trichloropropane	NA	ug/l		0.00146	32.0	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,2,4-Trichlorobenzene	NA	ug/l		1.51	80.0	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,2,4-Trimethylbenzene	NA	ug/l				--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,2-Dibromo-3-chloropropane (DBCP)	NA	ug/l		0.0547	1.60	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,2-Dibromoethane (EDB)	NA	ug/l	0.0100	0.0219	72.0	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,2-Dichlorobenzene	NA	ug/l			720	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,2-Dichloroethane	NA	ug/l	5.00	0.481	48.0	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,2-Dichloroethylene, cis	NA	ug/l			16.0	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,2-Dichloroethylene, trans	NA	ug/l			160	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,2-Dichloropropane	NA	ug/l		1.22	720	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,3,5-Trimethylbenzene	NA	ug/l			80.0	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,3-Dichlorobenzene	NA	ug/l				--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,3-Dichloropropane	NA	ug/l				--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,3-Dichloropropene, cis	NA	ug/l		0.438	240	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,3-Dichloropropene, trans	NA	ug/l		0.438	240	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,4-Dichlorobenzene	NA	ug/l		8.10	560	--	--	--	--	--	--	--	--	--	--	--	--	--	--
2,2-Dichloropropane	NA	ug/l				--	--	--	--	--	--	--	--	--	--	--	--	--	--
2-Hexanone	NA	ug/l				--	--	--	--	--	--	--	--	--	--	--	--	--	--
Acetone	NA	ug/l			7200	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Acrylonitrile	NA	ug/l		0.0810	320	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Benzene	NA	ug/l	5.00	0.795	32.0	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Bromobenzene	NA	ug/l				--	--	--	--	--	--	--	--	--	--	--	--	--	--
Bromochloromethane	NA	ug/l				--	--	--	--	--	--	--	--	--	--	--	--	--	--
Bromodichloromethane	NA	ug/l		0.706	160	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Bromoform	NA	ug/l		5.54	160	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Bromomethane	NA	ug/l			11.2	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Butylbenzene	NA	ug/l			400	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Butylbenzene, sec	NA	ug/l			800	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Butylbenzene, tert	NA	ug/l			800	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Carbon disulfide	NA	ug/l			800	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Carbon tetrachloride	NA	ug/l		0.625	32.0	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Chlorobenzene	NA	ug/l			160	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Chlorodibromomethane	NA	ug/l		0.521	160	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Chloroethane	NA	ug/l				--	--	--	--	--	--	--	--	--	--	--	--	--	--
Chloroform	NA	ug/l		1.41	80.0	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Chloromethane	NA	ug/l				--	--	--	--	--	--	--	--	--	--	--	--	--	--
Chlorotoluene, o	NA	ug/l			160	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Chlorotoluene, p	NA	ug/l				--	--	--	--	--	--	--	--	--	--	--	--	--	--
Cumene (isopropyl benzene)	NA	ug/l			800	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Cymene p- (toluene isopropyl p-)	NA	ug/l				--	--	--	--	--	--	--	--	--	--	--	--	--	--
Dibromomethane (methylene bromide)	NA	ug/l			80.0	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Dichlorodifluoromethane (Freon-12)	NA	ug/l			1600	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Ethyl benzene	NA	ug/l	700		800	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Hexachlorobutadiene	NA	ug/l		0.561	8.00	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Hexane (C6)	NA	ug/l			480	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Methyl ethyl ketone (2-butanone)	NA	ug/l			4800	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Methyl isobutyl ketone (MIBK)	NA	ug/l			640	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Methyl tertiary butyl ether (MTBE)	NA	ug/l	20.0	24.3		--	--	--	--	--	--	--	--	--	--	--	--	--	--

Table 2
Historical Groundwater Data - 2015 Landau PQLs vs. MTCA Cleanup Levels
Yakima Mill Site

					Location	**TP-MW-01**		**TP-MW-01**		**TP-MW-01**		**TP-MW-02**		**TP-MW-02**		**TP-MW-02**		**TP-MW-02**	
					Date	**12/19/2014**		**3/25/2015**		**6/24/2015**		**9/17/2014**		**12/19/2014**		**3/25/2015**		**6/25/2015**	
					Sample Type	**N**		**N**		**N**		**N**		**N**		**N**		**N**	
					Result Type	**PQL**	**Result**	**PQL**	**Result**	**PQL**	**Result**	**PQL**	**Result**	**PQL**	**Result**	**PQL**	**Result**	**PQL**	**Result**
					Data Status	**SSource**	**SSource**	**SSource**	**SSource**	**SSource**	**SSource**	**SSource**	**SSource**	**SSource**	**SSource**	**SSource**	**SSource**	**SSource**	**SSource**
Parameter	Total or Dissolved	Units	Washington GW Method A	Washington Groundwater Method B Cancer	Washington Groundwater Method B Noncancer														
Effective Date			07/01/2015	07/01/2015	07/01/2015														
Exceedance Key			No Exceedances	Shade	Border														
Methylene chloride	NA	ug/l	5.00	21.9	48.0	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Naphthalene	NA	ug/l	160		160	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Propylbenzene	NA	ug/l			800	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Styrene	NA	ug/l			1600	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Tetrachloroethylene	NA	ug/l	5.00	20.8	48.0	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Toluene	NA	ug/l	1000		640	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Trichloroethylene (TCE)	NA	ug/l	5.00	0.540	4.00	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Trichlorofluoromethane (Freon-11)	NA	ug/l			2400	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Vinyl chloride	NA	ug/l	0.200		24.0	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Xylene, m & p	NA	ug/l			1600	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Xylene, o	NA	ug/l			1600	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Pesticides																			
4,4'-DDD	NA	ug/l		0.365		--	--	--	--	--	--	--	--	--	--	--	--	--	--
4,4'-DDE	NA	ug/l		0.257		--	--	--	--	--	--	--	--	--	--	--	--	--	--
4,4'-DDT	NA	ug/l	0.300	0.257	8.00	--	--	--	--	--	--	--	--	--	--	--	--	--	--
a-BHC	NA	ug/l		0.0139	128	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Aldrin	NA	ug/l		0.00257	0.240	--	--	--	--	--	--	--	--	--	--	--	--	--	--
b-BHC	NA	ug/l		0.0486		--	--	--	--	--	--	--	--	--	--	--	--	--	--
Chlordane, alpha & gamma	NA	ug/l		0.250	8.00	--	--	--	--	--	--	--	--	--	--	--	--	--	--
d-BHC	NA	ug/l				--	--	--	--	--	--	--	--	--	--	--	--	--	--
Dieldrin	NA	ug/l		0.00547	0.800	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Endosulfan I	NA	ug/l			96.0	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Endosulfan II	NA	ug/l			96.0	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Endosulfan sulfate	NA	ug/l			96.0	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Endrin	NA	ug/l			4.80	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Endrin aldehyde	NA	ug/l				--	--	--	--	--	--	--	--	--	--	--	--	--	--
g-BHC (Lindane)	NA	ug/l	0.200	0.0795	4.80	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Heptachlor	NA	ug/l		0.0194	8.00	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Heptachlor epoxide	NA	ug/l		0.00481	0.104	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Hexachlorobenzene	NA	ug/l		0.0547	12.8	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Methoxychlor	NA	ug/l			80.0	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Toxaphene	NA	ug/l		0.0795		--	--	--	--	--	--	--	--	--	--	--	--	--	--
PCBs																			
Aroclor 1016	NA	ug/l		1.25	1.12	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Aroclor 1221	NA	ug/l				--	--	--	--	--	--	--	--	--	--	--	--	--	--
Aroclor 1232	NA	ug/l				--	--	--	--	--	--	--	--	--	--	--	--	--	--
Aroclor 1242	NA	ug/l				--	--	--	--	--	--	--	--	--	--	--	--	--	--
Aroclor 1248	NA	ug/l				--	--	--	--	--	--	--	--	--	--	--	--	--	--
Aroclor 1254	NA	ug/l		0.0438	0.320	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Aroclor 1260	NA	ug/l		0.0438		--	--	--	--	--	--	--	--	--	--	--	--	--	--
Total Petroleum Hydrocarbons																			
Total Petroleum Hydrocarbons (as diesel)	NA	ug/l	500			310	ND	130	ND	130	ND	310	ND	130 310	1500 ND	130	6200	130	1400
Total Petroleum Hydrocarbons (as diesel), silica gel	NA	ug/l	500			--	--	--	--	--	--	--	--	130	470	130	1600	130	430
Total Petroleum Hydrocarbons (as gasoline)	NA	ug/l	800			130	ND	--	--	--	--	130	ND	130	ND	--	--	--	--
Total Petroleum Hydrocarbons (as motor oil)	NA	ug/l	500			310	ND	250	ND	250	ND	310	ND	250 310	450 310	250	1700	250	700
Total Petroleum Hydrocarbons (as motor oil), silica gel	NA	ug/l	500			--	--	--	--	--	--	--	--	250	300	250	570	250	320

Landau qualifier - J: Indicates the analyte was positively identified; the associated numerical value is the approximate concentration of the analyte in the sample.

Landau qualifier - UJ: The analyte was not detected in the sample; the reported sample reporting limit is an estimate.

N: Normal Sample.

FD: Field Duplicate Sample.

ND: Not detected.

PQL: Practical Quantitation Limit.

SSource: Laboratory and/or field data obtained from a secondary source external to Barr. Second source QA/QC evaluation procedures may or may not have been performed beyond the original data generator.

Table was updated (items in red) after original submittal to add Landau qualifiers to be consistent with the memo.

Appendix E

Results from Analysis of Soil Samples from Closure of Wood Waste Landfill 2003-2004

(No changes from December 2017 Final RI Work Plan submittal)

Yakima Health District
104 North First Street
Yakima, Washington 98901
Phone (509) 575-4040

DEPT. OF ECOLOGY
Received
SEP 0 2 2003
CENTRAL REGION OFFICE

August 28, 2003

Jennifer Wasley
Boise Building Solutions, Manufacturing
1274 Boise Rd.
Kettle Falls, WA 99141

Re: The Boise Yakima Complex Wood Debris Landfill

Ms. Wasley,

This office has reviewed the site testing information dated July 25, 2003 and August 25, 2003 for the above closure project. The information indicates that all items tested for were below the level of concern. There are two items still needed for final acceptance of the closure of this portion of the landfill. The items needed are, copies of the lab results and a map showing the approximate size of the area in question and the approximate locations that the soil samples were collected for testing. Once these items are received, this portion of the landfill will be considered closed.

If you have any questions regarding this letter, please contact me. My telephone number is (509)249-6543.

Sincerely,

Art McEwen

Art McEwen
Environmental Health Specialist

Cc: Al Armstrong, DOE

BOISE

Boise Building Solutions, Manufacturing
Washington Region
1274 Boise Rd.
Kettle Falls WA 99141

DEPT OF ECOLOGY
Received
SEP 03 2003
CENTRAL REGION OFFICE

COPY

September 2, 2003

Art McEwen
Yakima Health District
104 N. First Street
Yakima, WA 98901

Re: Boise Yakima Wood Debris Landfill

As per your request, a copy of the lab results and map of sampling locations at the Boise Yakima wood debris landfill were submitted August 28, 2003. However, the previous submission did not indicate the size of the portion of the landfill in which material has been removed. The original size of the landfill was approximately 5.7 acres. The portion of the landfill in which closure is being requested at this time is approximately 2.5 acres.

A final letter of acceptance of closure on this portion of the property would be greatly appreciated.

Sincerely,

Jennifer L. Wasley

Jennifer L. Wasley
Region Environmental Engineer
(509) 738-3219

C: Al Armstrong, DOE

Yakima woodwaste site

BOISE

Boise Building Solutions, Manufacturing
Washington Region
1274 Boise Rd.
Kettle Falls WA 99141

DEPT. OF ECOLOGY
Received
AUG 26 2003
CENTRAL REGION OFFICE

COPY

August 25, 2003

Art McEwen
Yakima Health District
104 N. First Street
Yakima, WA 98901

Re: Additional Analyses of the Boise Yakima Complex Wood Debris Landfill

Dear Mr. McEwen;

This information is in addition to Boise's July 25, 2003 request for "acceptance of closure" on that portion of the landfill at the above mentioned facility.

Per your request, additional sampling was conducted on July 31, 2003 for the analyses of polynuclear aromatic hydrocarbons (PAH). On behalf of Boise, Fulcrum Environmental collected two, three way composite samples from the floor of the excavation for PAH analysis. According to the laboratory reports, all PAH results were not detected at or above the method reporting limit of 0.0100 mg/kg.

Please let me know if you have any questions regarding this submittal. We look forward to your approval of this matter.

Sincerely,

Jennifer L. Wasley

Jennifer L. Wasley
Region Environmental Engineer
(509) 738-3219

c Al Armstrong, Washington Department of Ecology

Yakima — Boise Cascade Yakima Woodwaste

Yakima Health District
104 North First Street
Yakima, Washington 98901
Phone (509) 575-4040

DEPT. OF ECOLOGY
Received
SEP 17 2003
CENTRAL REGION OFFICE

September 16, 2003

Jennifer Wasley
Boise Building Solutions, Manufacturing
1274 Boise Rd.
Kettle Falls, WA 99141

Re: The Boise Yakima Complex Wood Debris Landfill

Ms. Wasley,

This office has received the two items requested in my letter dated August 28, 2003. As per that letter, now that these items have been received, that portion of the landfill is considered closed.

If you have any questions regarding this letter, please contact me. My telephone number is (509)249-6543.

Sincerely,

Art McEwen

Art McEwen
Environmental Health Specialist

Cc: Al Armstrong, DOE

Yakima Woodwaste site

BOISE

Boise Building Solutions, Manufacturing
Washington Region
1274 Boise Rd.
Kettle Falls WA 99141

DEPT OF ECOLOGY
Received
AUG 29 2003
CENTRAL REGION OFFICE

August 28, 2003

Art McEwen
Yakima Health District
104 N. First Street
Yakima, WA 98901

Al Armstrong
Department of Ecology
15W Yakima Ave, Ste 200
Yakima, WA 98902

Please find enclosed for your records, a copy of the lab results and map of sampling locations at the Boise Yakima wood debris landfill.

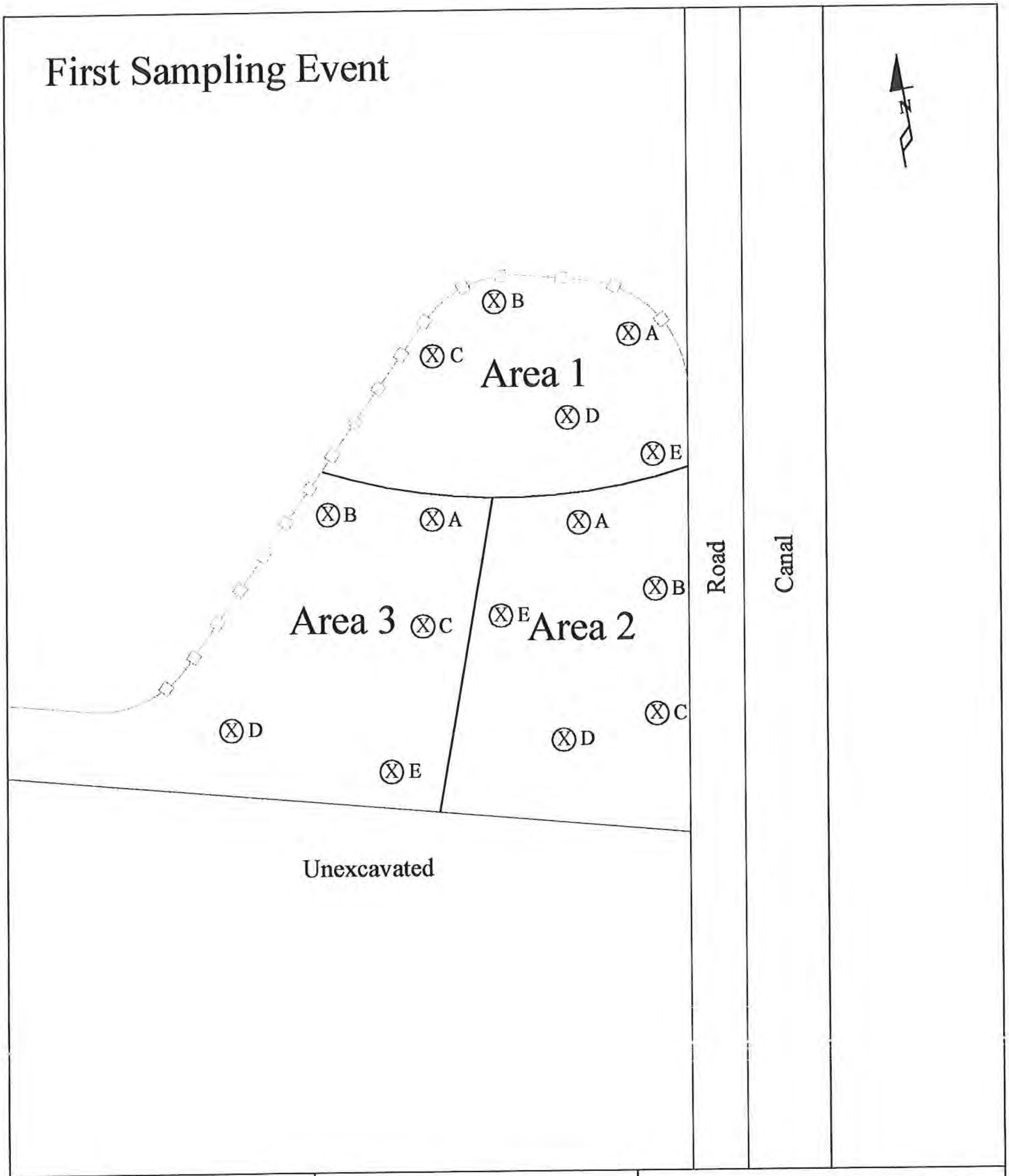
Sincerely,

Jennifer L. Wasley

Jennifer L. Wasley
Region Environmental Engineer
(509) 738-3219

Enc As stated

First Sampling Event



Legend

Sample Locations: Ⓧ
Fence Line: —□—□—□—
Scale: NTS

Figure 1
Sample Location Map

Boise Building Solutions
Yakima Facility
Woodwaste Landfill

Fulcrum Environmental Consulting, Inc.
222 North Second Street, Suite A
Yakima, Washington 98901
Phone (509) 574-0839 Fax (509) 575-8453

Drawn by: AMP	Project Number: 03-464
Date: 07/23/2003	File Name: Boise Sampling

www.ncalabs.com

Seattle 11720 North Creek Pkwy N. Suite 400 Bothell, WA 98011-8244
425.420.9200 fax 425.420.9210
Spokane East 11115 Montgomery, Suite B. Spokane, WA 99206-4776
509.924.9200 fax 509.924.9290
Portland 9405 SW Nimbus Avenue, Beaverton, OR 97008-7132
503.906.9200 fax 503.906.9210
Bend 20332 Empire Avenue, Suite F-1, Bend, OR 97701-5711
541.383.9310 fax 541.382.7588
Anchorage 2000 W. International Airport Road Suite A10, Anchorage, AK 99502-1119
907.563.9200 fax 907.563.9210

Fulcrum Environmental-Yakima
222 North Second Street, Suite A
Yakima, WA/USA 98901

Project: Boise Wood Waste Landfill
Project Number: 03-464
Project Manager: Ryan Mathews

Reported:
07/16/03 10:33

ANALYTICAL REPORT FOR SAMPLES

Sample ID	Laboratory ID	Matrix	Date Sampled	Date Received
Lab Composite 01	B3G0092-06	Soil	06/30/03 12:00	07/02/03 10:30
Lab Composite 02	B3G0092-12	Soil	06/30/03 12:00	07/02/03 10:30
Lab Composite 03	B3G0092-18	Soil	06/30/03 12:00	07/02/03 10:30
Composite 01	B3G0092-19	Soil	06/30/03 12:00	07/02/03 10:30

North Creek Analytical - Bothell

Jeff Gerdes

Jeff Gerdes, Project Manager

nca™
www.ncalabs.com

Seattle 11720 North Creek Pkwy N, Suite 400, Bothell, WA 98011-8244
425.420.9200 fax 425.420.9210
Spokane East 11115 Montgomery, Suite B, Spokane, WA 99206-4776
509.924.9200 fax 509.924.9290
Portland 9405 SW Nimbus Avenue, Beaverton, OR 97008-7132
503.906.9200 fax 503.906.9210
Bend 20332 Empire Avenue, Suite F-1, Bend, OR 97701-5711
541.383.9310 fax 541.382.7588
Anchorage 2000 W. International Airport Road, Suite A10, Anchorage, AK 99502-1119
907.563.9200 fax 907.563.9210

Fulcrum Environmental-Yakima
222 North Second Street, Suite A
Yakima, WA/USA 98901

Project: Boise Wood Waste Landfill
Project Number: 03-464
Project Manager: Ryan Mathews

Reported:
07/16/03 10:33

Hydrocarbon Identification by Washington DOE Method NWTPH-HCID
North Creek Analytical - Bothell

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
Lab Composite 01 (B3G0092-06) Soil	**Sampled: 06/30/03 12:00**		**Received: 07/02/03 10:30**						
Gx Range Hydrocarbons	ND	20.0	mg/kg dry	1	3G08019	07/09/03	07/08/03	NWTPH-HCID	
Kerosene Range Hydrocarbons	ND	50.0	"	"	"	"	"	"	
Diesel Range Hydrocarbons	ND	50.0	"	"	"	"	"	"	
Insulating Oil Range Hydrocarbons	ND	100	"	"	"	"	"	"	
Heavy Fuel Oil Range Hydrocarbons	ND	100	"	"	"	"	"	"	
Lube Oil Range Hydrocarbons	ND	100	"	"	"	"	"	"	
Surrogate: 2-FBP	*95.8 %*	*50-150*			"	"	"	"	
Surrogate: Octacosane	*117 %*	*50-150*			"	"	"	"	
Lab Composite 02 (B3G0092-12) Soil	**Sampled: 06/30/03 12:00**		**Received: 07/02/03 10:30**						
Gx Range Hydrocarbons	ND	20.0	mg/kg dry	1	3G08019	07/09/03	07/08/03	NWTPH-HCID	
Kerosene Range Hydrocarbons	ND	50.0	"	"	"	"	"	"	
Diesel Range Hydrocarbons	ND	50.0	"	"	"	"	"	"	
Insulating Oil Range Hydrocarbons	ND	100	"	"	"	"	"	"	
Heavy Fuel Oil Range Hydrocarbons	ND	100	"	"	"	"	"	"	
Lube Oil Range Hydrocarbons	ND	100	"	"	"	"	"	"	
Surrogate: 2-FBP	*99.5 %*	*50-150*			"	"	"	"	
Surrogate: Octacosane	*114 %*	*50-150*			"	"	"	"	
Lab Composite 03 (B3G0092-18) Soil	**Sampled: 06/30/03 12:00**		**Received: 07/02/03 10:30**						
Gx Range Hydrocarbons	ND	20.0	mg/kg dry	1	3G08019	07/09/03	07/08/03	NWTPH-HCID	
Kerosene Range Hydrocarbons	ND	50.0	"	"	"	"	"	"	
Diesel Range Hydrocarbons	ND	50.0	"	"	"	"	"	"	
Insulating Oil Range Hydrocarbons	ND	100	"	"	"	"	"	"	
Heavy Fuel Oil Range Hydrocarbons	ND	100	"	"	"	"	"	"	
Lube Oil Range Hydrocarbons	ND	100	"	"	"	"	"	"	
Surrogate: 2-FBP	*98.2 %*	*50-150*			"	"	"	"	
Surrogate: Octacosane	*107 %*	*50-150*			"	"	"	"	

Jeff Gerdes

Jeff Gerdes, Project Manager

Fulcrum Environmental-Yakima
222 North Second Street, Suite A
Yakima, WA/USA 98901

Project: Boise Wood Waste Landfill
Project Number: 03-464
Project Manager: Ryan Mathews

Reported:
07/16/03 10:33

Total Metals by EPA 6000/7000 Series Methods
North Creek Analytical - Bothell

Lab Composite 01 (B3G0092-06) Soil Sampled: 06/30/03 12:00 Received: 07/02/03 10:30

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
Silver	ND	0.794	mg/kg dry	1	3G08047	07/08/03	07/09/03	EPA 6020	
Arsenic	**2.74**	0.794	"	"	"	"	"	"	
Barium	**110**	7.94	"	"	"	"	"	"	
Cadmium	ND	0.794	"	"	"	"	"	"	
Chromium	**15.8**	0.794	"	"	"	"	"	"	
Mercury	ND	0.200	"	"	3G09015	07/09/03	07/09/03	EPA 7471A	
Lead	**6.39**	0.794	"	"	3G08047	07/08/03	07/09/03	EPA 6020	
Selenium	ND	0.794	"	"	"	"	"	"	

Lab Composite 02 (B3G0092-12) Soil Sampled: 06/30/03 12:00 Received: 07/02/03 10:30

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
Silver	ND	0.694	mg/kg dry	1	3G08047	07/08/03	07/09/03	EPA 6020	
Arsenic	**1.83**	0.694	"	"	"	"	"	"	
Barium	**114**	6.94	"	"	"	"	"	"	
Cadmium	ND	0.694	"	"	"	"	"	"	
Chromium	**13.2**	0.694	"	"	"	"	"	"	
Mercury	ND	0.200	"	"	3G09015	07/09/03	07/09/03	EPA 7471A	
Lead	**7.23**	0.694	"	"	3G08047	07/08/03	07/09/03	EPA 6020	
Selenium	ND	0.694	"	"	"	"	"	"	

Lab Composite 03 (B3G0092-18) Soil Sampled: 06/30/03 12:00 Received: 07/02/03 10:30

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
Silver	ND	0.694	mg/kg dry	1	3G08047	07/08/03	07/09/03	EPA 6020	
Arsenic	**4.53**	0.694	"	"	"	"	"	"	
Barium	**148**	6.94	"	"	"	"	"	"	
Cadmium	ND	0.694	"	"	"	"	"	"	
Chromium	**15.1**	0.694	"	"	"	"	"	"	
Mercury	ND	0.200	"	"	3G09015	07/09/03	07/09/03	EPA 7471A	
Lead	**11.5**	0.694	"	"	3G08047	07/08/03	07/09/03	EPA 6020	
Selenium	ND	0.694	"	"	"	"	"	"	

The results in this report apply to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

Jeff Gerdes

Jeff Gerdes, Project Manager

Fulcrum Environmental-Yakima
222 North Second Street, Suite A
Yakima, WA/USA 98901

Project: Boise Wood Waste Landfill
Project Number: 03-464
Project Manager: Ryan Mathews

Reported:
07/16/03 10:33

Semivolatile Organic Compounds by EPA Method 8270C
North Creek Analytical - Bothell

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
Composite 01 (B3G0092-19) Soil	**Sampled: 06/30/03 12:00**		**Received: 07/02/03 10:30**						
2,4,5-Trichlorophenol	ND	0.330	mg/kg dry	1	3G07004	07/07/03	07/08/03	EPA 8270C	
2,4,6-Trichlorophenol	ND	0.330	"	"	"	"	"	"	
Pentachlorophenol	ND	0.500	"	"	"	"	"	"	
Surrogate: 2-FP	*94.9 %*	*26-137*			"	"	"	"	
Surrogate: Phenol-d6	*93.4 %*	*10-153*			"	"	"	"	
Surrogate: 2,4,6-TBP	*86.7 %*	*10-133*			"	"	"	"	
Surrogate: Nitrobenzene-d5	*104 %*	*48-127*			"	"	"	"	
Surrogate: p-Terphenyl-d14	*78.1 %*	*44-144*			"	"	"	"	
Surrogate: 2-FBP	*78.6 %*	*36-146*			"	"	"	"	

Jeff Gerdes

Jeff Gerdes, Project Manager

Fulcrum Environmental-Yakima
222 North Second Street, Suite A
Yakima, WA/USA 98901

Project: Boise Wood Waste Landfill
Project Number: 03-464
Project Manager: Ryan Mathews

Reported:
07/16/03 10:33

Physical Parameters by APHA/ASTM/EPA Methods
North Creek Analytical - Bothell

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
Lab Composite 01 (B3G0092-06) Soil	**Sampled: 06/30/03 12:00**		**Received: 07/02/03 10:30**						
Dry Weight	84.1	1.00	%	1	3G08039	07/08/03	07/09/03	BSOPSPL003R07	
Lab Composite 02 (B3G0092-12) Soil	**Sampled: 06/30/03 12:00**		**Received: 07/02/03 10:30**						
Dry Weight	81.3	1.00	%	1	3G08039	07/08/03	07/09/03	BSOPSPL003R07	
Lab Composite 03 (B3G0092-18) Soil	**Sampled: 06/30/03 12:00**		**Received: 07/02/03 10:30**						
Dry Weight	72.4	1.00	%	1	3G08039	07/08/03	07/09/03	BSOPSPL003R07	
Composite 01 (B3G0092-19) Soil	**Sampled: 06/30/03 12:00**		**Received: 07/02/03 10:30**						
Dry Weight	85.0	1.00	%	1	3G09026	07/09/03	07/10/03	BSOPSPL003R07	

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Jeff Gerdes

Jeff Gerdes, Project Manager

Fulcrum Environmental-Yakima
222 North Second Street, Suite A
Yakima, WA/USA 98901

Project: Boise Wood Waste Landfill
Project Number: 03-464
Project Manager: Ryan Mathews

Reported:
07/16/03 10:33

Hydrocarbon Identification by Washington DOE Method NWTPH-HCID - Quality Control
North Creek Analytical - Bothell

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch 3G08019: Prepared 07/08/03	**Using HCID (WA)**									
Blank (3G08019-BLK1)										
Gx Range Hydrocarbons	ND	20.0	mg/kg							
Kerosene Range Hydrocarbons	ND	50.0	"							
Diesel Range Hydrocarbons	ND	50.0	"							
Insulating Oil Range Hydrocarbons	ND	100	"							
Heavy Fuel Oil Range Hydrocarbons	ND	100	"							
Lube Oil Range Hydrocarbons	ND	100	"							
Surrogate: 2-FBP	*DET*		*"*	*160*		*104*	*50-150*			
Surrogate: Octacosane	*DET*		*"*	*160*		*118*	*50-150*			
Blank (3G08019-BLK2)										
Gx Range Hydrocarbons	ND	20.0	mg/kg							
ene Range Hydrocarbons	ND	50.0	"							
Diesel Range Hydrocarbons	ND	50.0	"							
Insulating Oil Range Hydrocarbons	ND	100	"							
Heavy Fuel Oil Range Hydrocarbons	ND	100	"							
Lube Oil Range Hydrocarbons	ND	100	"							
Surrogate: 2-FBP	*DET*		*"*	*160*		*99.4*	*50-150*			
Surrogate: Octacosane	*DET*		*"*	*160*		*101*	*50-150*			
Duplicate (3G08019-DUP1)					**Source: B3G0092-06**					
Gx Range Hydrocarbons	ND	20.0	mg/kg dry		1.06			27.1	50	
Kerosene Range Hydrocarbons	ND	50.0	"		5.25			19.9	50	
Diesel Range Hydrocarbons	ND	50.0	"		8.85			8.75	50	
Insulating Oil Range Hydrocarbons	ND	100	"		5.61			28.7	50	
Heavy Fuel Oil Range Hydrocarbons	ND	100	"		28.8			0.692	50	
Lube Oil Range Hydrocarbons	ND	100	"		11.8			15.5	50	
Surrogate: 2-FBP	*DET*		*"*	*190*		*98.4*	*50-150*			
Surrogate: Octacosane	*DET*		*"*	*190*		*107*	*50-150*			

N--th Creek Analytical - Bothell

Jeff Gerdes

Jeff Gerdes, Project Manager

Fulcrum Environmental-Yakima	Project: Boise Wood Waste Landfill	
222 North Second Street, Suite A	Project Number: 03-464	**Reported:**
Yakima, WA/USA 98901	Project Manager: Ryan Mathews	07/16/03 10:33

Hydrocarbon Identification by Washington DOE Method NWTPH-HCID - Quality Control

North Creek Analytical - Bothell

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch 3G08019: Prepared 07/08/03 Using HCID (WA)										
Duplicate (3G08019-DUP2)					**Source: B3G0092-06**					
Gx Range Hydrocarbons	ND	20.0	mg/kg dry		1.06			90.4	50	Q-06
Kerosene Range Hydrocarbons	ND	50.0	"		5.25			74.6	50	Q-06
Diesel Range Hydrocarbons	ND	50.0	"		8.85			78.6	50	Q-06
Insulating Oil Range Hydrocarbons	ND	100	"		5.61			98.5	50	Q-06
Heavy Fuel Oil Range Hydrocarbons	ND	100	"		28.8			87.9	50	Q-06
Lube Oil Range Hydrocarbons	ND	100	"		11.8			101	50	Q-06
Surrogate: 2-FBP	*DET*		*"*	*190*		*97.9*	*50-150*			
Surrogate: Octacosane	*DET*		*"*	*190*		*100*	*50-150*			

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Jeff Gerdes

Jeff Gerdes, Project Manager

Fulcrum Environmental-Yakima
222 North Second Street, Suite A
Yakima, WA/USA 98901

Project: Boise Wood Waste Landfill
Project Number: 03-464
Project Manager: Ryan Mathews

Reported:
07/16/03 10:33

Total Metals by EPA 6000/7000 Series Methods - Quality Control
North Creek Analytical - Bothell

Batch 3G08047: Prepared 07/08/03 Using EPA 3050B

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Blank (3G08047-BLK1)										
Arsenic	ND	0.500	mg/kg							
Barium	ND	5.00	"							
Cadmium	ND	0.500	"							
Chromium	ND	0.500	"							
Lead	ND	0.500	"							
Selenium	ND	0.500	"							
Silver	ND	0.500	"							
LCS (3G08047-BS1)										
Arsenic	39.3	0.500	mg/kg	39.2		100	80-120			
Barium	39.6	5.00	"	39.2		101	80-120			
Cadmium	38.9	0.500	"	39.2		99.2	80-120			
Chromium	38.9	0.500	"	39.2		99.2	80-120			
Lead	38.1	0.500	"	39.2		97.2	80-120			
Selenium	40.1	0.500	"	39.2		102	80-120			
Silver	38.3	0.500	"	39.2		97.7	80-120			
LCS Dup (3G08047-BSD1)										
Arsenic	39.4	0.500	mg/kg	39.6		99.5	80-120	0.254	20	
Barium	39.5	5.00	"	39.6		99.7	80-120	0.253	20	
Cadmium	39.1	0.500	"	39.6		98.7	80-120	0.513	20	
Chromium	38.9	0.500	"	39.6		98.2	80-120	0.00	20	
Lead	38.5	0.500	"	39.6		97.2	80-120	1.04	20	
Selenium	40.0	0.500	"	39.6		101	80-120	0.250	20	
Silver	38.4	0.500	"	39.6		97.0	80-120	0.261	20	
Matrix Spike (3G08047-MS1)					**Source: B3G0163-01**					
Arsenic	28.3	0.500	mg/kg dry	45.0	2.69	56.9	72-130			Q-01
Barium	120	5.00	"	45.0	85.9	75.8	53-147			
Cadmium	26.7	0.500	"	45.0	0.0956	59.1	70-130			Q-01
Chromium	62.3	0.500	"	45.0	34.3	62.2	53-147			
Lead	29.9	0.500	"	45.0	3.36	59.0	62-137			Q-01
Selenium	25.7	0.500	"	45.0	ND	57.1	70-130			Q-01
Silver	25.1	0.500	"	45.0	0.112	55.5	63-125			Q-01

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Jeff Gerdes

Jeff Gerdes, Project Manager

Fulcrum Environmental-Yakima
222 North Second Street, Suite A
Yakima, WA/USA 98901

Project: Boise Wood Waste Landfill
Project Number: 03-464
Project Manager: Ryan Mathews

Reported:
07/16/03 10:33

Total Metals by EPA 6000/7000 Series Methods - Quality Control
North Creek Analytical - Bothell

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch 3G08047: Prepared 07/08/03 Using EPA 3050B										
Matrix Spike Dup (3G08047-MSD1)					**Source: B3G0163-01**					
Arsenic	42.2	0.500	mg/kg dry	44.6	2.69	88.6	72-130	39.4	30	Q-07
Barium	133	5.00	"	44.6	85.9	106	53-147	10.3	30	
Cadmium	41.3	0.500	"	44.6	0.0956	92.4	70-130	42.9	30	Q-07
Chromium	75.6	0.500	"	44.6	34.3	92.6	53-147	19.3	30	
Lead	43.6	0.500	"	44.6	3.36	90.2	62-137	37.3	30	Q-07
Selenium	40.3	0.500	"	44.6	ND	90.4	70-130	44.2	30	Q-07
Silver	38.4	0.500	"	44.6	0.112	85.8	63-125	41.9	50	
Post Spike (3G08047-PS1)					**Source: B3G0163-01**					
Arsenic	58.8	0.500	mg/kg dry	56.2	2.69	99.8	75-125			
Barium	142	5.00	"	56.2	85.9	99.8	75-125			
Cadmium	55.4	0.500	"	56.2	0.0956	98.4	75-125			
Chromium	89.4	0.500	"	56.2	34.3	98.0	75-125			
Lead	58.3	0.500	"	56.2	3.36	97.8	75-125			
Selenium	57.8	0.500	"	56.2	ND	103	75-125			
Silver	54.2	0.500	"	56.2	0.112	96.2	75-125			
Batch 3G09015: Prepared 07/09/03 Using EPA 7471A										
Blank (3G09015-BLK1)										
Mercury	ND	0.200	mg/kg							
LCS (3G09015-BS1)										
Mercury	0.495	0.200	mg/kg	0.500		99.0	80-120			
LCS Dup (3G09015-BSD1)										
Mercury	0.511	0.200	mg/kg	0.500		102	80-120	3.18	20	

The results in this report apply to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

Jeff Gerdes

Jeff Gerdes, Project Manager

Total Metals by EPA 6000/7000 Series Methods - Quality Control
North Creek Analytical - Bothell

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch 3G09015: Prepared 07/09/03 Using EPA 7471A										
Matrix Spike (3G09015-MS1)					**Source: B3F0738-01**					
Mercury	0.592	0.200	mg/kg dry	0.561	0.0381	98.7	70-130			
Matrix Spike Dup (3G09015-MSD1)					**Source: B3F0738-01**					
Mercury	0.551	0.200	mg/kg dry	0.518	0.0381	99.0	70-130	7.17	30	

Fulcrum Environmental-Yakima 222 North Second Street, Suite A Yakima, WA/USA 98901	Project: Boise Wood Waste Landfill Project Number: 03-464 Project Manager: Ryan Mathews	**Reported:** 07/16/03 10:33

Semivolatile Organic Compounds by EPA Method 8270C - Quality Control
North Creek Analytical - Bothell

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch 3G07004: Prepared 07/07/03 Using EPA 3545										
Blank (3G07004-BLK1)										
1,2,4-Trichlorobenzene	ND	0.330	mg/kg							
1,2-Dichlorobenzene	ND	0.330	"							
1,3-Dichlorobenzene	ND	0.330	"							
1,4-Dichlorobenzene	ND	0.330	"							
2,4,5-Trichlorophenol	ND	0.330	"							
2,4,6-Trichlorophenol	ND	0.330	"							
2,4-Dichlorophenol	ND	0.330	"							
2,4-Dimethylphenol	ND	0.330	"							
2,4-Dinitrophenol	ND	0.500	"							
2,4-Dinitrotoluene	ND	0.500	"							
2,6-Dinitrotoluene	ND	0.500	"							
oronaphthalene	ND	0.330	"							
2-Chlorophenol	ND	0.330	"							
2-Methylnaphthalene	ND	0.330	"							
2-Methylphenol	ND	0.330	"							
2-Nitroaniline	ND	0.500	"							
2-Nitrophenol	ND	0.330	"							
3 & 4-Methylphenol	ND	0.330	"							
3,3′-Dichlorobenzidine	ND	5.00	"							
3-Nitroaniline	ND	0.500	"							
4,6-Dinitro-2-methylphenol	ND	0.500	"							
4-Bromophenyl phenyl ether	ND	0.330	"							
4-Chloro-3-methylphenol	ND	0.330	"							
4-Chloroaniline	ND	0.500	"							
4-Chlorophenyl phenyl ether	ND	0.330	"							
4-Nitroaniline	ND	0.500	"							
4-Nitrophenol	ND	0.500	"							
Acenaphthene	ND	0.330	"							
Acenaphthylene	ND	0.330	"							
Aniline	ND	0.330	"							
Anthracene	ND	0.330	"							
Benzo (a) anthracene	ND	0.330	"							
Benzo (a) pyrene	ND	0.330	"							
Benzo (b) fluoranthene	ND	0.330	"							

Jeff Gerdes

Jeff Gerdes, Project Manager

Fulcrum Environmental-Yakima
222 North Second Street, Suite A
Yakima, WA/USA 98901

Project: Boise Wood Waste Landfill
Project Number: 03-464
Project Manager: Ryan Mathews

Reported:
07/16/03 10:33

Semivolatile Organic Compounds by EPA Method 8270C - Quality Control
North Creek Analytical - Bothell

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch 3G07004: Prepared 07/07/03 Using EPA 3545										
Blank (3G07004-BLK1)										
Benzo (ghi) perylene	ND	0.330	mg/kg							
Benzo (k) fluoranthene	ND	0.330	"							
Benzoic Acid	ND	1.00	"							
Benzyl alcohol	ND	0.330	"							
Bis(2-chloroethoxy)methane	ND	0.330	"							
Bis(2-chloroethyl)ether	ND	0.330	"							
Bis(2-chloroisopropyl)ether	ND	0.330	"							
Bis(2-ethylhexyl)phthalate	ND	0.330	"							
Butyl benzyl phthalate	ND	0.330	"							
Carbazole	ND	0.330	"							
Chrysene	ND	0.330	"							
butyl phthalate	ND	0.330	"							
Di-n-octyl phthalate	ND	0.330	"							
Dibenz (a,h) anthracene	ND	0.330	"							
Dibenzofuran	ND	0.330	"							
Diethyl phthalate	ND	0.330	"							
Dimethyl phthalate	ND	0.330	"							
Fluoranthene	ND	0.330	"							
Fluorene	ND	0.330	"							
Hexachlorobenzene	ND	0.330	"							
Hexachlorobutadiene	ND	0.330	"							
Hexachlorocyclopentadiene	ND	0.500	"							
Hexachloroethane	ND	0.330	"							
Indeno (1,2,3-cd) pyrene	ND	0.330	"							
Isophorone	ND	0.330	"							
N-Nitrosodi-n-propylamine	ND	0.330	"							
N-Nitrosodiphenylamine	ND	0.330	"							
Naphthalene	ND	0.330	"							
Nitrobenzene	ND	0.330	"							
Pentachlorophenol	ND	0.500	"							
Phenanthrene	ND	0.330	"							
Phenol	ND	0.330	"							
Pyrene	ND	0.330	"							

North Creek Analytical - Bothell

Jeff Gerdes

Jeff Gerdes, Project Manager

Fulcrum Environmental-Yakima
222 North Second Street, Suite A
Yakima, WA/USA 98901

Project: Boise Wood Waste Landfill
Project Number: 03-464
Project Manager: Ryan Mathews

Reported:
07/16/03 10:33

Semivolatile Organic Compounds by EPA Method 8270C - Quality Control
North Creek Analytical - Bothell

Batch 3G07004: Prepared 07/07/03 Using EPA 3545

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Blank (3G07004-BLK1)										
Surrogate: 2-FP	*1.80*		*mg/kg*	*1.67*		*108*	*26-137*			
Surrogate: Phenol-d6	*1.80*		"	*1.67*		*108*	*10-153*			
Surrogate: 2,4,6-TBP	*1.55*		"	*1.67*		*92.8*	*10-133*			
Surrogate: Nitrobenzene-d5	*1.98*		"	*1.67*		*119*	*48-127*			
Surrogate: p-Terphenyl-d14	*1.95*		"	*1.67*		*117*	*44-144*			
Surrogate: 2-FBP	*1.82*		"	*1.67*		*109*	*36-146*			
LCS (3G07004-BS1)										
1,2,4-Trichlorobenzene	3.43	0.330	mg/kg	3.33		103	61-126			
1,4-Dichlorobenzene	3.13	0.330	"	3.33		94.0	47-138			
2,4-Dinitrotoluene	3.70	0.500	"	3.33		111	71-133			
2-Chlorophenol	3.33	0.330	"	3.33		100	54-144			
oro-3-methylphenol	3.72	0.330	"	3.33		112	71-129			
4-Nitrophenol	3.32	0.500	"	3.33		99.7	46-135			
Acenaphthene	3.09	0.330	"	3.33		92.8	69-124			
N-Nitrosodi-n-propylamine	3.73	0.330	"	3.33		112	48-140			
Pentachlorophenol	3.22	0.500	"	3.33		96.7	57-128			
Phenol	3.57	0.330	"	3.33		107	51-142			
Pyrene	3.23	0.330	"	3.33		97.0	75-135			
Surrogate: 2-FP	*1.86*		"	*1.67*		*111*	*26-137*			
Surrogate: Phenol-d6	*1.84*		"	*1.67*		*110*	*10-153*			
Surrogate: 2,4,6-TBP	*1.76*		"	*1.67*		*105*	*10-133*			
Surrogate: Nitrobenzene-d5	*1.82*		"	*1.67*		*109*	*48-127*			
Surrogate: p-Terphenyl-d14	*1.63*		"	*1.67*		*97.6*	*44-144*			
Surrogate: 2-FBP	*1.64*		"	*1.67*		*98.2*	*36-146*			
LCS Dup (3G07004-BSD1)										
1,2,4-Trichlorobenzene	3.56	0.330	mg/kg	3.33		107	61-126	3.72	22	
1,4-Dichlorobenzene	3.09	0.330	"	3.33		92.8	47-138	1.29	26	
2,4-Dinitrotoluene	3.33	0.500	"	3.33		100	71-133	10.5	21	
2-Chlorophenol	3.16	0.330	"	3.33		94.9	54-144	5.24	22	
4-Chloro-3-methylphenol	3.92	0.330	"	3.33		118	71-129	5.24	19	
4-Nitrophenol	3.32	0.500	"	3.33		99.7	46-135	0.00	17	
Acenaphthene	2.84	0.330	"	3.33		85.3	69-124	8.43	24	
N-Nitrosodi-n-propylamine	3.82	0.330	"	3.33		115	48-140	2.38	23	

North Creek Analytical - Bothell

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Jeff Gerdes

Jeff Gerdes, Project Manager

Fulcrum Environmental-Yakima
222 North Second Street, Suite A
Yakima, WA/USA 98901

Project: Boise Wood Waste Landfill
Project Number: 03-464
Project Manager: Ryan Mathews

Reported:
07/16/03 10:33

Semivolatile Organic Compounds by EPA Method 8270C - Quality Control

North Creek Analytical - Bothell

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch 3G07004: Prepared 07/07/03 Using EPA 3545										
LCS Dup (3G07004-BSD1)										
Pentachlorophenol	2.95	0.500	mg/kg	3.33		88.6	57-128	8.75	17	
Phenol	3.45	0.330	"	3.33		104	51-142	3.42	20	
Pyrene	3.19	0.330	"	3.33		95.8	75-135	1.25	17	
Surrogate: 2-FP	*1.72*		"	*1.67*		*103*	*26-137*			
Surrogate: Phenol-d6	*1.70*		"	*1.67*		*102*	*10-153*			
Surrogate: 2,4,6-TBP	*1.55*		"	*1.67*		*92.8*	*10-133*			
Surrogate: Nitrobenzene-d5	*1.81*		"	*1.67*		*108*	*48-127*			
Surrogate: p-Terphenyl-d14	*1.64*		"	*1.67*		*98.2*	*44-144*			
Surrogate: 2-FBP	*1.61*		"	*1.67*		*96.4*	*36-146*			
Matrix Spike (3G07004-MS1)					**Source: B3G0092-19**					
1,2,4-Trichlorobenzene	3.08	0.330	mg/kg dry	3.92	ND	78.6	34-126			
Dichlorobenzene	2.85	0.330	"	3.92	ND	72.7	31-126			
2,4-Dinitrotoluene	3.44	0.500	"	3.92	ND	87.8	32-154			
2-Chlorophenol	3.12	0.330	"	3.92	ND	79.6	34-144			
4-Chloro-3-methylphenol	3.86	0.330	"	3.92	ND	98.5	32-156			
4-Nitrophenol	3.36	0.500	"	3.92	ND	85.7	10-171			
Acenaphthene	2.48	0.330	"	3.92	ND	63.3	33-139			
N-Nitrosodi-n-propylamine	3.48	0.330	"	3.92	ND	88.8	23-140			
Pentachlorophenol	3.17	0.500	"	3.92	ND	80.9	10-165			
Phenol	3.34	0.330	"	3.92	ND	85.2	32-144			
Pyrene	2.94	0.330	"	3.92	ND	75.0	28-156			
Surrogate: 2-FP	*1.76*		"	*1.96*		*89.8*	*26-137*			
Surrogate: Phenol-d6	*1.67*		"	*1.96*		*85.2*	*10-153*			
Surrogate: 2,4,6-TBP	*1.65*		"	*1.96*		*84.2*	*10-133*			
Surrogate: Nitrobenzene-d5	*1.79*		"	*1.96*		*91.3*	*48-127*			
Surrogate: p-Terphenyl-d14	*1.45*		"	*1.96*		*74.0*	*44-144*			
Surrogate: 2-FBP	*1.52*		"	*1.96*		*77.6*	*36-146*			

Fulcrum Environmental-Yakima 222 North Second Street, Suite A Yakima, WA/USA 98901	Project: Boise Wood Waste Landfill Project Number: 03-464 Project Manager: Ryan Mathews	**Reported:** 07/16/03 10:33

Semivolatile Organic Compounds by EPA Method 8270C - Quality Control

North Creek Analytical - Bothell

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch 3G07004: Prepared 07/07/03 Using EPA 3545										
Matrix Spike Dup (3G07004-MSD1)					**Source: B3G0092-19**					
1,2,4-Trichlorobenzene	3.53	0.330	mg/kg dry	3.92	ND	90.1	34-126	13.6	39	
1,4-Dichlorobenzene	3.25	0.330	"	3.92	ND	82.9	31-126	13.1	42	
2,4-Dinitrotoluene	3.87	0.500	"	3.92	ND	98.7	32-154	11.8	37	
2-Chlorophenol	3.53	0.330	"	3.92	ND	90.1	34-144	12.3	39	
4-Chloro-3-methylphenol	4.61	0.330	"	3.92	ND	118	32-156	17.7	36	
4-Nitrophenol	3.63	0.500	"	3.92	ND	92.6	10-171	7.73	36	
Acenaphthene	2.93	0.330	"	3.92	ND	74.7	33-139	16.6	35	
N-Nitrosodi-n-propylamine	3.89	0.330	"	3.92	ND	99.2	23-140	11.1	39	
Pentachlorophenol	3.50	0.500	"	3.92	ND	89.3	10-165	9.90	39	
Phenol	3.73	0.330	"	3.92	ND	95.2	32-144	11.0	40	
Pyrene	3.23	0.330	"	3.92	ND	82.4	28-156	9.40	35	
[illegible]gate: 2-FP	*1.95*		*"*	*1.96*		*99.5*	*26-137*			
Surrogate: Phenol-d6	*1.93*		*"*	*1.96*		*98.5*	*10-153*			
Surrogate: 2,4,6-TBP	*1.83*		*"*	*1.96*		*93.4*	*10-133*			
Surrogate: Nitrobenzene-d5	*2.06*		*"*	*1.96*		*105*	*48-127*			
Surrogate: p-Terphenyl-d14	*1.68*		*"*	*1.96*		*85.7*	*44-144*			
Surrogate: 2-FBP	*1.66*		*"*	*1.96*		*84.7*	*36-146*			

Jeff Gerdes

Jeff Gerdes, Project Manager

Physical Parameters by APHA/ASTM/EPA Methods - Quality Control

North Creek Analytical - Bothell

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch 3G08039: Prepared 07/08/03 Using Dry Weight										
Blank (3G08039-BLK1)										
Dry Weight	99.8	1.00	%							
Batch 3G09026: Prepared 07/09/03 Using Dry Weight										
Blank (3G09026-BLK1)										
Dry Weight	100	1.00	%							

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Jeff Gerdes

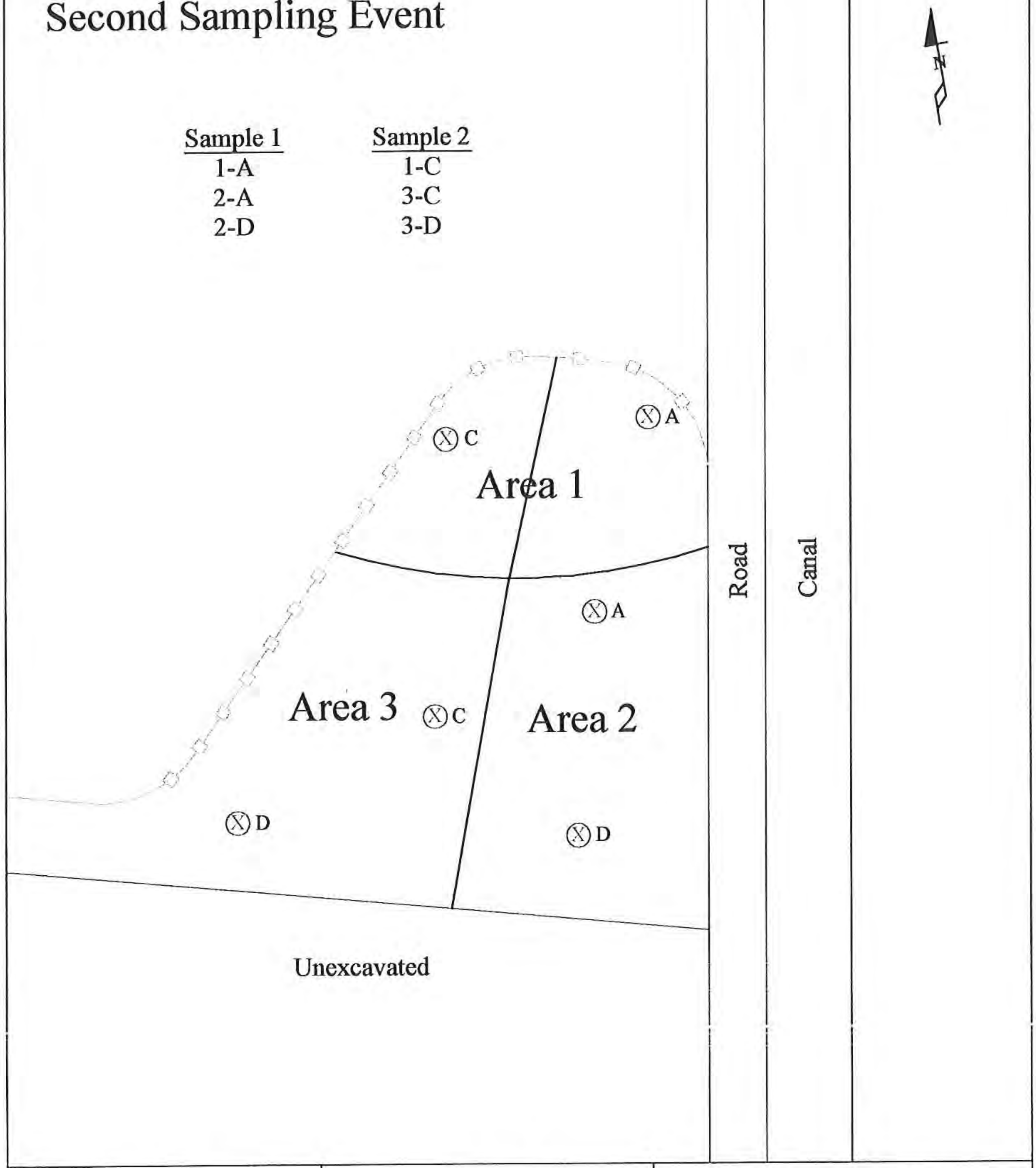
Jeff Gerdes, Project Manager

Notes and Definitions

Q-01	The spike recovery for this QC sample is outside of established control limits. Review of associated batch QC indicates the recovery for this analyte does not represent an out-of-control condition for the batch.
Q-06	Analyses are not controlled on RPD values from sample concentrations less than 5 times the reporting limit.
Q-07	The RPD value for this QC sample is above the established control limit. Review of associated QC indicates the high RPD does not represent an out-of-control condition for the batch.
DET	Analyte DETECTED
ND	Analyte NOT DETECTED at or above the reporting limit
NR	Not Reported
dry	Sample results reported on a dry weight basis
RPD	Relative Percent Difference

Second Sampling Event

Sample 1	Sample 2
1-A	1-C
2-A	3-C
2-D	3-D



Legend

Sample Locations: ⓧ
Fence Line: —□—□—□—
Scale: NTS

Figure 2
Sample Location Map

Boise Building Solutions
Yakima Facility
Woodwaste Landfill

Fulcrum Environmental Consulting, Inc.
222 North Second Street, Suite A
Yakima, Washington 98901
Phone (509) 574-0839 Fax (509) 575-8453

Drawn by: AMP	Project Number: 03-464
Date: 08/18/2003	File Name: Boise Sampling

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Seattle 11720 North Creek Pkwy N, Suite 400, Bothell, WA 98011-8244
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907.563.9200 fax 907.563.9210

Fulcrum Environmental-Yakima
222 North Second Street, Suite A
Yakima, WA/USA 98901

Project: Boise Wood Waste Landfill
Project Number: 03-464
Project Manager: Ryan Mathews

Reported:
08/14/03 16:05

ANALYTICAL REPORT FOR SAMPLES

Sample ID	Laboratory ID	Matrix	Date Sampled	Date Received
Composite 1A,2A,2D	B3H0030-04	Soil	07/31/03 09:00	08/01/03 11:15
Composite 1C,3C,3D	B3H0030-08	Soil	07/31/03 09:00	08/01/03 11:15

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Jeff Gerdes

Jeff Gerdes, Project Manager

Fulcrum Environmental-Yakima 222 North Second Street, Suite A Yakima, WA/USA 98901	Project: Boise Wood Waste Landfill Project Number: 03-464 Project Manager: Ryan Mathews	**Reported:** 08/14/03 16:05

Polynuclear Aromatic Hydrocarbons by GC/MS-SIM

North Creek Analytical - Bothell

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
Composite 1A,2A,2D (B3H0030-04) Soil	**Sampled: 07/31/03 09:00**		**Received: 08/01/03 11:15**						
1-Methylnaphthalene	ND	0.0100	mg/kg dry	1	3H04039	08/04/03	08/11/03	EPA 8270-SIM	
2-Methylnaphthalene	ND	0.0100	"	"	"	"	"	"	
Acenaphthene	ND	0.0100	"	"	"	"	"	"	
Acenaphthylene	ND	0.0100	"	"	"	"	"	"	
Anthracene	ND	0.0100	"	"	"	"	"	"	
Benzo (a) anthracene	ND	0.0100	"	"	"	"	"	"	
Benzo (a) pyrene	ND	0.0100	"	"	"	"	"	"	
Benzo (b) fluoranthene	ND	0.0100	"	"	"	"	"	"	
Benzo (ghi) perylene	ND	0.0100	"	"	"	"	"	"	
Benzo (k) fluoranthene	ND	0.0100	"	"	"	"	"	"	
Chrysene	ND	0.0100	"	"	"	"	"	"	
Dibenz (a,h) anthracene	ND	0.0100	"	"	"	"	"	"	
nthene	ND	0.0100	"	"	"	"	"	"	
Fluorene	ND	0.0100	"	"	"	"	"	"	
Indeno (1,2,3-cd) pyrene	ND	0.0100	"	"	"	"	"	"	
Naphthalene	ND	0.0100	"	"	"	"	"	"	
Phenanthrene	ND	0.0100	"	"	"	"	"	"	
Pyrene	ND	0.0100	"	"	"	"	"	"	
Surrogate: p-Terphenyl-d14	*119 %*	*42-141*			"	"	"	"	
Composite 1C,3C,3D (B3H0030-08) Soil	**Sampled: 07/31/03 09:00**		**Received: 08/01/03 11:15**						
1-Methylnaphthalene	ND	0.0100	mg/kg dry	1	3H04039	08/04/03	08/11/03	EPA 8270-SIM	
2-Methylnaphthalene	ND	0.0100	"	"	"	"	"	"	
Acenaphthene	ND	0.0100	"	"	"	"	"	"	
Acenaphthylene	ND	0.0100	"	"	"	"	"	"	
Anthracene	ND	0.0100	"	"	"	"	"	"	
Benzo (a) anthracene	ND	0.0100	"	"	"	"	"	"	
Benzo (a) pyrene	ND	0.0100	"	"	"	"	"	"	
Benzo (b) fluoranthene	ND	0.0100	"	"	"	"	"	"	
Benzo (ghi) perylene	ND	0.0100	"	"	"	"	"	"	
Benzo (k) fluoranthene	ND	0.0100	"	"	"	"	"	"	
Chrysene	ND	0.0100	"	"	"	"	"	"	
Dibenz (a,h) anthracene	ND	0.0100	"	"	"	"	"	"	
Fluoranthene	ND	0.0100	"	"	"	"	"	"	
Fluorene	ND	0.0100	"	"	"	"	"	"	

The results in this report apply to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

Jeff Gerdes

Jeff Gerdes, Project Manager

Fulcrum Environmental-Yakima 222 North Second Street, Suite A Yakima, WA/USA 98901	Project: Boise Wood Waste Landfill Project Number: 03-464 Project Manager: Ryan Mathews	**Reported:** 08/14/03 16:05

Polynuclear Aromatic Hydrocarbons by GC/MS-SIM

North Creek Analytical - Bothell

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
Composite 1C,3C,3D (B3H0030-08) Soil	**Sampled: 07/31/03 09:00**		**Received: 08/01/03 11:15**						
Indeno (1,2,3-cd) pyrene	ND	0.0100	mg/kg dry	1	3H04039	08/04/03	08/11/03	"	
Naphthalene	ND	0.0100	"	"	"	"	"	"	
Phenanthrene	ND	0.0100	"	"	"	"	"	"	
Pyrene	ND	0.0100	"	"	"	"	"	"	
Surrogate: p-Terphenyl-d14	*120 %*	*42-141*			"	"	"	"	

Fulcrum Environmental-Yakima
222 North Second Street, Suite A
Yakima, WA/USA 98901

Project: Boise Wood Waste Landfill
Project Number: 03-464
Project Manager: Ryan Mathews

Reported:
08/14/03 16:05

Physical Parameters by APHA/ASTM/EPA Methods

North Creek Analytical - Bothell

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
Composite 1A,2A,2D (B3H0030-04) Soil	**Sampled: 07/31/03 09:00**		**Received: 08/01/03 11:15**						
Dry Weight	**90.1**	1.00	%	1	3H12001	08/12/03	08/13/03	BSOPSPL003R08	
Composite 1C,3C,3D (B3H0030-08) Soil	**Sampled: 07/31/03 09:00**		**Received: 08/01/03 11:15**						
Dry Weight	**76.6**	1.00	%	1	3H12001	08/12/03	08/13/03	BSOPSPL003R08	

North Creek Analytical - Bothell

The results in this report apply to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

Jeff Gerdes

Jeff Gerdes, Project Manager

Fulcrum Environmental-Yakima 222 North Second Street, Suite A Yakima, WA/USA 98901	Project: Boise Wood Waste Landfill Project Number: 03-464 Project Manager: Ryan Mathews	**Reported:** 08/14/03 16:05

Polynuclear Aromatic Hydrocarbons by GC/MS-SIM - Quality Control

North Creek Analytical - Bothell

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch 3H04039: Prepared 08/04/03 Using EPA 3550B										
Blank (3H04039-BLK1)										
1-Methylnaphthalene	ND	0.0100	mg/kg							
2-Methylnaphthalene	ND	0.0100	"							
Acenaphthene	ND	0.0100	"							
Acenaphthylene	ND	0.0100	"							
Anthracene	ND	0.0100	"							
Benzo (a) anthracene	ND	0.0100	"							
Benzo (a) pyrene	ND	0.0100	"							
Benzo (b) fluoranthene	ND	0.0100	"							
Benzo (ghi) perylene	ND	0.0100	"							
Benzo (k) fluoranthene	ND	0.0100	"							
Chrysene	ND	0.0100	"							
Dibenz (a,h) anthracene	ND	0.0100	"							
Fluoranthene	ND	0.0100	"							
Fluorene	ND	0.0100	"							
Indeno (1,2,3-cd) pyrene	ND	0.0100	"							
Naphthalene	ND	0.0100	"							
Phenanthrene	ND	0.0100	"							
Pyrene	ND	0.0100	"							
Surrogate: p-Terphenyl-d14	*0.338*		*"*	*0.267*		*127*	*42-141*			
LCS (3H04039-BS2)										
Acenaphthene	0.307	0.0100	mg/kg	0.333		92.2	50-150			
Acenaphthylene	0.337	0.0100	"	0.333		101	50-150			
Anthracene	0.315	0.0100	"	0.333		94.6	50-150			
Benzo (a) anthracene	0.329	0.0100	"	0.333		98.8	50-150			
Benzo (a) pyrene	0.339	0.0100	"	0.333		102	50-150			
Benzo (b) fluoranthene	0.305	0.0100	"	0.333		91.6	50-150			
Benzo (ghi) perylene	0.322	0.0100	"	0.333		96.7	50-150			
Benzo (k) fluoranthene	0.349	0.0100	"	0.333		105	50-150			
Chrysene	0.297	0.0100	"	0.333		89.2	54-112			
Dibenz (a,h) anthracene	0.269	0.0100	"	0.333		80.8	50-150			
Fluoranthene	0.339	0.0100	"	0.333		102	50-150			
Fluorene	0.301	0.0100	"	0.333		90.4	51-107			
Indeno (1,2,3-cd) pyrene	0.291	0.0100	"	0.333		87.4	42-112			

Jeff Gerdes

Jeff Gerdes, Project Manager

Fulcrum Environmental-Yakima	Project: Boise Wood Waste Landfill	
222 North Second Street, Suite A	Project Number: 03-464	**Reported:**
Yakima, WA/USA 98901	Project Manager: Ryan Mathews	08/14/03 16:05

Polynuclear Aromatic Hydrocarbons by GC/MS-SIM - Quality Control
North Creek Analytical - Bothell

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch 3H04039: Prepared 08/04/03 Using EPA 3550B										
LCS (3H04039-BS2)										
Naphthalene	0.314	0.0100	mg/kg	0.333		94.3	50-150			
Phenanthrene	0.362	0.0100	"	0.333		109	50-150			
Pyrene	0.335	0.0100	"	0.333		101	50-150			
Surrogate: p-Terphenyl-d14	*0.323*		*"*	*0.267*		*121*	*42-141*			
LCS Dup (3H04039-BSD2)										
Acenaphthene	0.302	0.0100	mg/kg	0.333		90.7	50-150	1.64	25	
Acenaphthylene	0.327	0.0100	"	0.333		98.2	50-150	3.01	25	
Anthracene	0.378	0.0100	"	0.333		114	50-150	18.2	25	
Benzo (a) anthracene	0.323	0.0100	"	0.333		97.0	50-150	1.84	25	
Benzo (a) pyrene	0.362	0.0100	"	0.333		109	50-150	6.56	25	
Benzo (b) fluoranthene	0.360	0.0100	"	0.333		108	50-150	16.5	25	
Benzo (ghi) perylene	0.342	0.0100	"	0.333		103	50-150	6.02	25	
Benzo (k) fluoranthene	0.326	0.0100	"	0.333		97.9	50-150	6.81	25	
Chrysene	0.339	0.0100	"	0.333		102	54-112	13.2	37	
Dibenz (a,h) anthracene	0.283	0.0100	"	0.333		85.0	50-150	5.07	25	
Fluoranthene	0.364	0.0100	"	0.333		109	50-150	7.11	25	
Fluorene	0.331	0.0100	"	0.333		99.4	51-107	9.49	43	
Indeno (1,2,3-cd) pyrene	0.307	0.0100	"	0.333		92.2	42-112	5.35	32	
Naphthalene	0.326	0.0100	"	0.333		97.9	50-150	3.75	25	
Phenanthrene	0.349	0.0100	"	0.333		105	50-150	3.66	25	
Pyrene	0.354	0.0100	"	0.333		106	50-150	5.52	25	
Surrogate: p-Terphenyl-d14	*0.354*		*"*	*0.267*		*133*	*42-141*			
Matrix Spike (3H04039-MS1)					**Source: B3G0605-06**					
Acenaphthene	3.65	0.0500	mg/kg dry	3.87	0.0464	93.1	50-150			
Acenaphthylene	4.35	0.0500	"	3.87	0.0232	112	50-150			
Anthracene	4.41	0.0500	"	3.87	0.101	111	50-150			
Benzo (a) anthracene	5.07	0.0500	"	3.87	0.0310	130	50-150			
Benzo (a) pyrene	4.59	0.0500	"	3.87	ND	119	50-150			
Benzo (b) fluoranthene	3.95	0.0500	"	3.87	ND	102	50-150			
Benzo (ghi) perylene	4.66	0.0500	"	3.87	ND	120	50-150			
Benzo (k) fluoranthene	ND	0.0500	"	3.87	ND		50-150	NA		Q-02
Chrysene	2.47	0.0500	"	3.87	ND	63.8	29-143			

Jeff Gerdes

Jeff Gerdes, Project Manager

Fulcrum Environmental-Yakima	Project: Boise Wood Waste Landfill	
222 North Second Street, Suite A	Project Number: 03-464	**Reported:**
Yakima, WA/USA 98901	Project Manager: Ryan Mathews	08/14/03 16:05

Polynuclear Aromatic Hydrocarbons by GC/MS-SIM - Quality Control
North Creek Analytical - Bothell

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch 3H04039: Prepared 08/04/03 Using EPA 3550B										
Matrix Spike (3H04039-MS1)					**Source: B3G0605-06**					
Dibenz (a,h) anthracene	4.54	0.0500	mg/kg dry	3.87	ND	117	50-150			
Fluoranthene	5.80	0.0500	"	3.87	0.135	146	50-150			
Fluorene	4.16	0.0500	"	3.87	0.124	104	36-134			
Indeno (1,2,3-cd) pyrene	4.48	0.0500	"	3.87	ND	116	19-138			
Naphthalene	7.95	0.0500	"	3.87	4.97	77.0	50-150			
Phenanthrene	ND	0.0500	"	3.87	0.441	-11.4	50-150			Q-02
Pyrene	4.18	0.0500	"	3.87	0.120	105	50-150			
Surrogate: p-Terphenyl-d14	*0.290*		*"*	*0.310*		*93.5*	*42-141*			
Matrix Spike Dup (3H04039-MSD1)					**Source: B3G0605-06**					
Acenaphthene	2.75	0.0500	mg/kg dry	3.87	0.0464	69.9	50-150	28.1	25	Q-07
phthylene	3.13	0.0500	"	3.87	0.0232	80.3	50-150	32.6	25	Q-07
Anthracene	3.00	0.0500	"	3.87	0.101	74.9	50-150	38.1	25	Q-07
Benzo (a) anthracene	3.61	0.0500	"	3.87	0.0310	92.5	50-150	33.6	25	Q-07
Benzo (a) pyrene	3.08	0.0500	"	3.87	ND	79.6	50-150	39.4	25	Q-07
Benzo (b) fluoranthene	2.72	0.0500	"	3.87	ND	70.3	50-150	36.9	25	Q-07
Benzo (ghi) perylene	2.78	0.0500	"	3.87	ND	71.8	50-150	50.5	25	Q-07
Benzo (k) fluoranthene	2.68	0.0500	"	3.87	ND	69.3	50-150		25	
Chrysene	1.87	0.0500	"	3.87	ND	48.3	29-143	27.6	44	
Dibenz (a,h) anthracene	2.92	0.0500	"	3.87	ND	75.5	50-150	43.4	25	Q-07
Fluoranthene	4.25	0.0500	"	3.87	0.135	106	50-150	30.8	25	Q-07
Fluorene	2.81	0.0500	"	3.87	0.124	69.4	36-134	38.7	52	
Indeno (1,2,3-cd) pyrene	2.93	0.0500	"	3.87	ND	75.7	19-138	41.8	43	
Naphthalene	5.82	0.0500	"	3.87	4.97	22.0	50-150	30.9	25	Q-02, Q-07
Phenanthrene	5.45	0.0500	"	3.87	0.441	129	50-150		25	
Pyrene	2.78	0.0500	"	3.87	0.120	68.7	50-150	40.2	25	Q-07
Surrogate: p-Terphenyl-d14	*0.186*		*"*	*0.310*		*60.0*	*42-141*			

Fulcrum Environmental-Yakima
222 North Second Street, Suite A
Yakima, WA/USA 98901

Project: Boise Wood Waste Landfill
Project Number: 03-464
Project Manager: Ryan Mathews

Reported:
08/14/03 16:05

Physical Parameters by APHA/ASTM/EPA Methods - Quality Control
North Creek Analytical - Bothell

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch 3H12001: Prepared 08/12/03 Using Dry Weight										
Blank (3H12001-BLK1)										
Dry Weight	100	1.00	%							

Jeff Gerdes

Jeff Gerdes, Project Manager

Notes and Definitions

Q-02	The spike recovery for this QC sample is outside of NCA established control limits due to sample matrix interference.
Q-07	The RPD value for this QC sample is above the established control limit. Review of associated QC indicates the high RPD does not represent an out-of-control condition for the batch.
DET	Analyte DETECTED
ND	Analyte NOT DETECTED at or above the reporting limit
NR	Not Reported
dry	Sample results reported on a dry weight basis
RPD	Relative Percent Difference

DENNIS L. RADOCHA
Associate General Counsel
T 208 384 4840 F 208 384 4961
DennisRadocha@OfficeMax.com

DEPT OF ECOLOGY
Received
JUN 20 2005
CENTRAL REGION OFFICE

June 16, 2005

Al Armstrong
Washington Department of Ecology
15 West Yakima Avenue, Suite 200
Yakima, WA 98902

Subject: Former Boise Cascade Corporation Yakima Wood Debris Landfill

Dear Mr. Armstrong:

In 2003, Boise Cascade Corporation completed the removal of wood waste from approximately 2.5 acres of a 5.7 acre historic wood waste landfill adjacent to the company's former wood products mill. In September, 2003, the Washington Department of Ecology and the Yakima Health District approved the cleanup on that portion of the landfill.

Please note that in November, 2004, after a sale of its manufacturing assets, Boise Cascade Corporation changed its corporate name to OfficeMax Incorporated. OfficeMax is the continuing owner of this parcel.

In late 2004, Boise completed excavation of the remaining wood waste on the remaining approximately 2.2 acres of the parcel. In early 2005, Fulcrum Environmental Consulting, Inc. conducted soil sampling on the parcel.

I am enclosing the results of the 2005 sampling, along with the sampling and analysis plan developed for this portion of the property. As was done in 2003, OfficeMax requests your concurrence that cleanup is completed on the remaining parcel and that the entire 5.7 acre landfill is now considered closed.

I appreciate your review of the enclosed data and look forward to your response. Please give me a call if you have any questions.

Sincerely,

Dennis L. Radocha

Enclosure

{\\IDAHOAPP1\DATA\WDOX\OP\299007:0019:00249804:}

1111 WEST JEFFERSON STREET • BOISE, ID 83728 OfficeMax

FULCRUM
ENVIRONMENTAL CONSULTING, INC.

March 22, 2005

Dennis Radocha
Office Max, Inc.
c/o Boise Cascade, LLC
1111 West Jefferson
Boise, Idaho 83702

Boise Cascade Corp.
RECEIVED
MAR 25 2005
Legal Dept.

RE: Laboratory Results of Third Phase of Woodwaste Landfill Soil Sampling

Dear Dennis:

In February 2005, Fulcrum Environmental Consulting, Inc. (Fulcrum) completed final soil sampling from the historic Yakima facility woodwaste landfill location. The woodwaste landfill is adjacent to the former Boise Cascade Corporation (Boise) Lumber Mill and Plywood Facility. Boise sold the operational portions of the facility in April of 2004, while retaining ownership of the woodwaste landfill to complete site restoration activities. Subsequently, Boise became Office Max, Inc. (Office Max), the current site owner.

In July 2003, Boise completed excavation of the first phase of the woodwaste landfill, estimated to include 40% of the landfill extents. Soil sampling conducted in June and July 2003 confirmed completeness of activities. Laboratory analysis including diesel, oil, gasoline, metals, or wood preservatives were not identified above applicable Washington State Department of Ecology Model Toxics Control Act (MTCA) cleanup levels for soil. In October 2004, Boise completed excavation of the remaining woodwaste landfill.

Selected sampling density for the first phase sampling of the historic woodwaste landfill included three areas with five sub-samples in each area for an estimated 40% of the site area for northwest total petroleum hydrocarbons – hydrocarbon identification (NWTPH-HCID) and Resource Conservation and Recovery Act (RCRA) eight (8) metals analysis. Based on a calculation of the remaining 60% of the site, Fulcrum estimated that four sample areas, each composed of five sub-samples, would be consistent with June 2003 sampling density for HCID and metals analysis. Fulcrum reviewed the sampling density for semi-volatile and polyaromatic hydrocarbon (PAH) analysis and has estimated similar sampling density for these two analyses. See Table 1 for the sampling and analysis plan.

Table 1: Sampling and Analysis Plan

Sub-Samples	Laboratory Composites	Analyses	Analytes
20	4	NWTPH-HCID	Gasoline, Kerosene, Diesel, Insulating Oil, Heavy Fuel Oil, and Lube Oil Range Hydrocarbons
	4	RCRA 8-Metals by EPA 6000/7000	Arsenic, Barium, Cadmium, Chromium, Mercury, Lead, Selenium, and Silver
	2	Semi-volatiles by EPA Method 8270C	Pentachlorophenol, 2,4,5-Trichlorophenol, and 2,4,6-Trichlorophenol
9	3	PAH by GC/MS – SIM	Eighteen PAH analytes

222 NORTH 2ND STREET ▲ SUITE A
YAKIMA, WASHINGTON 98901-2361
PHONE: (509) 574-0839 ▲ FAX: (509) 575-8453
www.efulcrum.net

On February 1 and 2, 2005, Brianne Harcourt of Fulcrum collected twenty (20) soil samples from native soils at the historic woodwaste landfill. Prior to onsite sampling, the 20 sample locations were chosen to provide adequate spatial distribution. Once in the field, some sample locations were repositioned due to the presence of standing water at the site resulting from snow melt. Samples were identified and labeled using a continuation of the June and July 2003 sampling scheme.

At each location, surface soil and any remaining wood debris were removed. A shovel was used to remove soil from 12 to 18-inches below the location soil surface. Fulcrum examined the soil type present at each sample location. Soil type present ranged from lightly compacted, well-sorted sands and silts, to very compacted, poorly sorted sands and silts with gravels, and large cobbles. Soil strata information at each sample location is presented in Table 2.

Table 2: Description of Soil at each Sample Location

Sample	Soil Description
4A	Brown, moist, well-sorted silty sand with no gravel or cobbles present.
4B	Brown, moist, well-sorted silty sand with no gravel or cobbles present.
4C	Dark brown, very moist, well-sorted silty sand with no gravel or cobbles present.
4D	Light brown, moist, well-sorted clayey silt with no gravel or cobbles present.
4E	Light brown, moist, well-sorted clayey silt with no gravel or cobbles present.
5A	Brown, sand with loosely compacted, well-rounded gravel and cobbles present.
5B	Dark brown, moist sandy silt with few gravels and cobbles present.
5C	Dark brown, very moist, well-sorted sandy silt with no gravels or cobbles present.
5D	Dark brown, moist silty sand with light gravel present.
5E	Light brown, moist, well-sorted clay with no gravel or cobbles present.
6A	Brown silty sand with tightly packed well-rounded cobbles and boulders present.
6B	Brown silty sand with moderately compacted, well-rounded gravel and cobbles present.
6C	Brown silty sand with very few compacted, well-rounded gravel and boulders present.
6D	Brown silty sand with very few well-rounded gravels.
6E	Light brown silty sand with moderately compacted, well-rounded gravels and cobbles.
7A	Dark brown, very moist, well-sorted sand with no gravel or cobbles present.
7B	Brown sandy silt with loosely compacted, well-rounded gravels and cobbles.
7C	Brown, moist, well-sorted silty sand with no gravel or cobbles present.
7D	Light brown silty sand with few loosely compacted, well-rounded gravels and cobbles. present
7E	Brown, moist, well-sorted silty sand with no gravel or cobbles present.

At each location, one or two soil samples were collected into 4 oz. borosilicate glass jars with teflon lids. Samples were obtained by direct collection from the desired location using new latex or vinyl gloves. Sample containers were labeled with the area number and corresponding letter (4 through 7; A through E) indicating the location from which it was collected. Samples were packaged with ice and delivered via common carried to North Creek Analytical, Inc. (NCA) laboratory in Bothell, Washington for analysis. See the sample location map in Attachment A.

NCA completed analysis by Northwest Total Petroleum Hydrocarbons – Hydrocarbon Identification (NWTPH-HCID), Polynuclear Aromatic Hydrocarbons (PAH), RCRA 8 Metals and Semivolatile Organic Compounds.

Heavy fuel oil range hydrocarbons were detected in lab composite 5. See Table 3 for a summary of laboratory results for petroleum hydrocarbons, metals and semi-volatile analysis. Heavy oil concentration is below the MTCA Method A Cleanup Level for soil. All metal concentrations were identified within standard native soil concentrations for the area. No wood preservatives were detected in the samples. All PAH detected are below MTCA Method B Cleanup levels for soil. Table 4 presents laboratory results for PAH analysis. Complete laboratory results are located in Attachment B.

Four notes were identified during standard quality control (QC) procedures by NCA labs. Each note was reviewed by Fulcrum and NCA. NCA stated that the notes did not result in incorrectly reported results and that all other QC results provided assurance that the results are accurate.

Please let us know if you have any questions concerning the sampling methodology or the laboratory results.

Thank you,

Brianne D Harcourt

Brianne D. Harcourt, GIT
Environmental Geologist

Ryan K

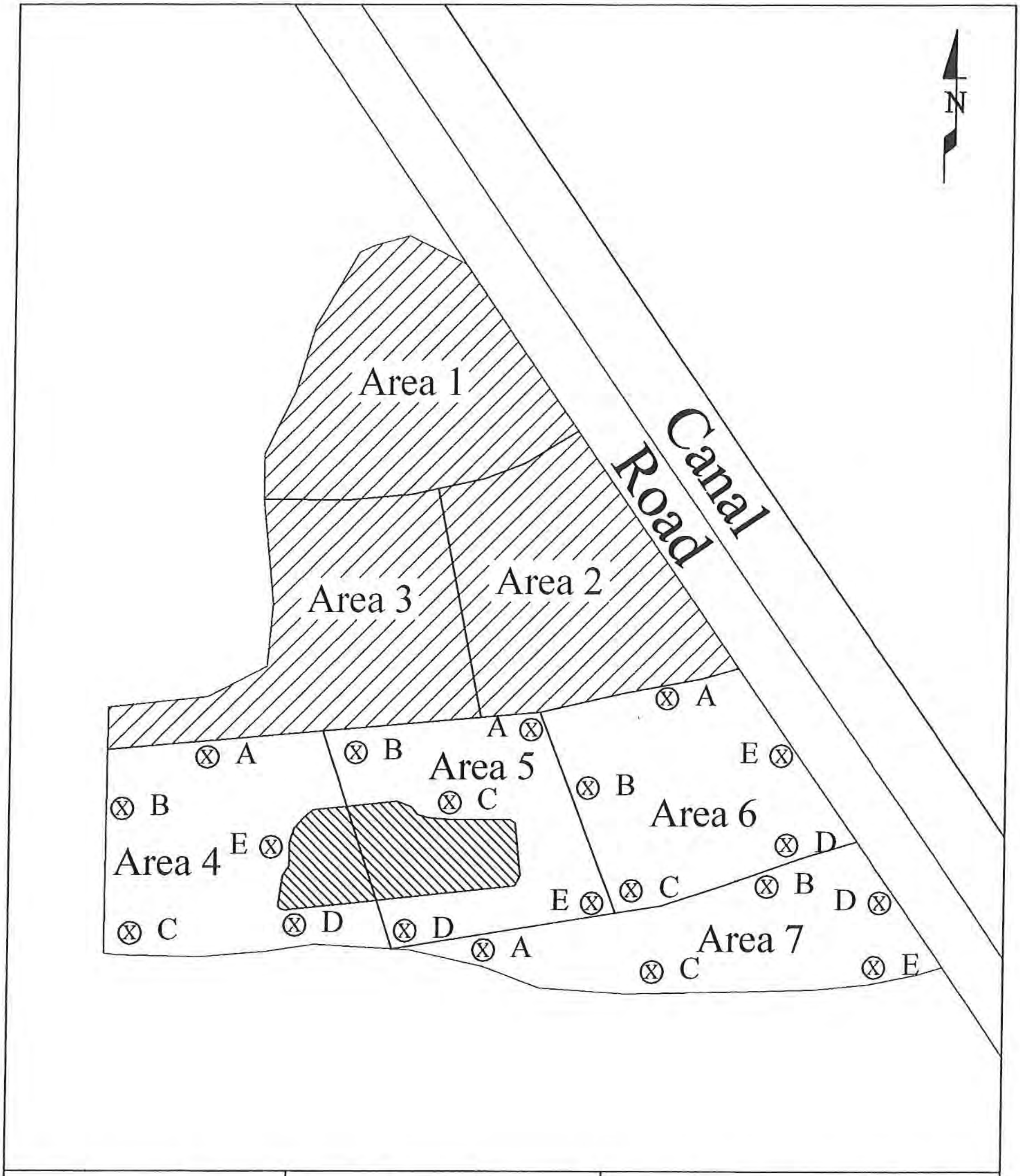
Ryan K. Mathews
Project Manager

Attachments

cc: Jennifer Wasley, Boise Building Solutions

ATTACHMENT A

Sample Location Map



Legend

Sample Locations: ⊗
Previously Sampled: ▨
Standing Water: ▧
Scale: NTS

Figure 1
Sample Locations Map

Yakima Facility
Woodwaste Landfill

Fulcrum Environmental Consulting, Inc.
222 North Second Street, Suite A
Yakima, Washington 98901
Phone (509) 574-0839 Fax (509) 575-8453

Drawn by: AMP	Project Number: 05-822
Date: 03/16/2005	File Name: Woodwaste Sampling

ATTACHMENT B

Laboratory Results

www.ncalabs.com

Seattle 11720 North Creek Pkwy N, Suite 400, Bothell, WA 98011-8244
425.420.9200 fax 425.420.9210
Spokane 11922 E. 1st Avenue, Spokane Valley, WA 99206-5302
509.924.9200 fax 509.924.9290
Portland 9405 SW Nimbus Avenue, Beaverton, OR 97008-7132
503.906.9200 fax 503.906.9210
Bend 20332 Empire Avenue, Suite F-1, Bend, OR 97701-5711
541.383.9310 fax 541.382.7588
Anchorage 2000 W. International Airport Road, Suite A10, Anchorage, AK 99502-1119
907.563.9200 fax 907.563.9210

02 March 2005

Ryan Mathews
Fulcrum Environmental-Yakima
222 North Second Street, Suite A
Yakima, WA/USA 98901
RE: Office Max Woodwaste Landfill

Enclosed are the results of analyses for samples received by the laboratory on 02/03/05 09:15. If you have any questions concerning this report, please feel free to contact me.

Sincerely,

Jeff Gerdes

Jeff Gerdes
Project Manager

nca™
www.ncalabs.com

Seattle 11720 North Creek Pkwy N, Suite 400, Bothell, WA 98011-8244
425.420.9200 fax 425.420.9210
Spokane 11922 E. 1st Avenue, Spokane Valley, WA 99206-5302
509.924.9200 fax 509.924.9290
Portland 9405 SW Nimbus Avenue, Beaverton, OR 97008-7132
503.906.9200 fax 503.906.9210
Bend 20332 Empire Avenue, Suite F-1, Bend, OR 97701-5711
541.383.9310 fax 541.382.7588
Anchorage 2000 W. International Airport Road, Suite A10, Anchorage, AK 99502-1119
907.563.9200 fax 907.563.9210

Fulcrum Environmental-Yakima	Project:	Office Max Woodwaste Landfill	
222 North Second Street, Suite A	Project Number:	05-822	**Reported:**
Yakima, WA/USA 98901	Project Manager:	Ryan Mathews	03/02/05 15:59

ANALYTICAL REPORT FOR SAMPLES

Sample ID	Laboratory ID	Matrix	Date Sampled	Date Received
COMPOSITE 4	B5B0109-06	Soil	02/02/05 12:00	02/03/05 09:15
COMPOSITE 5	B5B0109-12	Soil	02/02/05 12:00	02/03/05 09:15
COMPOSITE 6	B5B0109-18	Soil	02/02/05 12:00	02/03/05 09:15
COMPOSITE 7	B5B0109-24	Soil	02/02/05 12:00	02/03/05 09:15
COMPOSITE 4 & 5	B5B0109-25	Soil	02/02/05 12:00	02/03/05 09:15
COMPOSITE 6 & 7	B5B0109-26	Soil	02/02/05 12:00	02/03/05 09:15
COMPOSITE 4A, 4C, & 5D	B5B0109-27	Soil	02/02/05 12:00	02/03/05 09:15
COMPOSITE 5A, 6C, & 7A	B5B0109-28	Soil	02/02/05 12:00	02/03/05 09:15
COMPOSITE 6E, 7B, & 7E	B5B0109-29	Soil	02/02/05 12:00	02/03/05 09:15

North Creek Analytical - Bothell

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Jeff Gerdes

Jeff Gerdes, Project Manager

Fulcrum Environmental-Yakima 222 North Second Street, Suite A Yakima, WA/USA 98901	Project: Office Max Woodwaste Landfill Project Number: 05-822 Project Manager: Ryan Mathews	**Reported:** 03/02/05 15:59

Hydrocarbon Identification by Washington DOE Method NWTPH-HCID

North Creek Analytical - Bothell

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
COMPOSITE 4 (B5B0109-06) Soil	**Sampled: 02/02/05 12:00**		**Received: 02/03/05 09:15**						
Gx Range Hydrocarbons	ND	20.0	mg/kg dry	1	5B09057	02/09/05	02/11/05	NWTPH-HCID	
Kerosene Range Hydrocarbons	ND	50.0	"	"	"	"	"	"	
Diesel Range Hydrocarbons	ND	50.0	"	"	"	"	"	"	
Insulating Oil Range Hydrocarbons	ND	100	"	"	"	"	"	"	
Heavy Fuel Oil Range Hydrocarbons	ND	100	"	"	"	"	"	"	
Lube Oil Range Hydrocarbons	ND	100	"	"	"	"	"	"	
Surrogate: 2-FBP	*85.2 %*	*50-150*			"	"	"	"	
Surrogate: Octacosane	*89.6 %*	*50-150*			"	"	"	"	
COMPOSITE 5 (B5B0109-12) Soil	**Sampled: 02/02/05 12:00**		**Received: 02/03/05 09:15**						
Gx Range Hydrocarbons	ND	20.0	mg/kg dry	1	5B09057	02/09/05	02/11/05	NWTPH-HCID	
Kerosene Range Hydrocarbons	ND	50.0	"	"	"	"	"	"	
Diesel Range Hydrocarbons	ND	50.0	"	"	"	"	"	"	
Insulating Oil Range Hydrocarbons	ND	100	"	"	"	"	"	"	
Heavy Fuel Oil Range Hydrocarbons	**DET**	100	"	"	"	"	"	"	
Lube Oil Range Hydrocarbons	ND	100	"	"	"	"	"	"	
Surrogate: 2-FBP	*82.1 %*	*50-150*			"	"	"	"	
Surrogate: Octacosane	*86.8 %*	*50-150*			"	"	"	"	
COMPOSITE 6 (B5B0109-18) Soil	**Sampled: 02/02/05 12:00**		**Received: 02/03/05 09:15**						
Gx Range Hydrocarbons	ND	20.0	mg/kg dry	1	5B09057	02/09/05	02/11/05	NWTPH-HCID	
Kerosene Range Hydrocarbons	ND	50.0	"	"	"	"	"	"	
Diesel Range Hydrocarbons	ND	50.0	"	"	"	"	"	"	
Insulating Oil Range Hydrocarbons	ND	100	"	"	"	"	"	"	
Heavy Fuel Oil Range Hydrocarbons	ND	100	"	"	"	"	"	"	
Lube Oil Range Hydrocarbons	ND	100	"	"	"	"	"	"	
Surrogate: 2-FBP	*80.3 %*	*50-150*			"	"	"	"	
Surrogate: Octacosane	*88.0 %*	*50-150*			"	"	"	"	

North Creek Analytical - Bothell

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Jeff Gerdes

Jeff Gerdes, Project Manager

Hydrocarbon Identification by Washington DOE Method NWTPH-HCID

North Creek Analytical - Bothell

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
COMPOSITE 7 (B5B0109-24) Soil	**Sampled: 02/02/05 12:00**		**Received: 02/03/05 09:15**						
Gx Range Hydrocarbons	ND	20.0	mg/kg dry	1	5B09057	02/09/05	02/11/05	NWTPH-HCID	
Kerosene Range Hydrocarbons	ND	50.0	"	"	"	"	"	"	
Diesel Range Hydrocarbons	ND	50.0	"	"	"	"	"	"	
Insulating Oil Range Hydrocarbons	ND	100	"	"	"	"	"	"	
Heavy Fuel Oil Range Hydrocarbons	ND	100	"	"	"	"	"	"	
Lube Oil Range Hydrocarbons	ND	100	"	"	"	"	"	"	
Surrogate: 2-FBP	*83.3 %*	*50-150*			"	"	"	"	
Surrogate: Octacosane	*87.2 %*	*50-150*			"	"	"	"	

Jeff Gerdes

Jeff Gerdes, Project Manager

Fulcrum Environmental-Yakima	Project: Office Max Woodwaste Landfill	
222 North Second Street, Suite A	Project Number: 05-822	**Reported:**
Yakima, WA/USA 98901	Project Manager: Ryan Mathews	03/02/05 15:59

Semivolatile Petroleum Products by NWTPH-Dx with Acid/Silica Gel Clean-up

North Creek Analytical - Bothell

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
COMPOSITE 5 (B5B0109-12) Soil	**Sampled: 02/02/05 12:00**		**Received: 02/03/05 09:15**						
Diesel Range Hydrocarbons	393	10.0	mg/kg dry	1	5B14063	02/14/05	02/15/05	NWTPH-Dx	D-09
Lube Oil Range Hydrocarbons	349	25.0	"	"	"	"	"	"	
Surrogate: 2-FBP	*65.8 %*	*50-150*			"	"	"	"	
Surrogate: Octacosane	*118 %*	*50-150*			"	"	"	"	

Jeff Gerdes

Jeff Gerdes, Project Manager

Fulcrum Environmental-Yakima	Project: Office Max Woodwaste Landfill	
222 North Second Street, Suite A	Project Number: 05-822	**Reported:**
Yakima, WA/USA 98901	Project Manager: Ryan Mathews	03/02/05 15:59

Total Metals by EPA 6000/7000 Series Methods
North Creek Analytical - Bothell

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
COMPOSITE 4 (B5B0109-06) Soil	**Sampled: 02/02/05 12:00**	**Received: 02/03/05 09:15**							
Silver	ND	0.500	mg/kg dry	1	5B10037	02/10/05	02/10/05	EPA 6020	
Arsenic	**5.87**	0.500	"	"	"	"	"	"	
Cadmium	**0.638**	0.500	"	"	"	"	"	"	
Chromium	**13.4**	0.500	"	"	"	"	"	"	
Mercury	ND	0.100	"	"	5B11027	02/11/05	02/11/05	EPA 7471A	
Lead	**12.3**	0.500	"	"	5B10037	02/10/05	02/10/05	EPA 6020	
Selenium	ND	0.500	"	"	"	"	"	"	
COMPOSITE 4 (B5B0109-06RE1) Soil	**Sampled: 02/02/05 12:00**	**Received: 02/03/05 09:15**							
Barium	**296**	10.0	mg/kg dry	2	5B10037	02/10/05	02/11/05	EPA 6020	
COMPOSITE 5 (B5B0109-12) Soil	**Sampled: 02/02/05 12:00**	**Received: 02/03/05 09:15**							
Silver	ND	0.556	mg/kg dry	1	5B10037	02/10/05	02/10/05	EPA 6020	
senic	**3.85**	0.556	"	"	"	"	"	"	
Barium	**153**	5.56	"	"	"	"	"	"	
Cadmium	ND	0.556	"	"	"	"	"	"	
Chromium	**12.3**	0.556	"	"	"	"	"	"	
Mercury	ND	0.100	"	"	5B11027	02/11/05	02/11/05	EPA 7471A	
Lead	**17.8**	0.556	"	"	5B10037	02/10/05	02/10/05	EPA 6020	
Selenium	ND	0.556	"	"	"	"	"	"	
COMPOSITE 6 (B5B0109-18) Soil	**Sampled: 02/02/05 12:00**	**Received: 02/03/05 09:15**							
Silver	ND	0.500	mg/kg dry	1	5B10037	02/10/05	02/10/05	EPA 6020	
Arsenic	**2.04**	0.500	"	"	"	"	"	"	
Barium	**81.0**	5.00	"	"	"	"	"	"	
Cadmium	ND	0.500	"	"	"	"	"	"	
Chromium	**9.30**	0.500	"	"	"	"	"	"	
Mercury	ND	0.100	"	"	5B11027	02/11/05	02/11/05	EPA 7471A	
Lead	**4.61**	0.500	"	"	5B10037	02/10/05	02/10/05	EPA 6020	
Selenium	ND	0.500	"	"	"	"	"	"	

Jeff Gerdes

Fulcrum Environmental-Yakima 222 North Second Street, Suite A Yakima, WA/USA 98901	Project: Office Max Woodwaste Landfill Project Number: 05-822 Project Manager: Ryan Mathews	**Reported:** 03/02/05 15:59

Total Metals by EPA 6000/7000 Series Methods

North Creek Analytical - Bothell

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
COMPOSITE 7 (B5B0109-24) Soil	**Sampled: 02/02/05 12:00**	**Received: 02/03/05 09:15**							
Silver	ND	0.500	mg/kg dry	1	5B10037	02/10/05	02/10/05	EPA 6020	
Arsenic	**2.92**	0.500	"	"	"	"	"	"	
Barium	**128**	5.00	"	"	"	"	"	"	
Cadmium	ND	0.500	"	"	"	"	"	"	
Chromium	**15.3**	0.500	"	"	"	"	"	"	
Mercury	ND	0.100	"	"	5B11027	02/11/05	02/11/05	EPA 7471A	
Lead	**8.62**	0.500	"	"	5B10037	02/10/05	02/10/05	EPA 6020	
Selenium	ND	0.500	"	"	"	"	"	"	

Semivolatile Organic Compounds by EPA Method 8270C

North Creek Analytical - Bothell

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
COMPOSITE 4 & 5 (B5B0109-25) Soil	**Sampled: 02/02/05 12:00**		**Received: 02/03/05 09:15**						
Acenaphthene	ND	1.65	mg/kg dry	5	5B03052	02/03/05	02/26/05	EPA 8270C	
Acenaphthylene	ND	1.65	"	"	"	"	"	"	
Aniline	ND	1.65	"	"	"	"	"	"	
Anthracene	ND	1.65	"	"	"	"	"	"	
Benzo (a) anthracene	ND	1.65	"	"	"	"	"	"	
Benzo (a) pyrene	ND	1.65	"	"	"	"	"	"	
Benzo (b) fluoranthene	ND	1.65	"	"	"	"	"	"	
Benzo (k) fluoranthene	ND	1.65	"	"	"	"	"	"	
Benzo (ghi) perylene	ND	1.65	"	"	"	"	"	"	
Benzoic Acid	ND	5.00	"	"	"	"	"	"	
Benzyl alcohol	ND	1.65	"	"	"	"	"	"	
Bis(2-chloroethoxy)methane	ND	1.65	"	"	"	"	"	"	
2-chloroethyl)ether	ND	1.65	"	"	"	"	"	"	
Bis(2-chloroisopropyl)ether	ND	1.65	"	"	"	"	"	"	
Bis(2-ethylhexyl)phthalate	ND	1.65	"	"	"	"	"	"	
4-Bromophenyl phenyl ether	ND	1.65	"	"	"	"	"	"	
Butyl benzyl phthalate	ND	1.65	"	"	"	"	"	"	
Carbazole	ND	1.65	"	"	"	"	"	"	
4-Chloroaniline	ND	2.50	"	"	"	"	"	"	
4-Chloro-3-methylphenol	ND	1.65	"	"	"	"	"	"	
2-Chloronaphthalene	ND	1.65	"	"	"	"	"	"	
2-Chlorophenol	ND	1.65	"	"	"	"	"	"	
4-Chlorophenyl phenyl ether	ND	1.65	"	"	"	"	"	"	
Chrysene	ND	1.65	"	"	"	"	"	"	
Di-n-butyl phthalate	ND	1.65	"	"	"	"	"	"	
Dibenz (a,h) anthracene	ND	1.65	"	"	"	"	"	"	
Dibenzofuran	ND	1.65	"	"	"	"	"	"	
1,2-Dichlorobenzene	ND	1.65	"	"	"	"	"	"	
1,3-Dichlorobenzene	ND	1.65	"	"	"	"	"	"	
1,4-Dichlorobenzene	ND	1.65	"	"	"	"	"	"	
3,3′-Dichlorobenzidine	ND	25.0	"	"	"	"	"	"	
2,4-Dichlorophenol	ND	1.65	"	"	"	"	"	"	
Diethyl phthalate	ND	1.65	"	"	"	"	"	"	
2,4-Dimethylphenol	ND	1.65	"	"	"	"	"	"	
Dimethyl phthalate	ND	1.65	"	"	"	"	"	"	

North Creek Analytical - Bothell

Jeff Gerdes

Jeff Gerdes, Project Manager

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Fulcrum Environmental-Yakima	Project: Office Max Woodwaste Landfill	
222 North Second Street, Suite A	Project Number: 05-822	**Reported:**
Yakima, WA/USA 98901	Project Manager: Ryan Mathews	03/02/05 15:59

Semivolatile Organic Compounds by EPA Method 8270C

North Creek Analytical - Bothell

COMPOSITE 4 & 5 (B5B0109-25) Soil Sampled: 02/02/05 12:00 Received: 02/03/05 09:15

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
4,6-Dinitro-2-methylphenol	ND	2.50	mg/kg dry	5	5B03052	02/03/05	02/26/05	"	
2,4-Dinitrophenol	ND	2.50	"	"	"	"	"	"	
2,4-Dinitrotoluene	ND	2.50	"	"	"	"	"	"	
2,6-Dinitrotoluene	ND	2.50	"	"	"	"	"	"	
Fluoranthene	ND	1.65	"	"	"	"	"	"	
Fluorene	ND	1.65	"	"	"	"	"	"	
Hexachlorobenzene	ND	1.65	"	"	"	"	"	"	
Hexachlorobutadiene	ND	1.65	"	"	"	"	"	"	
Hexachlorocyclopentadiene	ND	2.50	"	"	"	"	"	"	
Hexachloroethane	ND	1.65	"	"	"	"	"	"	
Indeno (1,2,3-cd) pyrene	ND	1.65	"	"	"	"	"	"	
Isophorone	ND	1.65	"	"	"	"	"	"	
lethylnaphthalene	ND	1.65	"	"	"	"	"	"	
2-Methylphenol	ND	1.65	"	"	"	"	"	"	
3 & 4-Methylphenol	ND	1.65	"	"	"	"	"	"	
Naphthalene	ND	1.65	"	"	"	"	"	"	
2-Nitroaniline	ND	2.50	"	"	"	"	"	"	
3-Nitroaniline	ND	2.50	"	"	"	"	"	"	
4-Nitroaniline	ND	2.50	"	"	"	"	"	"	
Nitrobenzene	ND	1.65	"	"	"	"	"	"	
2-Nitrophenol	ND	1.65	"	"	"	"	"	"	
4-Nitrophenol	ND	2.50	"	"	"	"	"	"	
N-Nitrosodi-n-propylamine	ND	1.65	"	"	"	"	"	"	
N-Nitrosodiphenylamine	ND	1.65	"	"	"	"	"	"	
Di-n-octyl phthalate	ND	1.65	"	"	"	"	"	"	
Pentachlorophenol	ND	2.50	"	"	"	"	"	"	
Phenanthrene	ND	1.65	"	"	"	"	"	"	
Phenol	ND	1.65	"	"	"	"	"	"	
Pyrene	ND	1.65	"	"	"	"	"	"	
1,2,4-Trichlorobenzene	ND	1.65	"	"	"	"	"	"	
2,4,5-Trichlorophenol	ND	1.65	"	"	"	"	"	"	
2,4,6-Trichlorophenol	ND	1.65	"	"	"	"	"	"	
Surrogate: 2-FBP	*36.9 %*	*36-146*			*"*	*"*	*"*	*"*	
Surrogate: 2-FP	*51.5 %*	*26-137*			*"*	*"*	*"*	*"*	
Surrogate: Nitrobenzene-d5	*55.3 %*	*48-127*			*"*	*"*	*"*	*"*	

Fulcrum Environmental-Yakima	Project: Office Max Woodwaste Landfill	
222 North Second Street, Suite A	Project Number: 05-822	**Reported:**
Yakima, WA/USA 98901	Project Manager: Ryan Mathews	03/02/05 15:59

Semivolatile Organic Compounds by EPA Method 8270C

North Creek Analytical - Bothell

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
COMPOSITE 4 & 5 (B5B0109-25) Soil	**Sampled: 02/02/05 12:00**		**Received: 02/03/05 09:15**						
Surrogate: Phenol-d6	*38.3 %*	*10-153*			*5B03052*	*02/03/05*	*02/26/05*	"	
Surrogate: p-Terphenyl-d14	*59.0 %*	*44-144*			"	"	"	"	
Surrogate: 2,4,6-TBP	*74.2 %*	*10-133*			"	"	"	"	
COMPOSITE 6 & 7 (B5B0109-26) Soil	**Sampled: 02/02/05 12:00**		**Received: 02/03/05 09:15**						
Acenaphthene	ND	0.330	mg/kg dry	1	5B03052	02/03/05	02/26/05	EPA 8270C	
Acenaphthylene	ND	0.330	"	"	"	"	"	"	
Aniline	ND	0.330	"	"	"	"	"	"	
Anthracene	ND	0.330	"	"	"	"	"	"	
Benzo (a) anthracene	ND	0.330	"	"	"	"	"	"	
Benzo (a) pyrene	ND	0.330	"	"	"	"	"	"	
Benzo (b) fluoranthene	ND	0.330	"	"	"	"	"	"	
Benzo (k) fluoranthene	ND	0.330	"	"	"	"	"	"	
Benzo (ghi) perylene	ND	0.330	"	"	"	"	"	"	
Benzoic Acid	ND	1.00	"	"	"	"	"	"	
Benzyl alcohol	ND	0.330	"	"	"	"	"	"	
Bis(2-chloroethoxy)methane	ND	0.330	"	"	"	"	"	"	
Bis(2-chloroethyl)ether	ND	0.330	"	"	"	"	"	"	
Bis(2-chloroisopropyl)ether	ND	0.330	"	"	"	"	"	"	
Bis(2-ethylhexyl)phthalate	ND	0.330	"	"	"	"	"	"	
4-Bromophenyl phenyl ether	ND	0.330	"	"	"	"	"	"	
Butyl benzyl phthalate	ND	0.330	"	"	"	"	"	"	
Carbazole	ND	0.330	"	"	"	"	"	"	
4-Chloroaniline	ND	0.500	"	"	"	"	"	"	
4-Chloro-3-methylphenol	ND	0.330	"	"	"	"	"	"	
2-Chloronaphthalene	ND	0.330	"	"	"	"	"	"	
2-Chlorophenol	ND	0.330	"	"	"	"	"	"	
4-Chlorophenyl phenyl ether	ND	0.330	"	"	"	"	"	"	
Chrysene	ND	0.330	"	"	"	"	"	"	
Di-n-butyl phthalate	ND	0.330	"	"	"	"	"	"	
Dibenz (a,h) anthracene	ND	0.330	"	"	"	"	"	"	
Dibenzofuran	ND	0.330	"	"	"	"	"	"	
1,2-Dichlorobenzene	ND	0.330	"	"	"	"	"	"	
1,3-Dichlorobenzene	ND	0.330	"	"	"	"	"	"	
1,4-Dichlorobenzene	ND	0.330	"	"	"	"	"	"	

North Creek Analytical - Bothell

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Jeff Gerdes

Jeff Gerdes, Project Manager

Fulcrum Environmental-Yakima
222 North Second Street, Suite A
Yakima, WA/USA 98901

Project: Office Max Woodwaste Landfill
Project Number: 05-822
Project Manager: Ryan Mathews

Reported:
03/02/05 15:59

Semivolatile Organic Compounds by EPA Method 8270C
North Creek Analytical - Bothell

COMPOSITE 6 & 7 (B5B0109-26) Soil Sampled: 02/02/05 12:00 Received: 02/03/05 09:15

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
3,3′-Dichlorobenzidine	ND	5.00	mg/kg dry	1	5B03052	02/03/05	02/26/05	"	
2,4-Dichlorophenol	ND	0.330	"	"	"	"	"	"	
Diethyl phthalate	ND	0.330	"	"	"	"	"	"	
2,4-Dimethylphenol	ND	0.330	"	"	"	"	"	"	
Dimethyl phthalate	ND	0.330	"	"	"	"	"	"	
4,6-Dinitro-2-methylphenol	ND	0.500	"	"	"	"	"	"	
2,4-Dinitrophenol	ND	0.500	"	"	"	"	"	"	
2,4-Dinitrotoluene	ND	0.500	"	"	"	"	"	"	
2,6-Dinitrotoluene	ND	0.500	"	"	"	"	"	"	
Fluoranthene	ND	0.330	"	"	"	"	"	"	
Fluorene	ND	0.330	"	"	"	"	"	"	
xachlorobenzene	ND	0.330	"	"	"	"	"	"	
xachlorobutadiene	ND	0.330	"	"	"	"	"	"	
Hexachlorocyclopentadiene	ND	0.500	"	"	"	"	"	"	
Hexachloroethane	ND	0.330	"	"	"	"	"	"	
Indeno (1,2,3-cd) pyrene	ND	0.330	"	"	"	"	"	"	
Isophorone	ND	0.330	"	"	"	"	"	"	
2-Methylnaphthalene	ND	0.330	"	"	"	"	"	"	
2-Methylphenol	ND	0.330	"	"	"	"	"	"	
3 & 4-Methylphenol	ND	0.330	"	"	"	"	"	"	
Naphthalene	ND	0.330	"	"	"	"	"	"	
2-Nitroaniline	ND	0.500	"	"	"	"	"	"	
3-Nitroaniline	ND	0.500	"	"	"	"	"	"	
4-Nitroaniline	ND	0.500	"	"	"	"	"	"	
Nitrobenzene	ND	0.330	"	"	"	"	"	"	
2-Nitrophenol	ND	0.330	"	"	"	"	"	"	
4-Nitrophenol	ND	0.500	"	"	"	"	"	"	
N-Nitrosodi-n-propylamine	ND	0.330	"	"	"	"	"	"	
N-Nitrosodiphenylamine	ND	0.330	"	"	"	"	"	"	
Di-n-octyl phthalate	ND	0.330	"	"	"	"	"	"	
Pentachlorophenol	ND	0.500	"	"	"	"	"	"	
Phenanthrene	ND	0.330	"	"	"	"	"	"	
Phenol	ND	0.330	"	"	"	"	"	"	
Pyrene	ND	0.330	"	"	"	"	"	"	
1,2,4-Trichlorobenzene	ND	0.330	"	"	"	"	"	"	

Jeff Gerdes

Fulcrum Environmental-Yakima
222 North Second Street, Suite A
Yakima, WA/USA 98901

Project: Office Max Woodwaste Landfill
Project Number: 05-822
Project Manager: Ryan Mathews

Reported:
03/02/05 15:59

Semivolatile Organic Compounds by EPA Method 8270C

North Creek Analytical - Bothell

COMPOSITE 6 & 7 (B5B0109-26) Soil Sampled: 02/02/05 12:00 Received: 02/03/05 09:15

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
2,4,5-Trichlorophenol	ND	0.330	mg/kg dry	1	5B03052	02/03/05	02/26/05	"	
2,4,6-Trichlorophenol	ND	0.330	"	"	"	"	"	"	
Surrogate: 2-FBP	*58.3 %*	*36-146*			"	"	"	"	
Surrogate: 2-FP	*53.9 %*	*26-137*			"	"	"	"	
Surrogate: Nitrobenzene-d5	*54.9 %*	*48-127*			"	"	"	"	
Surrogate: Phenol-d6	*42.8 %*	*10-153*			"	"	"	"	
Surrogate: p-Terphenyl-d14	*62.1 %*	*44-144*			"	"	"	"	
Surrogate: 2,4,6-TBP	*62.6 %*	*10-133*			"	"	"	"	

North Creek Analytical - Bothell

Jeff Gerdes

Jeff Gerdes, Project Manager

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Fulcrum Environmental-Yakima
222 North Second Street, Suite A
Yakima, WA/USA 98901

Project: Office Max Woodwaste Landfill
Project Number: 05-822
Project Manager: Ryan Mathews

Reported:
03/02/05 15:59

Polynuclear Aromatic Hydrocarbons by GC/MS-SIM

North Creek Analytical - Bothell

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
COMPOSITE 4A, 4C, & 5D (B5B0109-27) Soil	**Sampled: 02/02/05 12:00**			**Received: 02/03/05 09:15**					
1-Methylnaphthalene	ND	0.0120	mg/kg dry	1	5B01057	02/07/05	02/11/05	EPA 8270-SIM	
2-Methylnaphthalene	ND	0.0120	"	"	"	"	"	"	
Acenaphthene	ND	0.0120	"	"	"	"	"	"	
Acenaphthylene	**0.0259**	0.0120	"	"	"	"	"	"	
Anthracene	ND	0.0120	"	"	"	"	"	"	
Benzo (a) anthracene	ND	0.0120	"	"	"	"	"	"	
Benzo (a) pyrene	ND	0.0120	"	"	"	"	"	"	
Benzo (b) fluoranthene	ND	0.0120	"	"	"	"	"	"	
Benzo (ghi) perylene	ND	0.0120	"	"	"	"	"	"	
Benzo (k) fluoranthene	ND	0.0120	"	"	"	"	"	"	
Chrysene	ND	0.0120	"	"	"	"	"	"	
Dibenz (a,h) anthracene	ND	0.0120	"	"	"	"	"	"	
[illegible]oranthene	**0.105**	0.0120	"	"	"	"	"	"	
Fluorene	ND	0.0120	"	"	"	"	"	"	
Indeno (1,2,3-cd) pyrene	ND	0.0120	"	"	"	"	"	"	
Naphthalene	**0.0857**	0.0120	"	"	"	"	"	"	
Phenanthrene	**0.0182**	0.0120	"	"	"	"	"	"	
Pyrene	**0.0157**	0.0120	"	"	"	"	"	"	
Surrogate: p-Terphenyl-d14	*75.4 %*	*28-161*			*"*	*"*	*"*	*"*	
COMPOSITE 5A, 6C, & 7A (B5B0109-28) Soil	**Sampled: 02/02/05 12:00**			**Received: 02/03/05 09:15**					
1-Methylnaphthalene	ND	0.0120	mg/kg dry	1	5B01057	02/07/05	02/11/05	EPA 8270-SIM	
2-Methylnaphthalene	ND	0.0120	"	"	"	"	"	"	
Acenaphthene	ND	0.0120	"	"	"	"	"	"	
Acenaphthylene	ND	0.0120	"	"	"	"	"	"	
Anthracene	ND	0.0120	"	"	"	"	"	"	
Benzo (a) anthracene	ND	0.0120	"	"	"	"	"	"	
Benzo (a) pyrene	ND	0.0120	"	"	"	"	"	"	
Benzo (b) fluoranthene	ND	0.0120	"	"	"	"	"	"	
Benzo (ghi) perylene	ND	0.0120	"	"	"	"	"	"	
Benzo (k) fluoranthene	ND	0.0120	"	"	"	"	"	"	
Chrysene	ND	0.0120	"	"	"	"	"	"	
Dibenz (a,h) anthracene	**0.0313**	0.0120	"	"	"	"	"	"	
Fluoranthene	**0.0174**	0.0120	"	"	"	"	"	"	
Fluorene	ND	0.0120	"	"	"	"	"	"	

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Jeff Gerdes

Jeff Gerdes, Project Manager

Polynuclear Aromatic Hydrocarbons by GC/MS-SIM

North Creek Analytical - Bothell

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
COMPOSITE 5A, 6C, & 7A (B5B0109-28) Soil	**Sampled: 02/02/05 12:00**	**Received: 02/03/05 09:15**							
Indeno (1,2,3-cd) pyrene	ND	0.0120	mg/kg dry	1	5B01057	02/07/05	02/11/05	"	
Naphthalene	**0.0176**	0.0120	"	"	"	"	"	"	
Phenanthrene	ND	0.0120	"	"	"	"	"	"	
Pyrene	ND	0.0120	"	"	"	"	"	"	
Surrogate: p-Terphenyl-d14	*85.9 %*	*28-161*			*"*	*"*	*"*	*"*	
COMPOSITE 6E, 7B, & 7E (B5B0109-29) Soil	**Sampled: 02/02/05 12:00**	**Received: 02/03/05 09:15**							
1-Methylnaphthalene	ND	0.0100	mg/kg dry	1	5B01057	02/07/05	02/10/05	EPA 8270-SIM	
2-Methylnaphthalene	ND	0.0100	"	"	"	"	"	"	
Acenaphthene	ND	0.0100	"	"	"	"	"	"	
Acenaphthylene	ND	0.0100	"	"	"	"	"	"	
Anthracene	ND	0.0100	"	"	"	"	"	"	
nzo (a) anthracene	ND	0.0100	"	"	"	"	"	"	
Benzo (a) pyrene	ND	0.0100	"	"	"	"	"	"	
Benzo (b) fluoranthene	ND	0.0100	"	"	"	"	"	"	
Benzo (ghi) perylene	ND	0.0100	"	"	"	"	"	"	
Benzo (k) fluoranthene	ND	0.0100	"	"	"	"	"	"	
Chrysene	ND	0.0100	"	"	"	"	"	"	
Dibenz (a,h) anthracene	ND	0.0100	"	"	"	"	"	"	
Fluoranthene	ND	0.0100	"	"	"	"	"	"	
Fluorene	ND	0.0100	"	"	"	"	"	"	
Indeno (1,2,3-cd) pyrene	ND	0.0100	"	"	"	"	"	"	
Naphthalene	ND	0.0100	"	"	"	"	"	"	
Phenanthrene	ND	0.0100	"	"	"	"	"	"	
Pyrene	ND	0.0100	"	"	"	"	"	"	
Surrogate: p-Terphenyl-d14	*89.4 %*	*28-161*			*"*	*"*	*"*	*"*	

Jeff Gerdes

Jeff Gerdes, Project Manager

Fulcrum Environmental-Yakima
222 North Second Street, Suite A
Yakima, WA/USA 98901

Project: Office Max Woodwaste Landfill
Project Number: 05-822
Project Manager: Ryan Mathews

Reported:
03/02/05 15:59

Physical Parameters by APHA/ASTM/EPA Methods

North Creek Analytical - Bothell

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
COMPOSITE 4 (B5B0109-06) Soil	**Sampled: 02/02/05 12:00**	**Received: 02/03/05 09:15**							
Dry Weight	**68.5**	1.00	%	1	5B04063	02/04/05	02/05/05	BSOPSPL003R08	
COMPOSITE 5 (B5B0109-12) Soil	**Sampled: 02/02/05 12:00**	**Received: 02/03/05 09:15**							
Dry Weight	**53.5**	1.00	%	1	5B04063	02/04/05	02/05/05	BSOPSPL003R08	
COMPOSITE 6 (B5B0109-18) Soil	**Sampled: 02/02/05 12:00**	**Received: 02/03/05 09:15**							
Dry Weight	**88.0**	1.00	%	1	5B04063	02/04/05	02/05/05	BSOPSPL003R08	
COMPOSITE 7 (B5B0109-24) Soil	**Sampled: 02/02/05 12:00**	**Received: 02/03/05 09:15**							
Dry Weight	**69.3**	1.00	%	1	5B04063	02/04/05	02/05/05	BSOPSPL003R08	
COMPOSITE 4 & 5 (B5B0109-25) Soil	**Sampled: 02/02/05 12:00**	**Received: 02/03/05 09:15**							
Dry Weight	**56.5**	1.00	%	1	5B04065	02/04/05	02/05/05	BSOPSPL003R08	
COMPOSITE 6 & 7 (B5B0109-26) Soil	**Sampled: 02/02/05 12:00**	**Received: 02/03/05 09:15**							
Dry Weight	**81.0**	1.00	%	1	5B04065	02/04/05	02/05/05	BSOPSPL003R08	
COMPOSITE 4A, 4C, & 5D (B5B0109-27) Soil	**Sampled: 02/02/05 12:00**	**Received: 02/03/05 09:15**							
Dry Weight	**63.6**	1.00	%	1	5B04065	02/04/05	02/05/05	BSOPSPL003R08	
COMPOSITE 5A, 6C, & 7A (B5B0109-28) Soil	**Sampled: 02/02/05 12:00**	**Received: 02/03/05 09:15**							
Dry Weight	**61.3**	1.00	%	1	5B04065	02/04/05	02/05/05	BSOPSPL003R08	
COMPOSITE 6E, 7B, & 7E (B5B0109-29) Soil	**Sampled: 02/02/05 12:00**	**Received: 02/03/05 09:15**							
Dry Weight	**83.8**	1.00	%	1	5B04065	02/04/05	02/05/05	BSOPSPL003R08	

Fulcrum Environmental-Yakima	Project: Office Max Woodwaste Landfill	
222 North Second Street, Suite A	Project Number: 05-822	**Reported:**
Yakima, WA/USA 98901	Project Manager: Ryan Mathews	03/02/05 15:59

Hydrocarbon Identification by Washington DOE Method NWTPH-HCID - Quality Control
North Creek Analytical - Bothell

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch 5B09057: Prepared 02/09/05 Using HCID (WA)										
Blank (5B09057-BLK1)										
Gx Range Hydrocarbons	ND	20.0	mg/kg							
Kerosene Range Hydrocarbons	ND	50.0	"							
Diesel Range Hydrocarbons	ND	50.0	"							
Insulating Oil Range Hydrocarbons	ND	100	"							
Heavy Fuel Oil Range Hydrocarbons	ND	100	"							
Lube Oil Range Hydrocarbons	ND	100	"							
Surrogate: 2-FBP	*DET*		*"*	*125*		*84.0*	*50-150*			
Surrogate: Octacosane	*DET*		*"*	*125*		*88.0*	*50-150*			
Duplicate (5B09057-DUP1)					**Source: B5B0109-06**					
Gx Range Hydrocarbons	ND	20.0	mg/kg dry		0.00				50	
Kerosene Range Hydrocarbons	11.3	50.0	"		22.5			66.3	50	Q-06
Diesel Range Hydrocarbons	9.82	50.0	"		26.1			90.6	50	Q-06
Insulating Oil Range Hydrocarbons	5.99	100	"		19.0			104	50	Q-06
Heavy Fuel Oil Range Hydrocarbons	17.1	100	"		60.6			112	50	Q-06
Lube Oil Range Hydrocarbons	7.71	100	"		36.3			130	50	Q-06
Surrogate: 2-FBP	*DET*		*"*	*182*		*85.2*	*50-150*			
Surrogate: Octacosane	*DET*		*"*	*182*		*87.4*	*50-150*			

North Creek Analytical - Bothell

Jeff Gerdes

Jeff Gerdes, Project Manager

Fulcrum Environmental-Yakima	Project: Office Max Woodwaste Landfill	
222 North Second Street, Suite A	Project Number: 05-822	**Reported:**
Yakima, WA/USA 98901	Project Manager: Ryan Mathews	03/02/05 15:59

Semivolatile Petroleum Products by NWTPH-Dx with Acid/Silica Gel Clean-up - Quality Control

North Creek Analytical - Bothell

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch 5B14063: Prepared 02/14/05 Using EPA 3550B										
Blank (5B14063-BLK1)										
Diesel Range Hydrocarbons	ND	10.0	mg/kg							
Lube Oil Range Hydrocarbons	ND	25.0	"							
Surrogate: 2-FBP	*4.93*		"	*8.33*		*59.2*	*50-150*			
Surrogate: Octacosane	*8.23*		"	*8.33*		*98.8*	*50-150*			
LCS (5B14063-BS1)										
Diesel Range Hydrocarbons	63.3	10.0	mg/kg	66.7		94.9	61-120			
Surrogate: 2-FBP	*6.25*		"	*8.33*		*75.0*	*50-150*			
LCS Dup (5B14063-BSD1)										
Diesel Range Hydrocarbons	61.4	10.0	mg/kg	66.7		92.1	61-120	3.05	40	
ogate: 2-FBP	*6.48*		"	*8.33*		*77.8*	*50-150*			
Duplicate (5B14063-DUP1)					**Source: B5B0109-12**					
Diesel Range Hydrocarbons	443	10.0	mg/kg dry		393			12.0	50	
Lube Oil Range Hydrocarbons	437	25.0	"		349			22.4	50	
Surrogate: 2-FBP	*9.96*		"	*15.3*		*65.1*	*50-150*			
Surrogate: Octacosane	*19.1*		"	*15.3*		*125*	*50-150*			

Fulcrum Environmental-Yakima	Project: Office Max Woodwaste Landfill	
222 North Second Street, Suite A	Project Number: 05-822	**Reported:**
Yakima, WA/USA 98901	Project Manager: Ryan Mathews	03/02/05 15:59

Total Metals by EPA 6000/7000 Series Methods - Quality Control
North Creek Analytical - Bothell

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch 5B10037: Prepared 02/10/05 Using EPA 3050B										
Blank (5B10037-BLK1)										
Silver	ND	0.500	mg/kg							
Arsenic	ND	0.500	"							
Barium	ND	5.00	"							
Cadmium	ND	0.500	"							
Chromium	ND	0.500	"							
Lead	ND	0.500	"							
Selenium	ND	0.500	"							
LCS (5B10037-BS1)										
Silver	38.7	0.500	mg/kg	40.0		96.8	80-120			
Arsenic	40.6	0.500	"	40.0		102	80-120			
rium	39.2	5.00	"	40.0		98.0	80-120			
Cadmium	39.5	0.500	"	40.0		98.8	80-120			
Chromium	38.3	0.500	"	40.0		95.8	80-120			
Lead	39.5	0.500	"	40.0		98.8	80-120			
Selenium	40.7	0.500	"	40.0		102	80-120			
LCS Dup (5B10037-BSD1)										
Silver	38.0	0.500	mg/kg	40.0		95.0	80-120	1.83	20	
Arsenic	39.9	0.500	"	40.0		99.8	80-120	1.74	20	
Barium	38.6	5.00	"	40.0		96.5	80-120	1.54	20	
Cadmium	38.8	0.500	"	40.0		97.0	80-120	1.79	20	
Chromium	37.7	0.500	"	40.0		94.2	80-120	1.58	20	
Lead	38.8	0.500	"	40.0		97.0	80-120	1.79	20	
Selenium	40.6	0.500	"	40.0		102	80-120	0.246	20	
Matrix Spike (5B10037-MS1)					**Source: B5B0109-06**					
Silver	56.7	0.500	mg/kg dry	62.8	0.0768	90.2	52-128			
Arsenic	63.7	0.500	"	62.8	5.87	92.1	52-139			
Cadmium	61.3	0.500	"	62.8	0.638	96.6	78-125			
Chromium	70.3	0.500	"	62.8	13.4	90.6	52-141			
Lead	71.4	0.500	"	62.8	12.3	94.1	62-137			
Selenium	60.5	0.500	"	62.8	0.423	95.7	61-125			

Jeff Gerdes

Jeff Gerdes, Project Manager

Total Metals by EPA 6000/7000 Series Methods - Quality Control

North Creek Analytical - Bothell

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch 5B10037: Prepared 02/10/05 Using EPA 3050B										
Matrix Spike (5B10037-MS2)					**Source: B5B0109-06**					
Barium	342	10.0	mg/kg dry	62.8	292	79.6	20-160			
Matrix Spike Dup (5B10037-MSD1)					**Source: B5B0109-06**					
Silver	55.6	0.500	mg/kg dry	59.6	0.0768	93.2	52-128	1.96	50	
Arsenic	61.7	0.500	"	59.6	5.87	93.7	52-139	3.19	30	
Cadmium	59.8	0.500	"	59.6	0.638	99.3	78-125	2.48	30	
Chromium	70.1	0.500	"	59.6	13.4	95.1	52-141	0.285	30	
Lead	69.3	0.500	"	59.6	12.3	95.6	62-137	2.99	30	
Selenium	58.8	0.500	"	59.6	0.423	97.9	61-125	2.85	30	
Matrix Spike Dup (5B10037-MSD2)					**Source: B5B0109-06**					
Barium	331	10.0	mg/kg dry	59.6	292	65.4	20-160	3.27	30	
Post Spike (5B10037-PS1)					**Source: B5B0109-06**					
Silver	0.0952		ug/ml	0.100	0.000100	95.1	75-125			
Arsenic	0.112		"	0.100	0.00764	104	75-125			
Cadmium	0.0987		"	0.100	0.000830	97.9	75-125			
Chromium	0.112		"	0.100	0.0174	94.6	75-125			
Lead	0.112		"	0.0995	0.0160	96.5	75-125			
Selenium	0.100		"	0.100	0.000551	99.4	75-125			
Post Spike (5B10037-PS2)					**Source: B5B0109-06**					
Barium	0.458		ug/ml	0.0995	0.380	78.4	75-125			
Batch 5B11027: Prepared 02/11/05 Using EPA 7471A										
Blank (5B11027-BLK1)										
Mercury	ND	0.100	mg/kg							

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Jeff Gerdes, Project Manager

Total Metals by EPA 6000/7000 Series Methods - Quality Control
North Creek Analytical - Bothell

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch 5B11027: Prepared 02/11/05 Using EPA 7471A										
LCS (5B11027-BS1)										
Mercury	0.487	0.100	mg/kg	0.500		97.4	80-120			
LCS Dup (5B11027-BSD1)										
Mercury	0.473	0.100	mg/kg	0.500		94.6	80-120	2.92	20	
Matrix Spike (5B11027-MS1)					**Source: B5B0268-01**					
Mercury	0.736	0.100	mg/kg dry	0.682	0.0504	101	70-130			
Matrix Spike Dup (5B11027-MSD1)					**Source: B5B0268-01**					
Mercury	0.720	0.100	mg/kg dry	0.682	0.0504	98.2	70-130	2.20	30	

Jeff Gerdes

Jeff Gerdes, Project Manager

Fulcrum Environmental-Yakima
222 North Second Street, Suite A
Yakima, WA/USA 98901

Project: Office Max Woodwaste Landfill
Project Number: 05-822
Project Manager: Ryan Mathews

Reported:
03/02/05 15:59

Semivolatile Organic Compounds by EPA Method 8270C - Quality Control
North Creek Analytical - Bothell

Batch 5B03052: Prepared 02/03/05 Using EPA 3550B

Blank (5B03052-BLK1)

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Acenaphthene	ND	0.330	mg/kg							
Acenaphthylene	ND	0.330	"							
Aniline	ND	0.330	"							
Anthracene	ND	0.330	"							
Benzo (a) anthracene	ND	0.330	"							
Benzo (a) pyrene	ND	0.330	"							
Benzo (b) fluoranthene	ND	0.330	"							
Benzo (k) fluoranthene	ND	0.330	"							
Benzo (ghi) perylene	ND	0.330	"							
Benzoic Acid	ND	1.00	"							
nzyl alcohol	ND	0.330	"							
(2-chloroethoxy)methane	ND	0.330	"							
Bis(2-chloroethyl)ether	ND	0.330	"							
Bis(2-chloroisopropyl)ether	ND	0.330	"							
Bis(2-ethylhexyl)phthalate	ND	0.330	"							
4-Bromophenyl phenyl ether	ND	0.330	"							
Butyl benzyl phthalate	ND	0.330	"							
Carbazole	ND	0.330	"							
4-Chloroaniline	ND	0.500	"							
4-Chloro-3-methylphenol	ND	0.330	"							
2-Chloronaphthalene	ND	0.330	"							
2-Chlorophenol	ND	0.330	"							
4-Chlorophenyl phenyl ether	ND	0.330	"							
Chrysene	ND	0.330	"							
Di-n-butyl phthalate	ND	0.330	"							
Dibenz (a,h) anthracene	ND	0.330	"							
Dibenzofuran	ND	0.330	"							
1,2-Dichlorobenzene	ND	0.330	"							
1,3-Dichlorobenzene	ND	0.330	"							
1,4-Dichlorobenzene	ND	0.330	"							
3,3'-Dichlorobenzidine	ND	5.00	"							
2,4-Dichlorophenol	ND	0.330	"							
Diethyl phthalate	ND	0.330	"							
2,4-Dimethylphenol	ND	0.330	"							

Jeff Gerdes

Jeff Gerdes, Project Manager

Semivolatile Organic Compounds by EPA Method 8270C - Quality Control

North Creek Analytical - Bothell

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch 5B03052: Prepared 02/03/05 Using EPA 3550B										
Blank (5B03052-BLK1)										
Dimethyl phthalate	ND	0.330	mg/kg							
4,6-Dinitro-2-methylphenol	ND	0.500	"							
2,4-Dinitrophenol	ND	0.500	"							
2,4-Dinitrotoluene	ND	0.500	"							
2,6-Dinitrotoluene	ND	0.500	"							
Fluoranthene	ND	0.330	"							
Fluorene	ND	0.330	"							
Hexachlorobenzene	ND	0.330	"							
Hexachlorobutadiene	ND	0.330	"							
Hexachlorocyclopentadiene	ND	0.500	"							
Hexachloroethane	ND	0.330	"							
Indeno (1,2,3-cd) pyrene	ND	0.330	"							
Isophorone	ND	0.330	"							
2-Methylnaphthalene	ND	0.330	"							
2-Methylphenol	ND	0.330	"							
3 & 4-Methylphenol	ND	0.330	"							
Naphthalene	ND	0.330	"							
2-Nitroaniline	ND	0.500	"							
3-Nitroaniline	ND	0.500	"							
4-Nitroaniline	ND	0.500	"							
Nitrobenzene	ND	0.330	"							
2-Nitrophenol	ND	0.330	"							
4-Nitrophenol	ND	0.500	"							
N-Nitrosodi-n-propylamine	ND	0.330	"							
N-Nitrosodiphenylamine	ND	0.330	"							
Di-n-octyl phthalate	ND	0.330	"							
Pentachlorophenol	ND	0.500	"							
Phenanthrene	ND	0.330	"							
Phenol	ND	0.330	"							
Pyrene	ND	0.330	"							
1,2,4-Trichlorobenzene	ND	0.330	"							
2,4,5-Trichlorophenol	ND	0.330	"							
2,4,6-Trichlorophenol	ND	0.330	"							

Semivolatile Organic Compounds by EPA Method 8270C - Quality Control
North Creek Analytical - Bothell

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch 5B03052: Prepared 02/03/05 Using EPA 3550B										
Blank (5B03052-BLK1)										
Surrogate: 2-FBP	*1.25*		*mg/kg*	*1.67*		*74.9*	*36-146*			
Surrogate: 2-FP	*1.19*		*"*	*1.67*		*71.3*	*26-137*			
Surrogate: Nitrobenzene-d5	*1.24*		*"*	*1.67*		*74.3*	*48-127*			
Surrogate: Phenol-d6	*1.06*		*"*	*1.67*		*63.5*	*10-153*			
Surrogate: p-Terphenyl-d14	*1.49*		*"*	*1.67*		*89.2*	*44-144*			
Surrogate: 2,4,6-TBP	*1.17*		*"*	*1.67*		*70.1*	*10-133*			
LCS (5B03052-BS1)										
Acenaphthene	3.03	0.330	mg/kg	3.33		91.0	69-124			
4-Chloro-3-methylphenol	3.10	0.330	"	3.33		93.1	71-129			
2-Chlorophenol	2.82	0.330	"	3.33		84.7	54-144			
1,4-Dichlorobenzene	2.78	0.330	"	3.33		83.5	47-138			
2,4-Dinitrotoluene	3.51	0.500	"	3.33		105	71-133			
4-Nitrophenol	2.99	0.500	"	3.33		89.8	46-135			
N-Nitrosodi-n-propylamine	3.12	0.330	"	3.33		93.7	48-140			
Pentachlorophenol	3.05	0.500	"	3.33		91.6	57-128			
Phenol	3.06	0.330	"	3.33		91.9	51-142			
Pyrene	3.23	0.330	"	3.33		97.0	75-135			
1,2,4-Trichlorobenzene	2.64	0.330	"	3.33		79.3	61-126			
Surrogate: 2-FBP	*1.25*		*"*	*1.67*		*74.9*	*36-146*			
Surrogate: 2-FP	*1.28*		*"*	*1.67*		*76.6*	*26-137*			
Surrogate: Nitrobenzene-d5	*1.29*		*"*	*1.67*		*77.2*	*48-127*			
Surrogate: Phenol-d6	*1.11*		*"*	*1.67*		*66.5*	*10-153*			
Surrogate: p-Terphenyl-d14	*1.54*		*"*	*1.67*		*92.2*	*44-144*			
Surrogate: 2,4,6-TBP	*1.47*		*"*	*1.67*		*88.0*	*10-133*			
LCS Dup (5B03052-BSD1)										
Acenaphthene	3.05	0.330	mg/kg	3.33		91.6	69-124	0.658	24	
4-Chloro-3-methylphenol	3.25	0.330	"	3.33		97.6	71-129	4.72	19	
2-Chlorophenol	2.82	0.330	"	3.33		84.7	54-144	0.00	22	
1,4-Dichlorobenzene	2.84	0.330	"	3.33		85.3	47-138	2.14	26	
2,4-Dinitrotoluene	3.72	0.500	"	3.33		112	71-133	5.81	21	
4-Nitrophenol	3.05	0.500	"	3.33		91.6	46-135	1.99	17	

Fulcrum Environmental-Yakima
222 North Second Street, Suite A
Yakima, WA/USA 98901

Project: Office Max Woodwaste Landfill
Project Number: 05-822
Project Manager: Ryan Mathews

Reported:
03/02/05 15:59

Semivolatile Organic Compounds by EPA Method 8270C - Quality Control
North Creek Analytical - Bothell

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch 5B03052: Prepared 02/03/05 Using EPA 3550B										
LCS Dup (5B03052-BSD1)										
N-Nitrosodi-n-propylamine	3.11	0.330	mg/kg	3.33		93.4	48-140	0.321	23	
Pentachlorophenol	3.20	0.500	"	3.33		96.1	57-128	4.80	17	
Phenol	3.12	0.330	"	3.33		93.7	51-142	1.94	20	
Pyrene	3.39	0.330	"	3.33		102	75-135	4.83	17	
1,2,4-Trichlorobenzene	2.72	0.330	"	3.33		81.7	61-126	2.99	22	
Surrogate: 2-FBP	*1.26*		"	*1.67*		*75.4*	*36-146*			
Surrogate: 2-FP	*1.33*		"	*1.67*		*79.6*	*26-137*			
Surrogate: Nitrobenzene-d5	*1.39*		"	*1.67*		*83.2*	*48-127*			
Surrogate: Phenol-d6	*1.13*		"	*1.67*		*67.7*	*10-153*			
Surrogate: p-Terphenyl-d14	*1.61*		"	*1.67*		*96.4*	*44-144*			
Surrogate: 2,4,6-TBP	*1.56*		"	*1.67*		*93.4*	*10-133*			
Matrix Spike (5B03052-MS1)					**Source: B5B0068-02**					
Acenaphthene	4.27	1.65	mg/kg dry	4.30	ND	99.3	33-139			
4-Chloro-3-methylphenol	3.75	1.65	"	4.30	ND	87.2	32-156			
2-Chlorophenol	3.57	1.65	"	4.30	ND	83.0	34-144			
1,4-Dichlorobenzene	3.37	1.65	"	4.30	ND	78.4	31-126			
2,4-Dinitrotoluene	4.19	2.50	"	4.30	ND	97.4	32-154			
4-Nitrophenol	4.04	2.50	"	4.30	ND	94.0	10-171			
N-Nitrosodi-n-propylamine	3.68	1.65	"	4.30	ND	85.6	23-140			
Pentachlorophenol	4.42	2.50	"	4.30	ND	103	10-165			
Phenol	4.47	1.65	"	4.30	ND	104	32-144			
Pyrene	4.43	1.65	"	4.30	ND	103	28-156			
1,2,4-Trichlorobenzene	3.57	1.65	"	4.30	ND	83.0	34-126			
Surrogate: 2-FBP	*1.97*		"	*2.15*		*91.6*	*36-146*			
Surrogate: 2-FP	*1.58*		"	*2.15*		*73.5*	*26-137*			
Surrogate: Nitrobenzene-d5	*1.45*		"	*2.15*		*67.4*	*48-127*			
Surrogate: Phenol-d6	*2.66*		"	*2.15*		*124*	*10-153*			
Surrogate: p-Terphenyl-d14	*3.01*		"	*2.15*		*140*	*44-144*			
Surrogate: 2,4,6-TBP	*2.63*		"	*2.15*		*122*	*10-133*			

Jeff Gerdes

Jeff Gerdes, Project Manager

Fulcrum Environmental-Yakima 222 North Second Street, Suite A Yakima, WA/USA 98901	Project: Office Max Woodwaste Landfill Project Number: 05-822 Project Manager: Ryan Mathews	**Reported:** 03/02/05 15:59

Semivolatile Organic Compounds by EPA Method 8270C - Quality Control

North Creek Analytical - Bothell

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch 5B03052: Prepared 02/03/05 Using EPA 3550B										
Matrix Spike Dup (5B03052-MSD1)					**Source: B5B0068-02**					
Acenaphthene	4.05	1.65	mg/kg dry	4.30	ND	94.2	33-139	5.29	35	
4-Chloro-3-methylphenol	3.79	1.65	"	4.30	ND	88.1	32-156	1.06	36	
2-Chlorophenol	3.34	1.65	"	4.30	ND	77.7	34-144	6.66	39	
1,4-Dichlorobenzene	3.06	1.65	"	4.30	ND	71.2	31-126	9.64	42	
2,4-Dinitrotoluene	3.82	2.50	"	4.30	ND	88.8	32-154	9.24	37	
4-Nitrophenol	3.99	2.50	"	4.30	ND	92.8	10-171	1.25	36	
N-Nitrosodi-n-propylamine	3.23	1.65	"	4.30	ND	75.1	23-140	13.0	39	
Pentachlorophenol	4.42	2.50	"	4.30	ND	103	10-165	0.00	39	
Phenol	4.17	1.65	"	4.30	ND	97.0	32-144	6.94	40	
Pyrene	4.26	1.65	"	4.30	ND	99.1	28-156	3.91	35	
2,4-Trichlorobenzene	3.32	1.65	"	4.30	ND	77.2	34-126	7.26	39	
Surrogate: 2-FBP	*1.79*		"	*2.15*		*83.3*	*36-146*			
Surrogate: 2-FP	*1.47*		"	*2.15*		*68.4*	*26-137*			
Surrogate: Nitrobenzene-d5	*1.26*		"	*2.15*		*58.6*	*48-127*			
Surrogate: Phenol-d6	*2.46*		"	*2.15*		*114*	*10-153*			
Surrogate: p-Terphenyl-d14	*2.93*		"	*2.15*		*136*	*44-144*			
Surrogate: 2,4,6-TBP	*2.51*		"	*2.15*		*117*	*10-133*			

North Creek Analytical - Bothell

The results in this report apply to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

Jeff Gerdes

Jeff Gerdes, Project Manager

Fulcrum Environmental-Yakima
222 North Second Street, Suite A
Yakima, WA/USA 98901

Project: Office Max Woodwaste Landfill
Project Number: 05-822
Project Manager: Ryan Mathews

Reported:
03/02/05 15:59

Polynuclear Aromatic Hydrocarbons by GC/MS-SIM - Quality Control
North Creek Analytical - Bothell

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch 5B01057: Prepared 02/07/05 Using EPA 3545										
Blank (5B01057-BLK1)										
1-Methylnaphthalene	ND	0.0100	mg/kg							
2-Methylnaphthalene	ND	0.0100	"							
Acenaphthene	ND	0.0100	"							
Acenaphthylene	ND	0.0100	"							
Anthracene	ND	0.0100	"							
Benzo (a) anthracene	ND	0.0100	"							
Benzo (a) pyrene	ND	0.0100	"							
Benzo (b) fluoranthene	ND	0.0100	"							
Benzo (ghi) perylene	ND	0.0100	"							
Benzo (k) fluoranthene	ND	0.0100	"							
Chrysene	ND	0.0100	"							
Dibenz (a,h) anthracene	ND	0.0100	"							
Fluoranthene	ND	0.0100	"							
Fluorene	ND	0.0100	"							
Indeno (1,2,3-cd) pyrene	ND	0.0100	"							
Naphthalene	ND	0.0100	"							
Phenanthrene	ND	0.0100	"							
Pyrene	ND	0.0100	"							
Surrogate: p-Terphenyl-d14	*0.368*		*"*	*0.333*		*111*	*28-161*			
LCS (5B01057-BS2)										
Acenaphthene	0.629	0.0100	mg/kg	0.667		94.3	53-120			
Acenaphthylene	0.764	0.0100	"	0.667		115	52-120			
Anthracene	0.784	0.0100	"	0.667		118	39-145			
Benzo (a) anthracene	0.649	0.0100	"	0.667		97.3	64-120			
Benzo (a) pyrene	0.735	0.0100	"	0.667		110	46-148			
Benzo (b) fluoranthene	0.773	0.0100	"	0.667		116	52-139			
Benzo (ghi) perylene	0.702	0.0100	"	0.667		105	54-125			
Benzo (k) fluoranthene	0.739	0.0100	"	0.667		111	47-138			
Chrysene	0.717	0.0100	"	0.667		107	57-125			
Dibenz (a,h) anthracene	0.653	0.0100	"	0.667		97.9	52-120			
Fluoranthene	0.700	0.0100	"	0.667		105	61-128			
Fluorene	0.725	0.0100	"	0.667		109	63-120			
Indeno (1,2,3-cd) pyrene	0.692	0.0100	"	0.667		104	54-128			

Polynuclear Aromatic Hydrocarbons by GC/MS-SIM - Quality Control

North Creek Analytical - Bothell

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch 5B01057: Prepared 02/07/05 Using EPA 3545										
LCS (5B01057-BS2)										
Naphthalene	0.532	0.0100	mg/kg	0.667		79.8	54-120			
Phenanthrene	0.693	0.0100	"	0.667		104	28-120			
Pyrene	0.707	0.0100	"	0.667		106	59-124			
Surrogate: p-Terphenyl-d14	*0.311*		*"*	*0.333*		*93.4*	*28-161*			
LCS Dup (5B01057-BSD2)										
Acenaphthene	0.615	0.0100	mg/kg	0.667		92.2	53-120	2.25	40	
Acenaphthylene	0.635	0.0100	"	0.667		95.2	52-120	18.4	40	
Anthracene	0.711	0.0100	"	0.667		107	39-145	9.77	40	
Benzo (a) anthracene	0.590	0.0100	"	0.667		88.5	64-120	9.52	40	
Benzo (a) pyrene	0.678	0.0100	"	0.667		102	46-148	8.07	26	
nzo (b) fluoranthene	0.678	0.0100	"	0.667		102	52-139	13.1	40	
Benzo (ghi) perylene	0.626	0.0100	"	0.667		93.9	54-125	11.4	40	
Benzo (k) fluoranthene	0.697	0.0100	"	0.667		104	47-138	5.85	40	
Chrysene	0.704	0.0100	"	0.667		106	57-125	1.83	24	
Dibenz (a,h) anthracene	0.640	0.0100	"	0.667		96.0	52-120	2.01	40	
Fluoranthene	0.633	0.0100	"	0.667		94.9	61-128	10.1	40	
Fluorene	0.647	0.0100	"	0.667		97.0	63-120	11.4	43	
Indeno (1,2,3-cd) pyrene	0.630	0.0100	"	0.667		94.5	54-128	9.38	39	
Naphthalene	0.514	0.0100	"	0.667		77.1	54-120	3.44	40	
Phenanthrene	0.648	0.0100	"	0.667		97.2	28-120	6.71	40	
Pyrene	0.673	0.0100	"	0.667		101	59-124	4.93	40	
Surrogate: p-Terphenyl-d14	*0.280*		*"*	*0.333*		*84.1*	*28-161*			
Matrix Spike (5B01057-MS1)					**Source: B5B0069-01**					
Acenaphthene	12.8	0.500	mg/kg dry	1.84	15.2	-130	41-120			Q-03
Acenaphthylene	2.20	0.500	"	1.84	0.342	101	46-120			
Anthracene	61.6	0.500	"	1.84	65.6	-217	23-151			Q-03
Benzo (a) anthracene	14.7	0.500	"	1.84	16.3	-87.0	44-124			Q-03
Benzo (a) pyrene	13.4	0.500	"	1.84	15.1	-92.4	21-138			Q-03
Benzo (b) fluoranthene	12.7	0.500	"	1.84	14.8	-114	32-139			Q-03
Benzo (ghi) perylene	4.95	0.500	"	1.84	5.07	-6.52	20-140			Q-03
Benzo (k) fluoranthene	12.7	0.500	"	1.84	14.7	-109	23-138			Q-03
Chrysene	42.4	0.500	"	1.84	48.3	-321	33-126			Q-03

Jeff Gerdes

Jeff Gerdes, Project Manager

Polynuclear Aromatic Hydrocarbons by GC/MS-SIM - Quality Control

North Creek Analytical - Bothell

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch 5B01057: Prepared 02/07/05 Using EPA 3545										
Matrix Spike (5B01057-MS1)					**Source: B5B0069-01**					
Dibenz (a,h) anthracene	4.14	0.500	mg/kg dry	1.84	3.53	33.2	26-125			
Fluoranthene	42.7	0.500	"	1.84	49.2	-353	36-141			Q-03
Fluorene	18.9	0.500	"	1.84	20.5	-87.0	46-126			Q-03
Indeno (1,2,3-cd) pyrene	4.99	0.500	"	1.84	4.97	1.09	24-138			Q-03
Naphthalene	3.73	0.500	"	1.84	3.36	20.1	35-120			Q-03
Phenanthrene	40.2	0.500	"	1.84	45.9	-310	29-140			Q-03
Pyrene	55.5	0.500	"	1.84	66.8	-614	27-143			Q-03
Surrogate: p-Terphenyl-d14	*0.419*		*"*	*0.368*		*114*	*28-161*			
Matrix Spike Dup (5B01057-MSD1)					**Source: B5B0069-01**					
enaphthene	14.1	0.500	mg/kg dry	1.84	15.2	-59.8	41-120	9.67	50	Q-03
cenaphthylene	2.64	0.500	"	1.84	0.342	125	46-120	18.2	50	Q-03
Anthracene	65.7	0.500	"	1.84	65.6	5.43	23-151	6.44	50	Q-01
Benzo (a) anthracene	17.2	0.500	"	1.84	16.3	48.9	44-124	15.7	50	
Benzo (a) pyrene	16.1	0.500	"	1.84	15.1	54.3	21-138	18.3	50	
Benzo (b) fluoranthene	15.8	0.500	"	1.84	14.8	54.3	32-139	21.8	50	
Benzo (ghi) perylene	6.17	0.500	"	1.84	5.07	59.8	20-140	21.9	50	
Benzo (k) fluoranthene	14.9	0.500	"	1.84	14.7	10.9	23-138	15.9	50	Q-03
Chrysene	48.9	0.500	"	1.84	48.3	32.6	33-126	14.2	44	Q-03
Dibenz (a,h) anthracene	5.03	0.500	"	1.84	3.53	81.5	26-125	19.4	50	
Fluoranthene	47.7	0.500	"	1.84	49.2	-81.5	36-141	11.1	50	Q-03
Fluorene	20.8	0.500	"	1.84	20.5	16.3	46-126	9.57	52	Q-03
Indeno (1,2,3-cd) pyrene	6.32	0.500	"	1.84	4.97	73.4	24-138	23.5	43	
Naphthalene	4.33	0.500	"	1.84	3.36	52.7	35-120	14.9	50	
Phenanthrene	44.3	0.500	"	1.84	45.9	-87.0	29-140	9.70	50	Q-03
Pyrene	63.9	0.500	"	1.84	66.8	-158	27-143	14.1	50	Q-03
Surrogate: p-Terphenyl-d14	*0.489*		*"*	*0.368*		*133*	*28-161*			

Fulcrum Environmental-Yakima
222 North Second Street, Suite A
Yakima, WA/USA 98901

Project: Office Max Woodwaste Landfill
Project Number: 05-822
Project Manager: Ryan Mathews

Reported:
03/02/05 15:59

Physical Parameters by APHA/ASTM/EPA Methods - Quality Control
North Creek Analytical - Bothell

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch 5B04063: Prepared 02/04/05 Using General Preparation										
Blank (5B04063-BLK1)										
Dry Weight	100	1.00	%							
Batch 5B04065: Prepared 02/04/05 Using General Preparation										
Blank (5B04065-BLK1)										
Dry Weight	99.8	1.00	%							

Jeff Gerdes

Jeff Gerdes, Project Manager

11720 North Creek Pkwy N Suite 400, Bothell, WA 98011-9508 | 425-420-9200 | FAX 420-9210 ☐
11115 E Montgomery Suite B, Spokane, WA 99206-4776 | 509-924-9200 | FAX 924-9290 ☐
9405 SW Nimbus Ave, Beaverton, OR 97008-7132 | 503-906-9200 | FAX 906-9210 ☐
20332 Empire Ave Suite F-1, Bend, OR 99701-5711 | 541-383-9310 | FAX 382-7588 ☐
3209 Denali St, Anchorage, AK 99503-4030 | 907-334-9200 | FAX 334-9210 ☐

CHAIN OF CUSTODY REPORT

Work Order #: B5B0109

CLIENT: Fulcrum Environmental Consulting
INVOICE TO: same
REPORT TO: Ryan Mathews
ADDRESS: 232 N. 2nd St, Suite A
Yakima, WA 98901
PHONE: 574-0839 FAX: 575-8453
P.O. NUMBER:
PROJECT NAME: Office Max woodwaste landfill
PROJECT NUMBER: 05-822
SAMPLED BY: B. Harcourt

TURNAROUND REQUEST in Business Days *

Organic & Inorganic Analyses
☐ 10 STD. ☐ 7 ☐ 5 ☐ 4 ☐ 3 ☐ 2 ☐ 1 ☐ <1

Petroleum Hydrocarbon Analyses
☐ 5 STD. ☐ 4 ☐ 3 ☐ 2 ☐ 1 ☐ <1

☐ OTHER Specify:

* Turnaround Requests less than standard may incur Rush Charges.

PRESERVATIVE

REQUESTED ANALYSES

	CLIENT SAMPLE IDENTIFICATION	SAMPLING DATE/TIME	NWTPH-HCID	RCRA 8 metals	Semi-volatiles 8270C	PAH (SIMS)	MATRIX (W, S, O)	# OF CONT.	LOCATION / COMMENTS	NCA WO ID
1	4A 2	2/2/05			— sets 4 #5 —	● composite	S	2	lab composite (HCID, RCRA8)	-01
2	4B	2/2/05						1		-02
3	4C 2	2/2/05				●		2		-03
4	4D	2/2/05						1		-04
5	4E	2/2/05						1		-05
6	5A 2	2/2/05			lab composite —	×				-06
7	5B	2/2/05							lab composite (HCID, RCRA 8)	-07
8	5C	2/2/05								-08
9	5D	2/2/05				●				-09
10	5E	2/2/05								-10
										-11

-06
-12
composites

RELEASED BY: Brianne D. Harcourt
PRINT NAME: Brianne D. Harcourt FIRM: Fulcrum
DATE: 2/2/05 TIME: 4:45 pm
RECEIVED BY: Tom Blankenship
PRINT NAME: Blankinship FIRM: NCA
DATE: 2/3/05 TIME: 0915
RELEASED BY:
PRINT NAME: FIRM:
DATE: TIME:
RECEIVED BY:
PRINT NAME: FIRM:
DATE: TIME:
ADDITIONAL REMARKS:
TEMP: 2.0 w/o
PAGE OF

COC REV 1/03

1120 North Creek Pkwy N Suite 400, Bothell, WA 98011-9508 425-420-9200 FAX 420-9210
11115 E Montgomery Suite B, Spokane, WA 99206-4776 509-924-9200 FAX 924-9290
9405 SW Nimbus Ave, Beaverton, OR 97008-7132 503-906-9200 FAX 906-9210
20332 Empire Ave Suite F-1, Bend, OR 99701-5711 541-383-9310 FAX 382-7588
3209 Denali St, Anchorage, AK 99503-4030 907-334-9200 FAX 334-9210

CHAIN OF CUSTODY REPORT

Work Order #: B5B0109

CLIENT:
REPORT TO: same as 1
ADDRESS:
PHONE: FAX:
PROJECT NAME:
PROJECT NUMBER: same as 1
SAMPLED BY:
INVOICE TO:
P.O. NUMBER:

TURNAROUND REQUEST
in Business Days *
Organic & Inorganic Analyses
10 STD. 7 5 4 3 2 1 <1
Petroleum Hydrocarbon Analyses
5 STD. 4 3 2 1 <1
OTHER Specify:
* Turnaround Requests less than standard may incur Rush Charges.

	CLIENT SAMPLE IDENTIFICATION	SAMPLING DATE/TIME	NWTPH-HCID	RCRA-8 metals	Semivolatiles 8270C	PAH (GC/MS)									MATRIX (W, S, O)	# OF CONT.	LOCATION / COMMENTS	NCA WO ID
1	6A	2/2/05			lab composite sets 6 & 7													
2	6B	2/1/05													S	1		-13
3	6C 2	2/1/05				X	lab composite									1		-14
4	6D	2/1/05														2	lab composite (HCID, RCRA8)	-15
5	6E 2	2/1/05				●										1		-16
6	7A 2	2/2/05				X										2		-17
7	7B 2	2/1/05				●	lab composite									2		-19
8	7C	2/2/05														2	lab composite (HCID, RCRA8)	-20
9	7D	2/1/05														1		-21
10	7E 2	2/2/05				●										1		-22
																2		-23

Composites → -18 -24

RELEASED BY: Brianne Harcouet
PRINT NAME: Brianne Harcouet FIRM: Fulcrum DATE: 2/2/05 TIME: 4:45
RECEIVED BY: Tom Blankship
PRINT NAME: Blankinship FIRM: NCA DATE: 2/3/05 TIME: 0915
RELEASED BY:
PRINT NAME: FIRM: DATE: TIME:
RECEIVED BY:
PRINT NAME: FIRM: DATE: TIME:
ADDITIONAL REMARKS:
TEMP: 2.0 w/o
PAGE OF

COC REV 1/03

Work Plan Exhibits

Exhibit A

Sampling and Analysis Plan (SAP)

(Changes to Section 5.0 and Appendix D from September 2018 Revised Final RI Work Plan submittal – no other changes)

Revised Final Sampling and Analysis Plan

Exhibit A to Revised Final Remedial Investigation Work Plan

Yakima Mill Site

Prepared for:
Office Max Incorporated
LeeLynn, Inc. & Wiley Mt., Inc
Yakima Resources, LLC
Dunollie Enterprises, LLC

January 2019

Prepared by:
Barr Engineering Co.
Fulcrum Environmental Consulting, Inc.

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Sampling and Analysis Plan

Exhibit A to Remedial Investigation Work Plan

January 2019

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Acronyms

Acronym	Description
AO	Agreed Order
AOC	Area of Concern
bgs	below ground surface
BTEX	Benzene, toluene, ethylbenzene, and xylenes
FDS	Fuel Distribution System
GPS	Global Positioning System
NTU	Nephelometric turbidity unit
PAH	Polycyclic aromatic hydrocarbon
PID	Photoionization detector
PCBs	Polychlorinated biphenyls
PVC	Polyvinyl chloride
SAP	Sample and Analysis Plan
SOP	Standard operating procedures
SVOC	Semi-volatile Organic Compound
QAPP	Quality Assurance Project Plan
TOC	Total organic carbon
TPH	Total Petroleum Hydrocarbons
VOC	Volatile Organic Compound
WAC	Washington Administrative Code

1.0 Introduction

This Sampling and Analysis Plan (SAP) has been prepared as an exhibit to the Revised Final Remedial Investigation (RI) Work Plan (Work Plan) and is to be used in conjunction with the Quality Assurance Project Plan (QAPP) to investigate areas of concern (AOCs) at the Yakima Mill Site (Site) located in Yakima, Washington (Figure 1). This document serves as a comprehensive reference for the sampling and analysis program that will be followed during implementation of the Work Plan. The SAP has been prepared to satisfy Part VII.A and Part VII.B of Agreed Order (AO) No. DE13959 in accordance with Washington Administrative Code (WAC) 173-340-820 requirements.

The Site is located immediately adjacent to the former City of Yakima landfill (Landfill Site). The Site is further defined by the extent of contamination caused by releases of hazardous substances at the Site, which, based on facts known as of the effective date of the AO, is exclusive of any area 1) where municipal waste has come to be located or 2) which is affected by a release or threatened release of hazardous substances from the municipal solid waste. Investigation activities will be conducted on the parcels that comprise the Site (Figure 2). No sampling activities will be completed on the Landfill Site. A summary of the Site history and previous investigations is provided in the Work Plan. The Site layout is shown on Figure 3.

1.1 Purpose and Objectives

The purpose of this SAP is to describe the sample collection, handling, and field analysis procedures that will be used at the Site during implementation of the RI Work Plan. The sample data will be used to determine the nature and extent of contamination in soil, groundwater, surface water, pond bottoms/sediment, and soil gas that has resulted from releases of hazardous substances, including petroleum products, at the AOCs on the Site. It will also be used to assess potential risks to human health and the environment posed by such releases, and to collect the information needed to support the development and evaluation of remedial action alternatives under WAC 173-340-360 through 173-340-390, if needed.

This SAP is the primary document for field work associated with the RI including the collection of samples, the measurement of groundwater levels, measurement of river levels, surveying, managing investigation derived waste, and other field procedures. Reasonable effort has been made to make all descriptions of field procedures in the Work Plan and QAPP consistent with language in this SAP, but the SAP language will supersede any inconsistent language in the Work Plan and QAPP regarding field procedures.

1.2 Investigation Organization and Responsibilities

Key staff members for this project are listed below with their project functions:

Person/Agency or Firm	Title	Responsibilities
Allan Gebhard Barr Engineering Co Phone: 952-832-2725	Project Coordinator	Responsible for implementation of the project in accordance with the Agreed Order. Provides overall leadership and coordination of work on the project, primarily ensuring that technical, financial, and schedule objectives are achieved successfully. Approval of all external report deliverables prior to submittal to Ecology, and may represent the project team at various meetings. May delegate certain responsibilities to appropriately qualified individuals.
John Greer, LG, LHG Barr Engineering Co Phone: 952-832-2691	Licensed Geologist/Hydrogeologist	In responsible charge of the RI work; reviews work plans and any deviations and the work performed to ensure its quality and technical content. May delegate certain responsibilities to appropriately qualified individuals but remains in responsible charge of the work.
Alec Danielson, PE Barr Engineering Co Phone: 952-832-2837	Overall Project Manager	Coordinates and directs staff to meet project objectives and to keep project on schedule and on budget; reviews the work performed to ensure its quality, responsiveness, and timeliness. May delegate certain responsibilities to appropriately qualified individuals.
Ryan Mathews Fulcrum Environmental Phone: 509-574-0839	Fulcrum Project Manager	Responsible for coordinating with the Project Coordinator, Licensed Geologist and Project Manager for work completed by Fulcrum on the project and for providing local knowledge. Responsible for quality, responsiveness, and timeliness of Fulcrum work. May delegate certain responsibilities to appropriately qualified individuals.
Dana Pasi Barr Engineering Co Phone: 952-832-2756	Data Quality Assurance (QA) Manager	Responsible for preparing the QAPP and verifying the laboratories implement the requirements of the QAPP and address any QA issues. Provides technical assistance to project staff and performs necessary audits and data verification and validation. May delegate certain responsibilities to appropriately qualified individuals.

Person/Agency or Firm	Title	Responsibilities
Kevin McGilp Barr Engineering Co Phone: 952-832-2856	Field Manager	Coordinates and directs field staff to see that the data collection and field activities are in conformance with the objectives of the Work Plan, SAP, and QAPP. Able to stop work on-site as required to deal with a site safety issue. May delegate certain responsibilities to appropriately qualified individuals but remains responsible for all field work.
Kevin McGilp	Field Safety Manager	Responsible for seeing that the PHASP is followed by all on-site personnel. Responsible for any modifications to the PHASP due to discovered conditions. Able to stop work if needed to deal with a site safety issue. May delegate certain responsibilities to appropriately qualified individuals.
Mike Ridgeway Fremont Analytical, Inc. Phone: 206-352-3790	Laboratory Director	Responsible for coordinating with the Field Manager, Project Manager and/or QA Manager for the sampling events. Responsible for adhering to the analysis requirements stated in the QAPP, SAP, and Work Plan and subsequent QAPP modifications. Contacts Barr Data QA Manager as necessary with problems that may affect data quality.

2.0 Investigation Approach

The investigation approach was developed to address the project objectives defined in Section 1.1 of this SAP. The investigation includes collection of soil samples from test trenches, soil borings, surface soil, and pond bottom sampling locations; collection of groundwater samples from temporary, existing, and newly installed monitoring wells; collection of surface water samples, collection of soil gas samples from existing and newly installed soil gas wells; surveying; utility locating, including using geophysical techniques as necessary; and water level monitoring. The investigation methods described below are consistent with the QAPP which is Exhibit B of the Work Plan.

2.1 Field Investigation Tasks

Field investigation tasks will consist of advancing soil borings for the collection of soil, soil gas and groundwater samples, test pitting for the collection of soil samples, hand tool sampling for surface soil sampling, surface water sampling, and sampling existing groundwater monitoring and soil gas wells.

2.1.1 Soil Sampling

Soil investigation activities at the Site will involve collecting samples from soil borings, test pits and surface locations. Soil samples will be field screened for odor, discoloration, sheen, organic vapor headspace using an 11.7 eV photoionization detector (PID), and characterized according to ASTM standard D2488 (Visual-Manual Method). Field screening will conform to the standard operating procedure (SOP) for Field Screening Soil Samples. Soil samples will be collected in accordance with the SOP for Collection of Soil Samples. Soil samples for VOC analysis will be preserved with a methanol solvent in accordance with EPA Method 5035. Sampling equipment will be decontaminated between sample locations in accordance with the SOP for Decontamination of Sampling Equipment. The SOPs are presented in Appendix A. Sample field logs for borings and wells are included in Appendix B and for test pits in Appendix C.

Soil samples will be collected from the intervals and analyzed for the parameters listed in Table 2 for each AOC. In general, soil sample intervals will be selected based on field screening/characterization results when evaluating potential petroleum impacts. Field observation of fill or former pond bottoms will be used to select sampling intervals with potential fill above native soil. A fixed sampling interval is provided for sampling locations that cannot be field screened for potential petroleum impacts or fill. Further discussion of the soil sampling design for each AOC is provided in Section 2.2. All soil samples will be grab samples (i.e., no composite samples are planned during this investigation).

2.1.1.1 Soil Borings

Soil borings will be completed via rotary sonic (rotasonic) drilling methods. Rotasonic drilling was selected because it can advance through concrete floors and cobbles/boulders while providing sufficient soil sample recovery volume. Rotasonic boreholes can also be easily completed as temporary or permanent wells. Soil borings will be completed to specified depths depending on the location. Target depths are described in Section 2.2. Drillers will be instructed to drill without water, as feasible, and to provide their observations to enhance the field geologist's notes.

Drilling by rotasonic methods will be conducted with continuous nominal 4-inch diameter core sampling, resulting in a nominal 6-inch diameter borehole. Boreholes will be advanced with full sampling runs (5 to 10 feet, depending on the type of rig used) or as directed by the field geologist. At soil borings completed for collection of shallow (0-2 feet bgs) samples, the drill bit will be advanced with a minimum of percussion to minimize heating of the soil column and potential loss of VOCs due to volatilization. Soil samples from sonic cores will be screened at approximate 2.5-foot intervals. If soil with elevated PID readings, odor, or staining is present at the target completion depth, the depth of the boring will be extended in an attempt to delineate the vertical extent of impacts.

Each soil boring will be documented with a field log using the form provided in Appendix B that includes boring location and depth, soil encountered, field screening results, and analytical samples collected. Soil borings will be sealed in accordance with the Minimum Standards for Construction and Maintenance of Wells (WAC 173-160).

2.1.1.2 Test Pits

Test pits will be used to investigate AOCs with potential buried debris or other fill. Test pits will also be used to investigate anticipated releases from and around structures and subsurface fuel lines and to collect surficial soil samples at locations with hard-packed ground that would be difficult to sample using hand tools. In areas where debris (notably log yard materials) or other fill is encountered, the test pit will extend vertically through the debris or fill and approximately two feet into the underlying native soil if the excavator reach is sufficient, the excavation sidewalls can be safely maintained, and the debris is inert.

Test pits will be dug with a back-hoe or excavator. The locations of these test pits may be modified from the locations shown on Figures 13-23 in the field based on accessibility, subsurface utilities, and field observations. Any modifications will be recorded in the test pit field log (Appendix C). Samples for field screening and laboratory analysis will be collected from soil in the excavator bucket. Each test pit will be documented with a field log that includes location, depth, length, soil encountered, field screening results, and analytical samples collected. Test pits will be completed to specified depths depending on the locations. Target depths are discussed in Section 2.2.

No personnel will enter any excavation deeper than four feet. Upon completion of a test pit, soil will be placed back in the pit in the order and approximate position from which it was removed and bucket tamped in approximate six- to ten-inch lifts to re-compact the soil as it is replaced. Soil that displays gross environmental impacts including visible product, will be contained on-Site for characterization and proper disposal (Section 4.1).

2.1.1.3 Surface Soil

Surface soil samples will be collected using hand tools in accordance with the SOPs (see Appendix A). Where concrete or pavement is present at the surface or where using hand tools is not feasible, a shallow test pit or soil boring will be used to collect the surface soil sample for field screening and laboratory analysis. Generally, laboratory soil samples will be collected from the upper one to two feet of soil depending on the individual AOC being investigated.

2.1.1.4 Pond Bottoms & Ditch Bottoms

Soil and settled solids at the bottom of the operational ponds and drainage ditches will be collected using sediment core sampling techniques in accordance with ASTM D4823-95(2014) and the SOP (see Appendix A). If sample recovery is poor using core sampling techniques at the operational ponds, ponar sampling techniques will be completed in accordance with Section 10 of ASTM E1391 and the SOP (see Appendix A). The samples will be collected from the upper one to two feet of soil and settled solids. The sample depth will be extended into native soil beneath the pond bottoms, as feasible, for characterization, field screening, and sampling of native soil beneath the pond bottoms. The depth of water and estimated thickness of soft settled solids will be measured and documented in the sampling log.

The field sampling crew will assess whether the pond bottom samples can be safely collected from the shoreline, existing pond control structure, or shallow water using waders. If a representative sample cannot otherwise be collected safely, kayaks with outriggers or an inflatable boat will be deployed.

Soil borings will be advanced within the former pond footprint at former operational ponds that have been filled.

2.1.2 Monitoring Well Installation

Monitoring wells will be installed via rotasonic drilling. All wells will be installed and decommissioned (in the case of temporary wells) by a licensed well contractor in accordance with all applicable rules and regulations and in accordance with WAC 173-160.

Water table monitoring well screens will be two-inch inner diameter (I.D.) polyvinyl chloride (PVC) pipe with a 10-foot long, continuous No. 20 slot (0.020”) well screen fitted with a flat base plate and threaded female flush coupling. Riser pipe will be two-inch diameter, Schedule 40 PVC. Monitoring well construction details are provided on Figure 32.

Water table wells will be set so that the screen intersects the water table with approximately three feet above the water table and seven feet below the water table at the time of placement, adjusted for seasonal fluctuations.

Upon completion of the borehole, the monitoring well screen and riser pipe, including an adequate number of centering guides, if needed, will be assembled without solvent or joint dressing and installed so that the screen is at the design depth, and the riser pipe extends approximately three feet above ground surface. If drilling fluid other than water has been used during borehole advancement, the drilling fluid will be flushed from the borehole by pumping potable water through the riser pipe and well screen until the return water is clear. The sand pack will be installed in a manner that will minimize segregation and ensure that the sand pack fills, as nearly as practical, the annular space between the well screen and the borehole wall to a depth of two feet above the top of the screen. Approximately two feet of bentonite chips will be added above the sandpack and hydrated. Neat cement grout will be placed above the bentonite seal by pumping under pressure through a tremie pipe. After six inches of grout has been placed in the borehole, the discharge point of the tremie pipe will be maintained three inches or more below the grout surface. Full strength grout will be placed to a depth of five feet from the ground surface. Down hole equipment will be withdrawn as necessary during the grouting process.

Each monitoring well will be finished above grade with a protective casing and a locking cap. Two to three protective posts will be placed two feet from the protective casing, symmetrically spaced approximately three feet apart.

Monitoring well logs will include location, well construction schematics, field screening observations, and soil classification data as shown in Appendix B.

2.1.2.1 Temporary Monitoring Well Installation

Temporary wells will be installed in borings drilled with a rotasonic drill rig and constructed using two-inch diameter, five-foot long PVC prepacked well screen with 0.020-inch slot size and appropriate sand pack. The bottom of the prepacked well screens will be placed five feet below the water level observed in a borehole. Groundwater samples will be collected according to the SOP for Collection of Groundwater Samples using Low-Flow Purging and Sampling (Appendix A), as feasible, from the temporary monitoring wells. If the recharge rate in the temporary well does not allow sampling within the allotted timeframe under Chapter 173-160 WAC, Minimum Functional Standards for Construction and Maintenance of Wells, five well volumes will be purged and a sample collected. Temporary monitoring well construction details are provided on Figure 33. The temporary wells will be properly sealed immediately following sample collection.

2.1.3 Monitoring Well Development

Monitoring wells (new and existing permanent wells; not including temporary wells) will be developed by air lifting, water jetting, surging and bailing, pumping, or a combination of these methods in accordance with the SOPs (Appendix A). The objective of monitoring well development will be to produce water with minimal turbidity (defined as < 5 nephelometric turbidity units; NTUs). This criterion may not be attainable for monitoring wells screened in fine grained soil or those with high organic content.

Monitoring well development will also be considered complete if the development criteria are not met, but at least ten well volumes have been removed. Well development techniques, purge volume, and stabilization criteria will be documented and provided in the RI Report. Samples will not be collected for laboratory analysis for at least 7 days following successful well development.

2.1.4 Existing Monitoring Well Redevelopment

Existing Site monitoring wells will be evaluated and, if necessary, redeveloped by air lifting, water jetting, surging and bailing, pumping, or a combination of these methods to remove sediment that accumulated in the well screen and break up bridging of the sand pack on the outside of the well screen, if present, to reestablish a good connection between the well and the aquifer.

Redevelopment activities will continue as practical until the monitoring well produces water that is clear and free of turbidity, (i.e., < 5 NTU), consistent with the criterion described in Section 2.1.3 above. This criterion may not be attainable for monitoring wells screened in fine grained soil or high organic content materials that may be encountered on the Site.

2.1.5 Groundwater Sampling

Thirteen existing onsite monitoring wells, eight new monitoring wells, and twelve temporary monitoring wells will be used to monitor groundwater quality and flow direction at the Site. Well purging, sampling, and stabilization will conform to the SOP for Collection of Groundwater Samples using Low-Flow Purging and Sampling (Appendix A). A well stabilization record form is included on the Field Log Data Sheet provided in the SOP and will be completed for each monitoring well and sampling event.

Each well will be purged and a stabilization test will be performed at each well prior to sample collection. Stabilization is achieved when three consecutive measurements of the following parameters are within the range shown on the table below (measurements for stabilization will be taken after each water-column volume is purged):

Parameter *(Typical unit of measurement)*	**Criteria**
Specific Conductance [corrected to 25 °C] (ohms/cm)	±3%
ORP (mV)	±10 mV
Turbidity (NTU)	+/-10%; three consecutive readings below 5 NTU will be considered stabilized even if the change between readings is more than +/-10%
Dissolved Oxygen (mg/L)	±10%; three consecutive readings below 0.5 mg/L will be considered stabilized even if the change between readings is more than +/-10%
pH (unit less)	± 0.1 Standard Units
Temperature (° C)	± 0.5 °C

Pumps and other downhole equipment will be equipped with check valves to prevent water from re-entering the well.

In the unlikely event that monitoring wells do not produce enough water to maintain a minimum drawdown level, those wells will be pumped dry, allowed to recover a minimum of one hour, and sampled as soon as sufficient water is present in the well. This is not anticipated at this Site based on what is currently known about the makeup of water bearing materials.

Groundwater samples will be collected from the new and existing monitoring wells quarterly for one year. One set of samples will be collected from the temporary wells at the time of the investigation. Individual analytes will vary among grab samples collected from temporary wells based on the constituents of concern for that AOC. Monitoring wells will be analyzed for a sitewide parameter list that includes total petroleum hydrocarbons (TPH)-Gx, TPH-Dx (with and without silica gel cleanup), total organic carbon

(TOC), benzene, toluene, ethylbenzene, and xylene (BTEX), fuel additives, semi-volatile organic compounds (SVOCs), volatile organic compounds (VOCs), and metals. In addition, nitrate, sulfate, and TOC will be evaluated for geochemical evaluation. The groundwater samples will be analyzed for the parameters in Table 1.

After the first two quarterly sampling events are completed, an evaluation of the sampling results will be performed to determine if the analytical parameter list can be reduced. If sample concentrations are below the reporting limits for a constituent during the first two sampling events, that constituent will be recommended for removal from the analytical suite for that sample location for the remaining two sampling events. This approach is consistent with an area-wide screening approach where a wide parameter list is used initially and then scaled back based on results. Any changes to the groundwater monitoring program will be submitted to Ecology for review and approval before they are implemented.

2.1.6 Surface Water Sampling

Surface water samples will be collected from two former operational ponds (recycle pond and settling pond) using an unpreserved transfer container in accordance with the SOP for Collection of Surface Water Samples (Appendix A). The samples will be collected a minimum of 7 days after a significant rain event (defined as greater than 0.1-inches of rain in 24 hours).

2.1.7 River Gage Installation

River gages will be installed to evaluate the elevation of the Yakima River at the approximate locations shown on Figure 24. An evaluation will be made in the field to determine the best approach to establish a secure river gage. Existing structures (e.g. bridge abutments) or fence posts will be utilized to secure the gages. A 2-inch PVC stilling well and level rod with 0.01 foot increments will be attached to the fencepost or existing structure. The location and elevation of the stilling well and level rod will be surveyed following installation.

2.1.8 Surveying

The elevations of the permanent monitoring wells and soil gas wells (top of well riser and ground surface) will be surveyed to the nearest 0.01 feet by a Washington State licensed Professional Land Surveyor using Washington State Plan Coordinates NAD 83/91 and NAVD88 datum. Top of well riser elevations will be measured on the north side of the riser and the surveyed point will be marked on the riser.

Horizontal locations of soil sampling locations and temporary wells will be measured with a Global Positioning System (GPS) survey equipped with a real-time differential GPS unit with internal averaging features and submeter accuracy. The GPS data will be post-processed using local benchmarks. The raw GPS survey data, including accuracy and standard deviation, will be provided in the RI Report.

2.1.9 Comprehensive Water Level Monitoring

Water level monitoring will be conducted at the new and existing monitoring wells during groundwater sampling events. Water level measurements from the network of monitoring wells will be collected within the shortest overall time frame possible in accordance with the SOP for Measuring Static Water Level, Immiscible Layers, and Total Well Depth (Appendix A). Water levels will also be measured at river gage monitoring locations during comprehensive water level monitoring events.

The depth to groundwater and total well depth will be measured from the measuring point marked on the well riser using a calibrated electronic water level meter or equivalent. Depth to water will be measured to the nearest 0.01 foot. The electronic water level meter will be decontaminated with an alconox-type cleaner and distilled water between each well in accordance with the SOP for Decontamination of Sampling Equipment (Appendix A).

2.1.10 Soil Gas Monitoring/Sampling

Fourteen existing soil gas wells and up to nine new soil gas wells are proposed to monitor/sample for methane. The soil gas wells will be monitored for methane, oxygen, and carbon dioxide using a landfill gas analyzer (GEM 2000 or equivalent) and monitored for hydrogen sulfide, carbon monoxide, LEL and oxygen using a 4-gas meter. Soil gas monitoring will begin following purging of a minimum of three tubing volumes as detailed in the Field Measurement of Soil Gases SOP (Appendix A). Four quarterly rounds of soil gas monitoring will be completed at the same time as the groundwater samples are collected.

2.1.10.1 New Soil Gas Wells

New soil gas wells will be constructed using 0.5-inch diameter PVC well screen and riser with 0.030-inch slot well screen. The well screens will be 5 feet long and the bottom of each screen will be set at a depth of 10 feet below ground surface (bgs) with the boring extended to a depth of 12 feet bgs, If groundwater is encountered at depths shallower than 12 feet bgs, the borehole will be backfilled with pea gravel so that the bottom of the soil gas well screen can be placed two feet above the groundwater elevation. The gravel pack will be installed in a manner that will minimize segregation and ensure that the gravel pack fills, as nearly as practicable, the annular space between the gas well screen and the borehole wall to a depth of one foot above the top of the screen. Approximately 1 foot of granular bentonite will be added above the gravel pack. Hydrated bentonite grout will be placed above the bentonite seal. Down hole equipment will be withdrawn as necessary during the grouting process.

The riser pipe of the soil gas wells will be completed with an air tight cap and sample port. Each soil gas well will be finished above grade with a protective casing and a locking cap. Two to three protective posts shall be placed two feet from the protective casing, symmetrically spaced approximately three feet apart. Soil gas well construction details are provided on Figure 34. Sampling will occur no sooner than 48 hours after the completion of construction. In addition, sampling will not occur within 48 hours after a significant precipitation event (defined as greater than 0.1-inches of rain of 1-inch of snow in 24 hours).

2.1.10.2 Existing Soil Gas Wells

Existing soil gas wells will be evaluated and repaired as necessary so the soil gas wells will yield a representative soil gas sample. Repairs and upgrades may include replacement of well caps, installation of sampling ports, removal of soil/debris from within the well, repair of surface seal, etc. Sampling will occur no sooner than 48 hours after the wells have been repaired. In addition, sampling will not occur within 48 hours after a significant precipitation event (defined as greater than 0.1-inches of rain or 1-inch of snow in 24 hours). If an existing soil gas well targeted for monitoring cannot be repaired to yield a representative soil gas sample, a replacement soil gas well will be constructed as detailed in Section 2.1.10.1.

2.1.11 Utility Locating / Geophysical Surveying

A private utility locator will be hired to locate onsite utilities beyond those marked by the Washington Utility Notification Center. Underground utilities will be located at sampling locations throughout the Site using a combination of passive electromagnetic survey and active electromagnetic survey (where utilities are exposed). Test pit, soil boring, and well locations will be modified as necessary to safely complete the work near underground utilities.

Additional effort will be made to locate the fuel lines between the ASTs and fuel dispensers. The private utility locator will complete the locate in the following sequence: 1) passive electromagnetic survey to locate lines near the fuel dispensers, 2) active electromagnetic survey while connected to lines located during the passive survey, and 3) a ground penetrating radar survey. The results of fuel line locating activities will be used to identify test pit and soil boring locations adjacent to the fuel transfer systems.

2.2 Sampling Design

This sampling design is based on previous Site sampling data and operational history. An area that has been investigated thoroughly in the past will have fewer samples than an area with minimal investigation. An area with less risk based on historical operations (e.g., finished lumber storage) will have fewer samples than an area that has higher risk of a release (e.g., chemical use/storage). The sampling design was developed consistent with Ecology Publication No. 94-49 and utilizes the focused sampling approach at areas with a known operational history or previously identified impacts and the area-wide sampling approach at areas with less operational knowledge or potential for dispersed impacts. The three general approaches to sampling are as follows:

1. Area-wide sampling
    a. To be conducted at AOCs where a release is not suspected, but historical Site operations or filling were conducted.
    b. Sampling will be conducted at spatially distributed locations throughout the AOC.
2. Focused sampling (operational feature)
    a. Targeted sampling at AOCs where the operational history indicates the risk of a potential release.
    b. Sampling will be conducted near the operational features that present the risk of a release.
3. Focused sampling (delineate extent of impacts)
    a. Further delineation/characterization at AOCs where impacts have been identified.
    b. The selected sampling locations augment existing sampling data to delineate the impacts for selection of a cleanup action under WAC 173-340-360 through 173-340-390.

The vertical sample intervals will be selected based on field screening if the contaminants of concern (COCs) for that area can be adequately characterized with field screening techniques. Field screening will be used to select sampling intervals for areas with: 1) potential petroleum impacts, and 2) fill soil. Fill soil (or pond bottoms) will be characterized based on the presence of anthropogenic materials (e.g. log yard materials), disturbed soil structure, or inconsistent lithology. Prescribed sampling depths will be used for areas with soil COCs that cannot be screened for petroleum impacts or fill. A summary of the sampling program for each AOC is detailed below. The identified data gap and investigation rationale is provided in Table 1. The soil sampling intervals are described in Table 2. The locations of the AOCs are shown on Figure 12 and the sampling locations are shown on Figures 13 through 26. Sitewide summaries of sampling locations for each media are provided on Figures 28 through 31 in this SAP. The sampling approach described below presents the initial RI scope for each AOC. Further delineation or characterization of impacts may be necessary during any supplemental Stage 2 RI work.

2.2.1 Potential Wood Waste Landfill Remnant (AOC 1)

- **Area-wide sampling**
    - **Six test pits**

The sampling objective at the wood waste landfill remnant is to assess the extent of wood waste (if present) and the potential impacts to soil quality beneath the wood waste. Area-wide sampling at spatially distributed locations was selected because of the undefined extents of the Wood Waste Landfill Remnant. A wide suite of analytical parameters was selected based on the potential for waste materials from the Site to have been deposited at the Wood Waste Landfill Remnant.

Six test pits are planned to be placed at the approximate locations shown on Figure 13. Based on available information, wood waste did not extend beyond the adjacent wood waste landfill; however, log yard materials presence will be investigated to determine if it is present from the surface to a depth of 15 feet bgs. If wood waste is observed in a test pit, the excavation of the test pit will be advanced until native soil is encountered or to the limit of the excavator, whichever occurs first. If wood waste is not observed, but fill soil is encountered, the excavation will be advanced to 2 feet into native soil or the depth of groundwater, whichever occurs first. Soil samples will be collected from the uppermost 2 feet of native soil beneath wood waste. If no wood waste is observed, a soil sample will be collected from 0-2 feet bgs. The samples will be analyzed for TPH-Gx, TPH-Dx (with and without silica gel cleanup), BTEX and fuel additives, metals, VOCs, SVOCs, and chlorinated pesticides/herbicides.

The soil analytical results will be compared to MTCA Method A and Method B cleanup levels to assess whether potential soil impacts are localized or dispersed. If impacts are localized, a decision will be made regarding additional sampling in Stage 2 of the RI to delineate the extent of impacts.

2.2.2 North First Lateral Drain (AOC 2)

- **Focused sampling (operational feature)**
    - **Two ditch bottom samples**

The objective of sampling at the north first lateral drain is to assess potential impacts to sediments within the ditch from operations at the Site. Surface water samples will not be collected based on the current and historical use of the north first lateral drain as an irrigation return flow ditch and lack of use during Site operations. The parameter list was selected based on compounds commonly used at the Site that will provide evidence of potential impact to sediments. A challenge will be to separate impacts from upstream sources from impacts attributable to the Site.

Ditch bottom samples will be collected at an upstream sampling location (where the north first lateral drain enters the Site from the surrounding residential neighborhood) and from a downstream sampling location (where the north first lateral drain enters a culvert prior to discharge east of the Site) as shown on Figure 13. The field geologist will select sampling locations that have a generally similar ditch profile (i.e., similar channel width and bank slope) and similar bottom texture (e.g., similar grain size distribution and organic content at both locations). The field geologist will document observations regarding the ditch shape, bottom materials, and surface water flow at the time of sampling. Samples will be collected from 0-1 feet below the ditch bottom at each location. The intent is to analyze samples with similar grain size and organic content at each location. The soil/sediment texture will be characterized by the field geologist prior to sampling. If the soil/sediment texture is significantly different (e.g., sandy bottom vs. fine-grained bottom), alternative sampling locations will be identified that have similar sediment texture. Samples will be analyzed for TPH-Dx (with and without silica gel cleanup), metals and TOC.

The ditch bottom sample analytical results will be compared to MTCA Method A and B soil cleanup levels. A comparison will also be made between the upstream and downstream samples and the concentration of TOC. The sample results will be used to determine if further sampling is appropriate for Stage 2 of the RI.

2.2.3 Equipment Boneyard (AOC 3)

- **Area-wide sampling**
    - **Six test pits**

The objective of sampling at the equipment boneyard is to assess potential impacts to soil from potential releases to ground surface from out-of-use equipment that was once stored here. Area-wide sampling at spatially distributed locations was selected based on the variable staging of equipment over the years at the equipment boneyard. The parameter list was selected to address potential releases of chemicals (i.e., hydraulic oil or metals) from staged equipment and potential application of chlorinated pesticides/herbicides.

Six test pits will be completed at the approximate locations shown on Figure 14. The test pits will be advanced to a depth of approximately seven feet bgs. Samples collected from 0-2 feet bgs and 5-7 feet bgs at each test pit will be analyzed for TPH-Dx (with and without silica gel cleanup), metals, and SVOCs. Chlorinated pesticides/herbicides will be analyzed at samples collected from TP-01, TP-03, and TP-05.

The soil analytical results will be compared to MTCA Method A and Method B cleanup levels to assess whether potential soil impacts are localized or dispersed. If impacts are identified, a decision will be made regarding the scope of additional sampling in Stage 2 of the RI.

2.2.4 Dry Kiln (AOC 4)

- **Focused sampling (operational feature)**
    - **Ten test pits**

The objective of sampling at the dry kiln area is to assess soil around the perimeter of the building that could have been impacted by oil in condensate dripping from the roof and from equipment leaks on the transfer rail line (western side of the dry kiln building). Potential surface soil staining and dripping condensate along the roof perimeter was noted during earlier investigations (Landau, 2013a). The source of oils in condensate is suspected to be natural wood oils from drying operations within the kiln. The concrete floor is in good condition and does not contain sumps, drains, or other collection systems. The parameter list was selected to reflect a wide range of petroleum constituents (either from dripping condensate or equipment leaks).

Ten test pits will be completed at the locations shown on Figure 15 to assess soil quality adjacent to the most recently operational dry kiln. The locations were selected to assess potential impacts from the roof condensate and adjacent transfer rail line. The test pits will be completed to a depth of approximately seven feet bgs. Samples collected from 0-2 feet bgs and 5-7 feet bgs at each shallow test pit will be analyzed for TPH-Gx and TPH-Dx (with and without silica gel cleanup), BTEX, fuel additives, and SVOCs. TPH-Dx will be analyzed with and without silica gel cleanup. Silica gel cleanup is intended to remove polar hydrocarbons associated with natural oils.

The soil analytical results will be compared to MTCA Method A and B cleanup levels. If impacts are identified, a decision will be made regarding the scope of additional sampling in Stage 2 of the RI.

2.2.5 Kiln Ponds (AOC 5)

- **Focused sampling (operational feature)**
    - **Two borings, 1 temp well at the North Kiln Pond**
    - **Two borings, 1 temp well at the South Kiln Pond**

The ponds have been filled with borrow soil since cessation of operations. The objective of sampling at the kiln ponds is to evaluate fill, pond bottoms, soil immediately beneath pond bottoms, and groundwater quality at the former pond locations. A wide suite of analytical parameters was selected based on the potential for the ponds to act as accumulation areas during Site operations.

Two borings will be advanced within each pond with one of the borings completed as a temporary well (Figure 15). The borings will be advanced at least 2 feet into native soil beneath the pond bottoms. Soil samples will be collected from 0-2 feet bgs, 5-7 feet bgs, from the pond bottoms based on field identification (the presence of ash and other fines will demarcate pond bottoms), and from native soil immediately beneath pond bottoms for analysis of TPH-Gx, TPH-Dx (with and without silica gel cleanup), BTEX, fuel additives, VOCs, SVOCs, and metals. Groundwater samples will be analyzed for TPH-Gx, TPH-Dx (with and without silica gel cleanup), BTEX, fuel additives, VOCs, SVOCs, metals, and TOC.

The soil and pond bottom sample analytical results will be compared to MTCA Method A and B cleanup levels. If impacts are identified, a decision will be made regarding the scope of additional sampling in Stage 2 of the RI.

2.2.6 North Log Pond Fill (AOC 6)

- **Area-wide sampling**
    - **Twelve test pits distributed within the North Log Pond Fill**
    - **Four test pits distributed within the log yard material fill area**

The objective of sampling of the north log pond fill is to assess the fill and underlying soil quality beneath log yard materials. Area-wide sampling at spatially distributed locations was selected because of the variability of potential fill over the duration of operations within the former pond. A wide suite of analytical parameters was selected based on the potential for waste materials from the Site to have been deposited in the north log pond fill during Site operations.

Twelve test pits will be advanced to evaluate the characteristics and extent of the historical north log pond fill and four test pits will be advanced to evaluate the fill in the adjacent log yard material fill area. The approximate locations are shown on Figure 16. The evaluation of the fill will include an assessment of fill materials (e.g., log yard materials, cobbles, and debris) and potential impacts to soil. If fill is observed in a test pit, the excavation will be advanced until native soil is encountered, the depth of the water table, or 15 feet bgs, whichever is encountered first.

Soil samples will be collected from 0-2 feet bgs, 5-7 feet bgs (if fill is present), 13-15 feet bgs (if fill is present), and the uppermost 2 feet of native soil beneath log yard materials (if less than 15 feet bgs) at each test pit. Collected samples will be analyzed for TPH-Gx, TPH-Dx (with and without silica gel cleanup), BTEX, fuel additives, SVOCs, and metals. Chlorinated pesticides and herbicides will be analyzed in samples collected from TP-01, TP-05, TP-09, and TP-13.

Soil gas will be evaluated for the presence of methane by installing soil gas monitoring wells at the approximate locations shown on Figure 25 and monitoring at existing soil gas well GP-34. The soil gas wells will be monitored as described in Section 2.2.26.

The soil analytical results will be compared to MTCA Method A and Method B cleanup levels to assess and determine whether soil impacts, if any, are localized or dispersed. If impacts are identified, a decision will be made regarding the scope of additional sampling in Stage 2 of the RI.

2.2.7 Recycle Pond (AOC 7)

- **Focused sampling (operational feature)**
    - **One existing monitoring well (MW-5)**
    - **One surface water sample**
    - **One pond bottom sample**
    - **One native soil sample beneath pond bottoms**

The objective of sampling at the recycle pond is to evaluate surface water, pond bottoms, soil immediately beneath pond bottoms, and groundwater immediately downgradient of the pond for potential impacts from use of the recycle pond during Site operations. A wide suite of analytical parameters was selected based on the potential for the pond to act as an accumulation area.

Existing monitoring well MW-5 will be sampled to evaluate if water in the recycle pond has impacted shallow groundwater. Prior to sampling, MW-5 will be evaluated and, if necessary, redeveloped as described in Section 2.1.4. The locations of the recycle pond and monitoring well MW-5 are shown on Figure 17. Monitoring well MW-5 will be sampled quarterly for one year and the samples will be analyzed for TPH-Gx, TPH-Dx (with and without silica gel cleanup), BTEX, fuel additives, VOCs, SVOCs, metals, iron, manganese, TOC, nitrate, and sulfate. One surface water sample will be collected from the recycle pond for analysis of TPH-Dx (with and without silica gel cleanup), SVOCs, and metals. Volatile organic constituents (TPH-Gx, BTEX, fuel additives, and VOCs) will not be sampled from the surface water as these constituents would have likely degraded in surface water due to volatilization and degradation.

Pond bottom (i.e. settled solids) and native soil samples will be collected using core sampling techniques in accordance with ASTM D4823-95(2014) and the SOP (Appendix A). The core will be advanced into native soil beneath the settled solids, as feasible. Samples from the pond bottom material and from the uppermost portion of native soil beneath the pond bottoms will be collected for analysis of TPH-Gx, TPH-Dx (with and without silica gel cleanup), BTEX, fuel additives, metals, SVOCs, VOCs, chlorinated pesticides/herbicides, and TOC. If core sampling techniques do not provide sufficient sample recovery, a grab sample of the pond bottoms will be collected using ponar sampling techniques in accordance with Section 10 of ASTM E1391 and the SOP (Appendix A). Core sampling will be attempted first because ponar grab samples are unlikely to penetrate into the underlying soils.

The surface water, groundwater, pond bottom, and underlying soil sample analytical results will be compared to MTCA Method A and B cleanup levels. An evaluation will be made following stage 1 of the RI to determine the interaction of surface water, pond bottoms, soil, and groundwater for assessment of the need for additional information during Stage 2 of the RI.

2.2.8 Settling Pond (AOC 8)

- **Focused sampling (operational feature)**
    - **One existing monitoring well (MW-6)**
    - **One surface water sample**
    - **One pond bottom sample**
    - **One native soil sample beneath pond bottoms**

The objective of sampling at the settling pond is to evaluate surface water, pond bottoms, soil immediately beneath pond bottoms, and groundwater immediately downgradient of the pond for potential impacts from use of the settling pond during Site operations. A wide suite of analytical parameters was selected based on the potential for the pond to act as an accumulation area.

Existing monitoring well MW-6 will be sampled to evaluate if water in the settling pond has impacted shallow groundwater. Prior to sampling, well MW-6 will be evaluated and, if necessary, redeveloped as described in Section 2.1.4. The locations of the settling pond and monitoring well MW-6 are shown on Figure 17. Monitoring well MW-6 will be sampled quarterly for one year and the samples will be analyzed for TPH-Gx, TPH-Dx (with and without silica gel cleanup), BTEX, fuel additives, VOCs, SVOCs, metals, iron, manganese, TOC, nitrate, and sulfate. One surface water sample will be collected from the settling pond for analysis of TPH-Dx (with and without silica gel cleanup), SVOCs, and metals. Volatile organic constituents (TPH-Gx, BTEX, fuel additives, and VOCs) will not be sampled from the surface water as these constituents would have likely degraded in surface water due to volatilization and degradation.

Pond bottom (i.e. settled solids) and native soil samples will be collected using core sampling techniques in accordance with ASTM D4823-95(2014) and the SOP (Appendix A). The core will be advanced into native soil beneath the settled solids, as feasible. Samples from the pond bottom material and from the uppermost portion of native soil beneath the pond bottoms will be collected for analysis of TPH-Gx, TPH-Dx (with and without silica gel cleanup), BTEX, fuel additives, metals, SVOCs, VOCs, chlorinated pesticides/herbicides, and TOC. If core sampling techniques do not provide sufficient sample recovery, a grab sample of the pond bottoms will be collected using ponar sampling techniques in accordance with Section 10 of ASTM E1391 and the SOP (Appendix A). Core sampling will be attempted first because ponar grab samples are unlikely to penetrate into the underlying soils.

The surface water, groundwater, pond bottom, and underlying soil sample analytical results will be compared to MTCA Method A and B cleanup levels. An evaluation will be made following Stage 1 of the RI to determine the interaction of surface water, pond bottoms, soil, and groundwater for assessment of the need for additional information during Stage 2 of the RI.

2.2.9 Fruitvale Wasteway (AOC 9)

- **Focused sampling (operational feature)**
    - **One surface soil sample**

The objective of sampling the fruitvale wasteway is to assess impacts to soil at the discharge of the culvert. The fruitvale wasteway carries excess irrigation water in a culvert across the Site. The location of the fruitvale wasteway across the Site changed over time, but the location of the culvert outfall has remained consistent. A wide suite of parameters has been selected due to the variety of potential contributions to the fruitvale wasteway. A challenge will be to separate impacts from upstream sources from impacts attributable to the Site.

Surface soil at the outfall of the culvert will be sampled using hand tools or a shallow test pit (see Figure 17). The soil sample will be collected from 0-2 feet bgs for analysis of TPH-Gx, TPH-Dx (with and without silica gel cleanup), BTEX, fuel additives, SVOCs, VOCs, and metals. If sediment is observed at 3 feet bgs, an additional sample will be collected from 3-5 feet bgs for analysis of TPH-Gx, TPH-Dx (with and without silica gel cleanup), BTEX, fuel additives, SVOCs, VOCs, and metals.

The analytical results will be compared to MTCA Method A and B cleanup levels for soil. If soil concentrations are greater than cleanup levels, additional evaluation and sampling will be considered to differentiate potential impacts from Site operations from those attributable to upstream sources.

2.2.10 Mill Transformers (AOC 10)

- **Focused sampling (operational feature)**
  - **Seven borings at targeted locations**

The sampling objective at the mill transformers is to assess shallow soils adjacent to the transformer locations with the potential to release PCB-containing mineral oils to the ground surface. The analytical suite was selected to reflect the types of oil used in transformers at the Site.

Seven shallow borings will be completed at the locations shown on Figure 15 and Figure 18 immediately adjacent to the transformers. The test pits will be completed to a depth of approximately two feet bgs. One soil sample will be collected from 0-2 feet bgs at each test pit and analyzed for TPH-Dx (with and without silica gel cleanup) and PCBs.

The soil sample analytical results will be compared to MTCA Method A and B cleanup levels. If impacts are identified, a decision will be made regarding the scope of additional sampling in Stage 2 of the RI.

2.2.11 Large Log Sawmill (AOC 11)

- **Focused sampling (delineate extent of impacts near the Dry Well and TP-10)**
  - **Four test pits**
  - **Two borings with temporary monitoring wells**

The sampling objective near TP-10 is to delineate the extent of oil impacts identified during the Parametrix (2008) Phase II. A suspected drywell is located near the location of TP-10 and the investigation will be focused in this area. Previous sample results indicate that the oil impacts consisted of diesel and oil range organics consistent with the hydraulic and lubricating oils that were used at the sawmill.

Four test pits and two borings with temporary wells will be advanced at the approximate locations shown on Figure 18. The excavator will be used to attempt to positively identify the drywell, prior to beginning sample collection. The four test pits will be completed around the drywell, taking into consideration the test pits already completed at the Site (see Figure 18). The test pits will be advanced to a depth of 15 feet bgs or the water table, if encountered at depths shallower than 15 feet bgs. One boring with a temporary well will be placed upgradient of the drywell/TP-10-impacted area and one boring with a temporary well will be placed downgradient of the drywell/TP-10 area. The borings will be advanced to a depth of 5 feet below field screening evidence of petroleum impacts or 5 feet below the water table, whichever is deepest. The borings and temporary wells will be installed after the test pits to use the information gathered during the test pitting to locate the borings according to the rationale described above.

Soil samples from the test pits and borings will be collected from the depth of the dry well based on visual identification during test pitting, a 2-foot interval with the greatest field evidence of petroleum impacts and a non-impacted interval beneath petroleum impacts, if above the water table. If no petroleum impacts are identified, a sample will be collected from the approximate depth of the bottom of the dry well. Soil and groundwater samples (from the temporary wells) will be analyzed for TPH-Dx (with and without silica gel cleanup).

The soil and groundwater analytical results will be compared to MTCA Method A and B cleanup levels. Additional sampling or well installation may be necessary in Stage 2 of the RI to delineate impacts, if identified.

- **Area-wide sampling (beneath large log mill floor)**
    - **Six borings**

The sampling objective is to assess potential impacts to soil beneath the floor from lubricating and hydraulic oil use on the south side of the large log mill. Area-wide sampling was selected as oils were used throughout this portion of the mill to debark, cut, and move logs.

Six soil borings will be completed at the locations shown on Figure 18. The boring locations are spaced throughout the LLM with the exception of the northeastern-most boring that is located near the reported dry well location. The borings will be advanced through/beneath the concrete floor to a depth of 15 feet bgs. Soil samples will be collected from the uppermost 2 feet beneath the floor. If petroleum impacts are observed, soil samples will be collected from the interval with the greatest evidence of petroleum impacts. Soil samples will be collected from a non-impacted interval beneath petroleum impacts, interval immediately above the water table, or 13-15 feet bgs, whichever is shallower. Soil samples will be analyzed for TPH-Dx (with and without silica gel cleanup).

The soil analytical results will be compared to MTCA Method A and Method B cleanup levels to assess whether potential soil impacts are localized or dispersed. If impacts are identified, a decision will be made regarding the scope of additional sampling in Stage 2 of the RI.

- **Area-wide sampling (groundwater)**
    - **1 well near large log mill**

A new monitoring well will be installed south of the large log mill to evaluate sitewide groundwater quality as described in AOC 25.

2.2.12 Small Log Mill (AOC 12)

- **Area-wide sampling (beneath small log mill floor)**
    - **Three borings**

The sampling objective is to assess potential impacts to soil beneath the floor from lubricating and hydraulic oil use on the south side of the small log mill. Area-wide sampling was selected as oils were used throughout this portion of the mill to debark, cut, and move logs.

Three soil borings will be completed at the locations shown on Figure 18. The boring locations are spaced throughout the southern portion of the small log mill. The borings will be advanced through/beneath the concrete floor to a depth of 15 feet bgs. Soil samples will be collected from the uppermost 2 feet beneath the floor. If petroleum impacts are observed, soil samples will be collected from the interval with the greatest evidence of petroleum impacts. One soil sample will be collected from a non-impacted interval beneath petroleum impacts, the interval immediately above the water table, or 13-15 feet bgs, whichever is shallower. Soil samples will be analyzed for TPH-Dx (with and without silica gel cleanup).

The soil analytical results will be compared to MTCA Method A and Method B cleanup levels to assess whether potential soil impacts are localized or dispersed. If impacts are identified, a decision will be made regarding the scope of additional sampling in Stage 2 of the RI.

- **Focused sampling (operational feature – used oil storage)**
    - **One boring**

The objective of sampling at the used oil storage area at the small log mill is to assess potential impacts to soil from above ground oil storage. The parameter list was selected to evaluate used oil from mill operations.

One soil boring will be completed at the location shown on Figure 18, located beyond the SLM footprint, near the southwest corner of the building. The boring will be installed through/beneath the asphalt surface to a depth of 15 feet bgs. Soil samples will be collected from the uppermost 2 feet beneath the asphalt. If petroleum impacts are observed, soil samples will be collected from the interval with the greatest evidence of petroleum impacts. One soil sample will be collected from a non-impacted interval beneath petroleum impacts, the interval immediately above the water table, or 13-15 feet bgs, whichever is shallower. Soil samples will be analyzed for TPH-Dx (with and without silica gel cleanup), TPH-Gx, BTEX and fuel additives, metals, and SVOCs.

The soil analytical results will be compared to MTCA Method A and Method B cleanup levels. If impacts are identified, a decision will be made regarding the scope of additional sampling in Stage 2 of the RI.

- **Focused sampling (operational feature – storm drains)**
    - **Two borings with temporary monitoring wells**

The objective of sampling adjacent to the storm drains is to assess potential impacts to soil and groundwater from hydraulic and lubricating oil releases within the small log mill that discharged to the storm drains. Discharges of oily water were noted at these locations during the URS 2003 Phase I.

Two borings with temporary monitoring wells will be installed at the locations shown on Figure 18. The borings will be advanced to a depth of 5 feet below field screening evidence of petroleum impacts or 5 feet below the water table, whichever is deepest.

Soil samples from the borings will be collected from the depth of the storm drain, the interval with the greatest evidence of petroleum impacts, and a non-impacted interval beneath petroleum impacts, if above the water table. Soil and groundwater samples will be analyzed for TPH-Dx (with and without silica gel cleanup).

The soil and groundwater analytical results will be compared to MTCA Method A and B cleanup levels. Additional sampling or well installation may be necessary in Stage 2 of the RI to delineate impacts, if identified.

2.2.13 Boiler House (AOC 13)

- **Focused sampling (operational feature - capacitors)**
    - **Two borings**

The sampling objective at the capacitors is to assess shallow soils adjacent to capacitors with the potential to release PCB-containing mineral oils to the ground surface. The analytical suite was selected to reflect the types of oil used in transformers at the Site.

Two shallow borings will be completed at the locations shown on Figure 19 near the power poles that contained the capacitors. It is reported that a release in 1988 of PCB-containing mineral oil occurred from one of these capacitors southwest of the boiler house. It is not known which capacitor had the release, so sampling will be completed adjacent to both power poles that had capacitors. The borings will be completed to a depth of approximately two feet bgs. One soil sample will be collected from 0-2 feet bgs at each boring and analyzed for TPH-Dx (with and without silica gel cleanup) and PCBs.

The soil sample analytical results will be compared to MTCA Method A and B cleanup levels. If impacts are identified, a decision will be made regarding the scope of additional sampling in Stage 2 of the RI.

- **Focused sampling (operational feature – water treatment chemical storage/use)**
    - **Three borings**

The sampling objective at the water treatment chemical storage/use area is to evaluate potential releases from above ground storage tanks of water treatment chemicals. Floor drains near the chemical storage area have been previously identified (Parametrix, 2008). The analytical list was selected based on the types of chemicals (notably caustics and scale treatment) stored in the boiler house. Boilers are still present for the eastern portion of the building and may need to be evaluated at a later date.

Three borings will be advanced at the approximate locations shown on Figure 19. An attempt will be made to locate the outlet of the floor drains during site reconnaissance and the borings located adjacent to the outlets. The northern most boring will be completed immediately adjacent to the above ground storage tanks. Soil samples will be collected from 0-2 feet bgs (or immediately beneath pavement) and 5-7 feet bgs at each location for analysis of metals, SVOCs, and VOCs.

The soil sample analytical results will be compared to MTCA Method A and B cleanup levels. If impacts are identified, a decision will be made regarding the scope of additional sampling in Stage 2 of the RI.

2.2.14 Hog Fuel Pile (AOC 14)

- **Area-wide sampling**
    - **Four soil borings**

The sampling objective at the hog fuel pile is to evaluate potential impact to soils beneath the former hog fuel pile. Wood waste (hog fuel) was staged at this location and wastes with high BTU content, such as paints and oils were reportedly incorporated into the hog fuel prior to burning. Area-wide sampling at spatially distributed locations was selected because of the undefined extents of the hog fuel pile. A wide suite of analytical parameters was selected based on the potential for waste materials from the Site to be deposited on the hog fuel pile prior to burning.

Four soil borings will be placed at the locations shown on Figure 19. The borings will be advanced to a depth of approximately 15 feet bgs. Soil samples will be collected from 0-2 feet bgs, 5-7 feet bgs, and 13-15 feet bgs or interval immediately above the water table, whichever is shallower. Soil samples will be analyzed for TPH-Gx, TPH-Dx (with and without silica gel cleanup), BTEX, fuel additives, VOCs, SVOCs, metals, and chlorinated pesticides/herbicides.

The soil analytical results will be compared to MTCA Method A and Method B cleanup levels to assess whether potential soil impacts are localized or dispersed. If impacts are identified, additional sampling will be considered for Stage 2 of the RI.

2.2.15 Paint, Machine, and Storage Shed (AOC 15)

- **Focused sampling (operational feature – chemical storage)**
    - **Two test pits**
    - **One soil boring with temporary well**

The sampling objective is to evaluate potential impacts to soil and groundwater from chemical storage in above ground containers at the paint, machine, and storage shed. A wide suite of analytical parameters was selected based on the potential variety of chemicals that could have been stored at the storage shed during operations.

One soil boring with a temporary monitoring well will be installed immediately southeast of the former paint, machine, and storage shed (i.e., approximately downgradient based on available information) at the location shown on Figure 19. The boring will be advanced 5 feet below the water table. Two test pits will be placed at the locations shown on Figure 19 to evaluate soil quality. The test pits will be completed to a depth of seven feet bgs. Soil samples will be collected from the test pits in the intervals 0-2 feet bgs and 5-7 feet bgs. Soil and groundwater samples will be analyzed for TPH-Gx, TPH-Dx (with and without silica gel cleanup), BTEX, fuel additives, SVOCs, VOCs, and metals. Soil samples will additionally be analyzed for chlorinated pesticides/herbicides.

Soil and groundwater sample analytical results will be compared to MTCA Method A and B cleanup levels. If impacts are identified, a decision will be made regarding the scope of additional sampling in Stage 2 of the RI.

2.2.16 Fuel Distribution System (AOC 16)

The Fuel Distribution System (FDS) consists of the following areas:

- Former Diesel Dispenser for Log Yard Equipment
- Former Gasoline Dispenser for Vehicles
- Former Diesel Dispenser for Vehicles and Equipment
- Fuel Lines between previous ASTs and Dispensers
- Above Ground Storage Tanks (previously investigated)

Each of the areas will be individually investigated. However, due to the similar and interconnected nature, these areas will be evaluated as one AOC. The intent of the FDS investigation is to define the horizontal and vertical extent of potential petroleum impacts to soil and groundwater resulting from releases within the FDS. Based on groundwater monitoring results at the Site, a petroleum release appears to have occurred from the FDS, but the primary release location has not been identified. Soil and groundwater samples collected from the FDS area will be analyzed for TPH-Gx, TPH-Dx (with and without silica gel cleanup), BTEX, and fuel additives consistent with the storage and use of gasoline and diesel. Groundwater samples will also be analyzed for TOC, nitrate, sulfate, iron and manganese. Groundwater will be investigated as part of new borings and temporary wells and permanent wells sampled as part of sitewide groundwater monitoring described in Section 2.2.24.

The soil and groundwater analytical results will be compared to MTCA Method A and B cleanup levels. The investigation results from the entire fuel distribution system will be evaluated in aggregate to determine release locations and potential contribution to groundwater impacts. The site conceptual model for the FDS will be updated based on the investigation results and potential data gaps identified for Stage 2 of the RI.

Investigation of each of the Fuel Distribution System areas is further discussed in the following sections.

2.2.16.1 Diesel Dispenser for Log Yard Equipment

- **Focused sampling (operational feature and delineate extent of impacts)**
  - **One boring with temporary well**
  - **Three borings**

The sampling objective at the gasoline dispenser is to further delineate soil and groundwater impacts near TP-12 (see Figure 20). This data along with the test pits along the fuel lines (see Section 2.2.16.3) and previous investigation results will delineate the extent of impacts for future remedial actions.

One soil boring with a temporary monitoring well will be installed immediately southeast of the diesel dispenser (i.e., approximately downgradient based on available information) and three soil borings will be advanced around the TP-12 area at the locations shown on Figure 20. The boring will be advanced to approximately 5 feet below the water table.

Soil samples will be collected from 0-2 feet bgs and the interval with the greatest evidence of petroleum impacts, if impacts are identified. A soil sample will be collected from a non-impacted interval beneath petroleum impacts, the interval immediately above the water table, or 13-15 feet bgs, whichever is shallower. A groundwater sample will be collected from the temporary well following well development and then the temporary well will be abandoned.

2.2.16.2 Gasoline Dispenser for Vehicles

- **Focused sampling (operational feature)**
    - **One boring with temporary well**

The sampling objective at the gasoline dispenser is to assess soil and groundwater quality near the dispenser to evaluate potential impacts throughout the FDS and to inform placement of additional monitoring wells, if necessary.

One soil boring with a temporary monitoring well will be installed immediately south of the gasoline dispenser (i.e., approximately downgradient based on available information) at the location shown on Figure 20. The boring will be advanced to approximately 5 feet below the water table.

Soil samples will be collected from 0-2 feet bgs and the interval with the greatest evidence of petroleum impacts, if impacts are identified. A soil sample will be collected from a non-impacted interval beneath petroleum impacts, the interval immediately above the water table, or 13-15 feet bgs, whichever is shallower. A groundwater sample will be collected from the temporary well following well development and then the temporary well will be abandoned.

2.2.16.3 Diesel Dispenser for Vehicles and Equipment

- **Focused sampling (operational feature)**
    - **One boring with temporary monitoring well**

The sampling objective at the diesel dispenser is to assess soil and groundwater quality near the dispenser to evaluate potential impacts throughout the fuel distribution system and to inform siting of additional monitoring wells, if necessary.

One soil boring with a temporary monitoring well will be installed immediately south of the gasoline dispenser (i.e., approximately downgradient based on available information) at the location shown on Figure 20. The boring will be advanced to approximately 5 feet below the water table.

Soil samples will be collected from 0-2 feet bgs and the interval with the greatest evidence of petroleum impacts, if impacts are identified. A soil sample will be collected from a non-impacted interval beneath petroleum impacts, the interval immediately above the water table, or 13-15 feet bgs, whichever is shallower. A groundwater sample will be collected from the temporary well following well development and then the temporary well will be properly sealed.

2.2.16.4 Fuel Lines between AST/USTs and Dispenser Pumps

- **Focused sampling (operational feature)**
    - **Multiple test pits spaced every 25 lineal feet**

The sampling objective for the fuel lines is to identify release locations from the underground piping network and provide initial delineation of those impacts. Tight spacing of test pits along the fuel lines across the width of the fuel distribution system was selected to identify the release location(s).

Multiple test pits are planned adjacent to the buried fuel lines connecting the former storage tanks and dispenser pumps. Prior to digging, a private locator and/or ground penetrating radar will be used to locate the fuel lines as described in Section 2.1.11. The test pits will be completed approximately every 25 lineal feet adjacent to the located buried fuel lines as shown on Figure 20.

The test pits will be completed to a minimum depth of five feet bgs, or two feet below the buried fuel lines, whichever is greater. If field screening impacts are present, the test pit will be advanced until non-impacted soil is identified based on field screening. Soil samples will be collected from the interval beneath the buried pipe (approximately 3-5 feet bgs) and the interval with the greatest evidence of impacts, if impacts are identified. I impacts are identified, a sample will also be collected from non-impacted soil below the impacted soil in each test pit, the interval immediately above the water table, or 13-15 feet bgs, whichever is shallower. If field screening impacts are not observed, a soil sample will be collected from the interval beneath the buried pipe (assumed to be 3-5 feet bgs).

2.2.16.5 Groundwater Quality Downgradient of the Fuel Distribution System

- **Area-wide sampling (groundwater)**
    - **One new monitoring well downgradient of the fuel lines**
    - **Two existing monitoring wells (TP-MW-1 & TP-MW-2)**

Existing monitoring wells TP-MW-1 and TP-MW-2 (see Figure 20) and a new monitoring well installed south of the FDS approximately equidistant between TP-MW-1 and TP-MW-2 will be used to evaluate sitewide groundwater quality as described in AOC 25. The location of the new well shown on Figure 20 may be adjusted based on test pit results (e.g., placed downgradient of identified release location).

2.2.17 Mill Supply Warehouse and Auto Repair Shop (AOC 17)

- **Focused sampling (operational feature)**
    - **Four borings**

The sampling objective at the mill supply warehouse and auto repair shop is to evaluate soil for potential impacts from petroleum products used at this location. The analytical parameter list was selected based on petroleum compounds that were reportedly used and potential solvents that may have been used during auto maintenance.

Four borings will be advanced through the pavement/concrete at the locations shown on Figure 21. Three borings will be located around the perimeter of the auto repair shop area and one boring will be advanced near the former lube pit. The borings will be advanced through/beneath the concrete floor to a depth of seven feet bgs. Soil samples will be collected from the uppermost 2 feet beneath the pavement/concrete and from 5-7 feet bgs. Soil samples will be analyzed for TPH-Gx, TPH-Dx (with and without silica gel cleanup), BTEX, fuel additives, SVOCs, VOCs, and metals.

The soil analytical results will be compared to MTCA Method A and B cleanup levels. If impacts are identified, a decision will be made regarding the scope of additional sampling in Stage 2 of the RI.

2.2.18 Oil House/Service Pit (AOC 18)

- **Focused sampling (delineate extent of impacts)**
    - **Two borings**

The sampling objective at the oil house/service pit is to delineate the extent of surface soil impacts near SS-1 (see Figure 21) sampled during the 2008 Phase II (Parametrix, 2008).

Two borings will be completed at the locations shown on Figure 21. The borings will be advanced to a depth of seven feet bgs. Soil samples will be collected from 0-2 feet bgs and 5-7 feet bgs. Soil samples will be analyzed for TPH-Gx, TPH-Dx (with and without silica gel cleanup), BTEX, fuel additives, SVOCs, VOCs, and metals.

The soil analytical results will be compared to MTCA Method A and B cleanup levels. The sample results, in combination with previous sampling results, will be used to delineate the extent of impacts in this area.

2.2.19 Log Yard Shop (AOC 19)

- **Focused sampling (delineate extent of impacts and operational features)**
    - **Seven borings**

The sampling objective at the log yard shop is to assess and delineate potential impacts from petroleum and other chemical storage and use at the shop. While there are known petroleum impacts at the log yard shop (Parametrix, 2008), a wide analytical parameter suite was selected to assess the potential variety of chemicals that could have been stored/used at the shop.

Two borings will be completed northwest of the log yard shop adjacent to the oil storage area and location of former ASTs reported in the January 30, 2004 SPCC Plan, and the reported location of steam cleaning. Two borings will also be completed near the southeast edge of the building where oily soils were reported (Parametrix, 2008). Two borings will be advanced through pavement/concrete; one adjacent to the used oil tank in the southeast portion of the shop and one adjacent to the former locations of the lubricating and hydraulic oil tanks in the northwest portion of the shop. One boring with a temporary well will be installed to the southeast of the log yard shop in the downgradient groundwater flow direction. The borings will be advanced to a depth of 15 feet bgs with the exception of the temporary well which will be advanced to a depth of 5 feet below the water table. The locations of the borings are shown on Figure 21. Soil samples will be collected from 0-2 feet bgs or the uppermost 2 feet beneath the floor, 5-7 feet bgs, and 13-15 feet bgs, if fill is present. Soil and groundwater samples will be analyzed for TPH-Gx, TPH-Dx (with and without silica gel cleanup), BTEX, fuel additives, SVOCs, VOCs, and metals.

The soil analytical results will be compared to MTCA Method A and B cleanup levels. If impacts are identified, a decision will be made regarding the scope of additional sampling in Stage 2 of the RI.

2.2.20 Plywood Plant (AOC 20)

- **Focused sampling (delineate extent of impacts – lathe pit)**
    - **Three borings**

The sampling objective near the lathe pit is to delineate soil and groundwater impacts near the lathe pit. Previous sampling has indicated diesel and oil range organics in soil and groundwater near the lathe pit (Landau, 2013b). The bottom depth of the lathe pit is approximately 10 feet bgs and the depth to groundwater is approximately 15 feet bgs. Soil impacts predominantly occur in the smear zone above the water table and below the lathe pit. Previous sampling results indicate that diesel and heavy oil range petroleum constituents are the contaminants of concern and did not identify other constituents (Landau, 2013; Landau, 2015).

Three borings will be advanced to the east and southwest of the lathe pit to further delineate impacts (Figure 22). In particular, these borings will evaluate what impacts are present in the vadose zone, smear zone, or saturated zone downgradient of the lathe pit. Many of the historical soil samples collected in this area are from the smear zone or saturated zone and may be more representative of groundwater impacts. The borings will be advanced to a depth of 5 feet below field screening evidence of petroleum impacts or 5 feet below the water table, whichever is deepest.

Soil samples will be collected from 13-15 feet bgs in the interval between the bottom of the lathe pit and the water table. Soil samples will be analyzed for TPH-Dx (with and without silica gel cleanup) and SVOCs.

The soil analytical results will be compared to MTCA Method A and B cleanup levels. The sample results, in combination with previous sampling results, will be used to delineate the extent of impacts in this area.

- **Focused sampling (operational feature – press pits and resin storage area)**
    - **Three borings**

The sampling objective is to evaluate soil quality at the press pits and resin storage area. Multiple borings have been completed in this area (Landau, 2013b) Analysis of samples collected from the borings adjacent to the press pits and resin storage area did not indicate any impacts greater than MTCA cleanup levels. The press pits have been filled since the previous investigations. The analytical suite of parameters was selected based on the hydraulic oil, lubricating oil, and adhesives that were used/stored in this area.

Two borings will be advanced within or adjacent to the now filled-in former press pits (center of plywood plant) and one boring will be advanced near the former resin storage area (eastern edge of plywood plant) at the locations shown on Figure 22. The borings will be advanced to a depth of 15 feet below the base of the concrete slab. Soil samples will be collected from the uppermost 2 feet beneath the concrete slab, 5-7 feet bgs, and from 13-15 feet bgs. Soil samples will be analyzed for TPH-Dx (with and without silica gel cleanup), SVOCs, and metals.

The soil analytical results will be compared to MTCA Method A and B cleanup levels. The sample results, in combination with previous sampling results, will be used to delineate the extent of impacts in this area.

- **Focused sampling (delineate extent of impacts near SS-5)**
    - **One boring**

The sampling objective is to resample near surface soil at location SS-5 in the southwest portion of the plywood plant (Figure 22). The analytical parameters were selected based on the sample results that were above MTCA cleanup levels during the 2008 Phase II (Parametrix, 2008). Chromium speciation was not completed during the previous sampling event.

One boring will be advanced at a location adjacent to SS-5 as shown on Figure 22. A new boring will be advanced to a depth of 7 feet below the base of the concrete slab immediately adjacent SS-5. Soil samples will be collected from the uppermost 2 feet beneath the concrete slab and 5-7 feet bgs. Soil samples will be analyzed for TPH-Gx, TPH-Dx (with and without silica gel cleanup), BTEX, fuel additives, SVOCs, and metals.

The soil analytical results will be compared to MTCA Method A and B cleanup levels. If impacts are identified, a decision will be made regarding the scope of additional sampling in Stage 2 of the RI.

- **Focused sampling (operational feature – used oil storage)**
    - **One boring**

The sampling objective at the used oil storage area is to assess potential impacts to soil from above ground oil storage. The parameter list was selected to evaluate oil used during mill operations.

One soil boring will be completed in the southeastern portion of the plywood plant at the location shown on Figure 22. The boring will be installed through/beneath the asphalt surface to a depth of 7 feet bgs. Soil samples will be collected from the uppermost 2 feet beneath the asphalt and 5-7 feet bgs. Soil samples will be analyzed for TPH-Gx, TPH-Dx (with and without silica gel cleanup), BTEX, fuel additives, metals, and SVOCs.

The soil analytical results will be compared to MTCA Method A and Method B cleanup levels. If impacts are identified, a decision will be made regarding the scope of additional sampling in Stage 2 of the RI.

2.2.21 Former Equalization Pond (AOC 21)

- **Focused sampling (operational feature)**
    - **One boring**

The objective of sampling at the equalization pond is to evaluate fill, pond bottoms, and soil immediately beneath pond bottoms. The pond has been filled with borrow soil since cessation of operations. A wide suite of analytical parameters was selected based on the potential for the pond to have acted as an accumulation area during site operations.

One boring will be advanced through the former pond at the location shown on Figure 22. The boring will be advanced at least 2 feet into native soil beneath the pond bottoms. Soil samples will be collected from 0-2 feet bgs, 5-7 feet bgs, from the pond bottoms based on field identification (the presence of fines will demarcate pond bottoms), and from native soil immediately beneath pond bottoms for analysis of TPH-

Gx, TPH-Dx (with and without silica gel cleanup), BTEX, fuel additives, SVOCs, VOCs, metals, and chlorinated pesticides/herbicides.

The soil and pond bottom sample analytical results will be compared to MTCA Method A and B cleanup levels. If impacts are identified, a decision will be made regarding the scope of additional sampling in Stage 2 of the RI.

2.2.22 Plywood Transformers (AOC 22)

- **Focused sampling (operational feature)**
    - **Four borings**

The objective of sampling at the plywood transformers is to assess shallow soils adjacent to the former locations of transformers that had the potential to release PCB-containing mineral oils to the ground surface. The analytical suite was selected to reflect the types of oil used in transformers at the Site.

Four shallow borings will be completed at the locations shown on Figure 22 immediately adjacent to the former transformer locations. The test pits will be completed to a depth of approximately two feet bgs. One soil sample will be collected from 0-2 feet bgs at each test pit and analyzed for TPH-Dx (with and without silica gel cleanup) and PCBs.

The soil sample analytical results will be compared to MTCA Method A and B cleanup levels. If impacts are identified, a decision will be made regarding the scope of additional sampling in Stage 2 of the RI.

2.2.23 Barker Building (AOC 23)

- **Focused sampling (delineate extent of impacts – downgradient of lathe pit)**
    - **One boring with temporary well**

The objective of sampling east of the barker building is to delineate soil and groundwater impacts downgradient of the lathe pit. A previous investigation (Landau, 2013b) identified impacts beneath the northern portion of the barker building that appear to be attributable to impacts migrating from the lathe pit. The planned boring is located to assess potential contribution from the barker building and define the eastern edge of known impacts. Previous sampling results indicate that diesel and heavy oil range petroleum constituents are the contaminants of concern and did not identify other constituents (Landau, 2013).

One boring with a temporary well will be installed at the location shown on Figure 22. The location is approximately equidistant from monitoring well MW-101 and the previously identified petroleum impacts. The boring will be advanced to a depth of 5 feet below field screening evidence of petroleum impacts or 5 feet below the water table, whichever is deepest. Soil samples from the boring will be collected from 0-2 feet bgs and the interval with the greatest evidence of petroleum impacts, if impacts are identified. A soil sample will be collected from a non-impacted interval beneath petroleum impacts, the interval immediately above the water table, or 13-15 feet bgs, whichever is shallower. Soil and groundwater samples will be analyzed for TPH-Dx (with and without silica gel cleanup).

The soil and groundwater analytical results will be compared to MTCA Method A and B cleanup levels. If impacts are identified, a decision will be made regarding the scope of additional sampling in Stage 2 of the RI.

- **Area-wide sampling (beneath barker building floor)**
  - **Six borings through floor**
  - **1 boring outside of building**

The objective of sampling through the barker building floor is to assess potential impacts to soil beneath the floor from lubricating and hydraulic oil usage in the barker building. Area-wide sampling was selected as oils were used throughout this building on equipment used to debark logs.

Six soil borings will be completed within the barker building and one boring will be advanced to the east of the building at the locations shown on Figure 22. The boring locations are spatially distributed throughout the barker building. The borings will be advanced through/beneath the concrete floor to a depth of 15 feet below the concrete floor. The boring advanced outside of the building footprint will be advanced to a depth of 15 feet bgs. Soil samples will be collected from the uppermost 2 feet beneath the floor or ground surface and the interval with the greatest evidence of petroleum impacts, if impacts are identified. A soil sample will be collected from a non-impacted interval beneath petroleum impacts, the interval immediately above the water table, or 13-15 feet bgs, whichever is shallower. Soil samples will be analyzed for TPH-Dx (with and without silica gel cleanup).

The soil analytical results will be compared to MTCA Method A and Method B cleanup levels to assess whether potential soil impacts are localized or dispersed. If impacts are identified, additional sampling will be considered for Stage 2 of the RI.

2.2.24 Southwest Area (AOC 24)

- **Area-wide sampling**
  - **Two borings**

The objective of sampling in the southwest area is to assess potential impacts to surface soil from potential releases to the ground surface from truck parking. Area-wide sampling was selected based on the variable locations of truck parking over the years. The parameter list was selected to address potential release of fuels or use of chlorinated pesticides/herbicides.

Two borings will be completed at the approximate locations shown on Figure 23. The borings will be advanced to a depth of 15 feet bgs. Soil samples will be collected from 0-2 feet bgs, 5-7 feet bgs, and 13-15 feet bgs. Soil samples will be analyzed for TPH-Gx, TPH-Dx (with and without silica gel cleanup), BTEX, fuel additives, and chlorinated pesticides/herbicides.

The soil analytical results will be compared to MTCA Method A and Method B cleanup levels. If impacts are identified, a decision will be made regarding the scope of additional sampling in Stage 2 of the RI.

2.2.25 Sitewide Groundwater (AOC 25)

- **Area-wide sampling**
    - **Eight new monitoring wells**
    - **Thirteen existing monitoring wells (MW-1, MW-5, MW-6, MW-9A, MW-10, MW-12, MW-18, MW-100, MW-101, TP-MW-1, TP-MW-2, FPP-MW-1, FPP-MW-3)**

The sampling objective of sitewide groundwater is to evaluate potential impact to groundwater from operations at the Site. Sampling will be conducted for an extensive suite of parameters at the existing and new monitoring wells to support holistic evaluation of potential impacts to groundwater at the Site. In addition to analyzing samples for the chemicals of concern (i.e., TPH-Gx, TPH-Dx (with and without silica gel cleanup), BTEX, fuel additives, SVOCs, VOCs, metals), samples from each well will be analyzed for common electron acceptors (nitrate, sulfate), the reduced and oxidized forms of iron and manganese, and TOC to support geochemical characterization of groundwater. The geochemical parameters, with the exception of dissolved oxygen, oxidation-reduction potential, and other field stabilization parameters will be measured in the laboratory as described in the QAPP.

Groundwater quality and water levels will be evaluated across the Site. The sitewide monitoring well network will be comprised of thirteen existing monitoring wells and eight new monitoring wells at the locations shown on Figure 24. One of the new monitoring wells is discussed in Section 2.2.16.5 for assessment of groundwater conditions downgradient of the fuel distribution system. Another of the new monitoring wells is discussed in Section 2.2.11, south of the large log mill and upgradient of the hog fuel pile, paint, machine, and storage shed, and fuel distribution system. The remaining six new well locations were selected to assess upgradient groundwater quality and provide spatial coverage for overall groundwater characterization across the Site. The rationales for the remaining six wells are as follows:

- Northeast corner of the Site (approximately 250 feet east of previously abandoned well MW-3.
    - Assess groundwater quality and elevations from a portion of the Site without extensive land disturbance in an assumed side-gradient flow direction.
- Northern extent of the Log Pond Fill area (approximately 600 feet northeast of MW-10).
    - Assess groundwater quality and elevations within an area with log yard materials and to give spatial coverage across the Site. This well will be installed approximately equidistant between wells MW-1 and MW-5.
- Northwest corner of the Site.
    - Assess groundwater quality and elevations upgradient of Site AOCs.
- Western boundary of the Site (immediately north of the Loading/Storage/Shipping Shed).
    - Assess groundwater quality and elevations upgradient of Site AOCs.
- Western boundary of the Site (immediately north of the Lumber Sheds).
    - Assess groundwater quality and elevations upgradient of Site AOCs.
- Central portion of the Site (approximately 750 feet southwest of well MW-5).
    - Assess groundwater quality and elevations within an area with log yard materials and to give spatial coverage across the Site. This well will be installed approximately equidistant between wells MW-10 and MW-6.

Sampling is also proposed at 13 existing wells (MW-1, MW-5, MW-6, MW-9A, MW-10, MW-12, MW-18, MW-100, MW-101, TP-MW-1, TP-MW-2, FPP-MW-1, FPP-MW-3). Prior to sampling, these monitoring wells will be evaluated and, if necessary, redeveloped as described in Section 2.1.4.

The groundwater analytical results will be compared to MTCA Method A and Method B cleanup levels to assess whether potential impacts are localized or dispersed. After the first two sampling events are completed, an evaluation of the results will be performed to determine if the analytical parameter list can be reduced. If sample concentrations are below the reporting limits or an order of magnitude below MTCA cleanup levels for a constituent during the first two sampling events, that constituent will be recommended for removal from the analytical suite for that sample location for the remaining two sampling events. This approach is consistent with an area-wide screening approach where a long parameter list is used initially and then scaled back based on the results. Any changes to the groundwater monitoring program will be submitted to Ecology for review and approval before being implemented.

2.2.26 Sitewide Methane (AOC 26)

- **Area-wide sampling**
    - **Nine new soil gas wells**
    - **Fourteen existing soil gas wells (GP-3, GP-6, GP-10, GP-11, GP-23, GP-24, GP-25, GP-26, GP-32, GP-33, GP-34, GP-35, GP-36, GP-37)**

The sampling objective of sitewide methane monitoring is to evaluate soil gas concentrations of methane across the Site. The soil gas monitoring network includes soil gas wells installed in former ponds, fill areas, adjacent to operating buildings, and adjacent to the landfill.

The magnitude and extent of soil gas methane across the Site will be evaluated by monitoring fourteen existing soil gas wells and nine new soil gas wells at the locations shown on Figure 25. The soil gas wells will be monitored for methane, oxygen, and carbon dioxide using a landfill gas analyzer (GEM 2000 or equivalent) and monitored for hydrogen sulfide, carbon monoxide, LEL and oxygen using a 4-gas meter.

The fourteen existing soil gas wells included in the sitewide methane monitoring network are:

GP-3
GP-6
GP-10
GP-11
GP-23
GP-24
GP-25
GP-26
GP-32
GP-33
GP-34
GP-35
GP-36
GP-37

Prior to monitoring, these existing soil gas wells will be evaluated and, if necessary, repaired as described in Section 2.1.10.2.

The presence and concentration of methane will be evaluated throughout the Site and compared to adjacent subsurface materials (e.g., log yard materials, MSW, common fill) to assess likely contributions to methane in soil gas. If there is uncertainty regarding the source of methane following two rounds of soil gas monitoring, methane isotope analysis may be recommended to help determine the source of methane.

2.2.27 Machine Shop Pit (AOC 27)

- **Focused sampling (operational feature)**
    - **Two borings**

The sampling objective is to assess potential impacts to soil from potential releases to the pit located at the northwest corner of the machine shop. The parameter list was selected to address potential release of fuels or chemicals used at the machine shop.

Two borings will be completed at the approximate locations shown on Figure 19. The borings will be advanced to a depth of seven feet bgs. One sample will be collected from 0-2 feet bgs and one sample will be collected at 5-7 feet bgs. Soil samples will be analyzed for TPH-Gx, TPH-Dx (with and without silica gel cleanup), BTEX, fuel additives, metals, SVOCs, and VOCs.

The soil analytical results will be compared to MTCA Method A and Method B cleanup levels. If impacts are identified, a decision will be made regarding the scope of additional sampling in Stage 2 of the RI.

3.0 Sample Handling

Field staff members will collect samples, prepare samples for shipment, complete all necessary paperwork, maintain sample documentation, and decontaminate sampling equipment. Sample containers, sample preservation and preparation, sample identification and documentation, sample chain-of-custody, and sample packaging and shipping procedures are discussed below. Analytical methods, preservation, and sample holding times are presented in the Quality Assurance Project Plan (QAPP), which is presented in Exhibit B to the RI Work Plan.

3.1.1 Sample Containers

All sample containers will be provided by the laboratory. Only new sample containers (e.g., I-CHEM 200 or Industrial Glassware or equivalent) will be used for sample collection. The laboratory will provide the appropriate size and type of sample container with the applicable preservative. Sample containers will be kept closed and in a cooler or in the shipping package until use. As they are collected, samples will be labeled and recorded in the field notebook along with other pertinent collection data. All sample containers will be placed on ice in a cooler immediately after they are filled and labeled.

Field staff will verify specifications for the containers by checking the supplier's certified statement and analytical results for each container lot. These activities will be completed and documented on a continuing basis. The documentation will be maintained in the project file.

3.1.2 Sample Preservation and Preparation

All samples requiring preservation will be stored on ice and shipped to the laboratory by overnight delivery. Sample containers, preservation, and holding times for each analytical method are provided as Tables 3 and 4.

3.1.2.1 Silica Gel Cleanup

All soil, groundwater, and surface water samples for TPH-Dx (diesel and oil range organics) will be analyzed with and without silica gel cleanup. Silica gel cleanup will be conducted by the analytical laboratory in accordance with the sample preparation SOPs and analytical methods detailed in the QAPP.

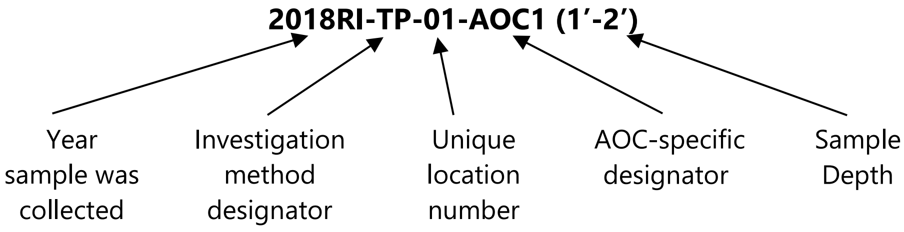
Silica gel cleanup will remove naturally occurring polar hydrocarbons known to be present at the Site because of the history of wood handling operations and the prevalence of buried log yard materials. The use of silica gel cleanup was shown to have a significant effect on the reported diesel and oil-range organic concentrations in the Plywood Plant area during the Landau 2015 Supplemental RI (Landau, 2015). The TPH chromatograms and TOC concentrations will be evaluated and a weight of evidence approach will be used to provide an opinion as to the petroleum fraction of the TPH concentration for diesel and oil range organics.

3.1.3 Soil Sample Identification

Each sample collected for this investigation will be represented by four designators:

1. The year the sample is collected and the identifier "RI";
2. Two letters representing the type of investigation method;
3. A two-digit unique location number; and
4. A Site-specific AOC designator from where the sample is collected. In the case of soil samples, the sample depth will also be included.

For example, a soil sample collected from a test pit at a depth of 1 – 2 feet bgs at the Wood Waste Landfill Remnant (AOC 1) will be labeled as follows:



Soil Sampling Method Designator

Soil samples will be assigned the following designator for each type of sample.

- **SB (Soil Boring)**: Represents a soil boring installed with a Rotasonic drill rig or similar rig for the purpose of collecting information on stratigraphy or for collecting soil samples, groundwater samples from temporary wells or soil gas samples from temporary soil gas wells.
- **TP (Test Pit):** Represents a test pit excavated for the purpose of observing subsurface conditions or for collecting soil samples.
- **SS (Surface Soil):** Represents a surface soil sample collected with hand tools beneath the surface vegetation and the rooting zone.
- **PB (Pond Bottom):** Represents a sample collected from settled solids and soil beneath the former operational ponds.

Unique Location Number

The two digit unique location number for soil sampling will start with the number 01 for each type of investigation method and continue in order (02, 03, etc.) as the investigation progresses, regardless of the AOC from where the sample was collected. For example, the first surface soil sample collected will be represented by the designation 2018RI-SS-01-XXX (X′-X′), where XXX is the AOC-specific designator and (X′-X′) is the sample depth.

Site-specific AOC Designator

The Site-specific AOC designator is the number assigned to the AOC to distinguish where the sample is collected. The Site-specific designators are listed next to the AOC titles in Section 2.2 of this SAP.

3.1.4 Groundwater Sample Identification

Groundwater samples collected from monitoring wells (new and existing) will be represented by the well identification number (MW-XX). Newly installed monitoring wells will start with the well identification number MW-19 and continue in order (MW-20, MW-21, etc.) as the investigation progresses.

Groundwater samples collected from temporary wells will be identified similar to soil samples with the year, TW method identifier, unique location identifier, and AOC-specific designator. For example, 2018RI-TW-01-AOC16 represents a sample collected from a temporary well in the Fuel Distribution System (AOC 16).

3.1.5 Surface Water Sample Identification

Surface water samples will be represented by the surface water monitoring location identification provided below.

- REC – Recycle Pond
- SET – Settling Pond

3.1.6 River Gage Location Identification

River gage monitoring locations will be given a unique identification (RG-letter) starting at RG-A and continuing in order (RG-B, RG-C).

3.1.7 Soil Gas Well Sample Identification

Soil gas samples from soil gas wells (new and existing) will be represented by the soil gas well identification number (GP-XX). Newly installed soil gas monitoring wells will start with the well identification number GP-45 and continue in order (GP-46, GP-47, etc.) as the investigation progresses.

3.1.8 Quality Assurance/Quality Control Samples

In addition to investigation soil, groundwater, and soil gas samples, Quality Assurance/Quality Control (QA/QC) samples consisting of field blanks, field duplicates, equipment blanks, methanol blanks, and matrix spikes and matrix spike duplicates will be used at the rates described in the QAPP. QA/QC samples will be identified by the following codes, followed by a sequential number.

- **M (Field [Masked] Duplicate Sample):** Represents a duplicate soil or groundwater sample collected to give a measure of the precision associated with sample collection, preservation, and storage, as well as with laboratory procedures. (Example: M-1, M-2)
- **FB (Field Blank Sample):** Represents a field blank sample collected to determine whether the field environment has contaminated the sample. (Example: FB-1, FB-2). Field blank samples will consist of analyte-free water exposed to environmental conditions at the sampling site by transferring the water from one sample container to another or by removing the lid and exposing a container filled with analyte-free water to the atmosphere for the time necessary to fill a sampling container. The analyte-free water will be provided by the laboratory and expected to be

non-detect for all investigation parameters. Field blank samples measure the potential for sample cross contamination due to site conditions. Field blank samples will be submitted to the laboratory with investigation samples and analyzed for the same parameters as the investigation samples.

- **EB (Equipment Blank Sample):** Represents an equipment rinsate sample collected to determine whether the sample transporting procedures, equipment cleaning procedures, and/or environment has contaminated the sample. (Example: EB-1, EB-2). In the event that field equipment is reused, an equipment blank sample will be collected. Equipment blank samples will follow the same procedure as a field blank except it will include the analyte-free water placed into contact with sampling equipment to assess the effectiveness of decontamination procedures or possible sources of field contamination.
- **TB (Trip Blank):** Represents a sample collected from a container filled by the laboratory with ultra clean water for QA/QC procedures to determine if contamination has occurred during the sampling process. (Example: TB-1, TB-2)

3.1.9 Field Documentation

Field activities and information will be recorded in a dedicated field notebook and/or field record forms. Information will be recorded as the work occurs and will include date, work time(s), field information (boring and test pit logs, field screening results, sampling intervals, field analytical results, QA/QC sample information, etc.), project health and safety information and issues, any scope changes and reasons for the scope change, internal Barr/Fulcrum communications, client communications, decision-making processes and decision rationale, and other observations or activities relevant to the project. Copies of field documentation will be provided as part of the RI Report.

3.1.10 Sample Chain-Of-Custody Procedures

Samples will be collected and handled using chain-of-custody procedures as described in the SOP for Documentation on a Chain-of-Custody (Appendix A). When collecting samples for laboratory analysis, field personnel will complete the laboratory paperwork used for tracking samples (i.e., Chain-of-Custody forms).

One field staff member per sampling team will be appointed as the sample custodian. Upon completion of all required documentation, the sample custodian will list the time of sample collection and sign and date the documents. The custodian will also confirm the completeness of all descriptive information on the chain-of-custody forms, which will then be included with each shipping container. Copies of the chain of custody forms will be included with all laboratory correspondence and provided with the analytical results as part of the RI Report.

3.1.11 Sample Analysis

Sample analysis information, including anticipated laboratory practical quantification limits, is presented in the QAPP. A summary of parameter groups for soil and groundwater sample analysis is provided below:

Soil

Laboratory analysis for soil samples will include one or more of the following parameter groups:

Diesel and Heavy Oil by NWTPH-Dx[1]
Gasoline by NWTPH-Gx[1]
Metals by EPA Method 6020
VOCs by EPA Method 8260B[2]
Chlorinated Pesticides by EPA Method 8081
Hexavalent Chromium by EPA Method 7196
PCBs using EPA Method 8082
PAHs by EPA Method 8270D
BTEX by EPA Method 8260B or 8021B[2]
Fuel Additives by EPA Method 8260[2, 3]
Chlorinated Herbicides by EPA Method 8151

[1] Samples analyzed with and without silica gel cleanup

[2] Soil samples will be collected using EPA 5035 methodology

[3] Fuel Additives include MTBE, TAME, EDB and EDC

Groundwater

Laboratory analysis for groundwater samples will include one or more of the following parameter groups:

Diesel and Heavy Oil by NWTPH-Dx[1]
Gasoline by NWTPH-Gx
Metals (total and dissolved) by EPA Method 6020
TOC by Method SM 5310C
VOCs by EPA Method 8260B
SVOCs by EPA Method 8270D
BTEX by EPA Method 8260B or 8021B
Fuel Additives by EPA Method 8260[2,]

[1] Samples analyzed with and without silica gel cleanup

[2] Fuel Additives include MTBE, TAME, EDB and EDC

The sampling design is based on historical operations for each AOC. The parameters to be analyzed at each AOC were selected based on the chemicals that have been, or could potentially have been, used at the AOC. A focused sampling approach was selected for AOCs with a known operational feature or where impacts have been identified by previous investigations but not fully delineated. An area-wide sampling approach will be used for locations with potentially dispersed or variable impacts.

Data from focused sampling will be used to assess for a potential release (sampling from the most likely release location) or for delineating localized impacts. Area wide sampling will be used to differentiate between potentially dispersed or localized impacts. A staged approach to the RI is proposed in which releases are identified in Stage 1 and identified impacts are further delineated in Stage 2. Soil and groundwater sample analytical results will be compared to MTCA Method A and B cleanup levels.

3.1.12 Sample Packaging and Shipping Procedures

Sample packaging and shipping procedures are described in the SOP for Transporting Samples to the Laboratory. Environmental samples collected for chemical analysis will be shipped to the appropriate laboratories using an overnight delivery service or hand delivered. Sample containers will be placed in plastic bubble wrap bags, as appropriate, to reduce the chance of breakage during shipment. The sample containers will then be placed in coolers filled with additional cushioning material. Ice that has been double-bagged, and/or reusable "blue ice", will then be placed in the coolers to maintain the appropriate temperature during transport.

Laboratory paperwork for the samples will be placed in a sealed plastic bag and taped to the inside of the cooler lid. The cooler lid will then be securely taped closed and custody seals will be placed on the cooler lid and across the latch of the cooler. All shipping containers will be labeled as required by the U.S. Department of Transportation.

4.0 Investigation Derived Waste and Equipment Decontamination

This section describes the management of investigation derived waste (IDW) and equipment decontamination to be used during the RI.

4.1 Investigation Derived Waste

Soil and groundwater will be containerized for evaluation and management in accordance with the document *Guidance for Remediation of Petroleum Contaminated Sites* (DOE, 2016). Storage of investigative wastes will be limited to 90 days in accordance with Section 4.7 of Ecology's June 2016 Guidance for Remediation of Petroleum Contaminated Sites unless Long-term Storage is required. Long-term Storage will follow the guidance in Section 11.3.2 of the above-referenced June 2016 Guidance.

4.1.1 Soil

Soil Boring

Cuttings from drilling operations will be containerized and the containers properly labeled and sealed pending analytical testing. Following testing, clean soil will be thin spread onsite in proximity to the origination location. Contaminated soil cuttings will be properly characterized and disposed of at a permitted disposal facility.

Test Pits

The standard procedure will include backfilling excavated soils into the test pit in the reverse order they were removed. Where subsurface debris is encountered in a test pit, the inert debris (i.e., no gross environmental impact, visible product, or chemical or fuel containers) will be backfilled into the test pit. Soils that display gross environmental impacts including visible product will be containerized on site for proper characterization and disposal of at a permitted facility.

4.1.2 Groundwater

Groundwater generated during well development and/or sampling will be containerized and the containers properly labeled and sealed pending analytical testing. Following testing, containerized groundwater will be disposed at a permitted disposal facility.

4.1.3 Personal Protective Equipment (PPE)

Disposable PPE is anticipated to consist primarily of disposable coveralls (e.g., Tyvek, Kleenguard, etc.), nitrile gloves, and paper towels. If free product is encountered, additional PPE will be available to the field staff consistent with the Project Health and Safety Plan (PHASP). For disposal, used PPE will be managed as investigation derived waste.

4.1.4 Containers

Both soil and groundwater IDW will generally be containerized in 55-gallon steel drums. In the event that a large amount of heavily impacted soil is generated from a test pit, either lined roll-off boxes or a properly designed bermed and lined storage area will be used. If a large volume of contaminated water is to be generated from well development activities, larger, reinforced poly totes will be used. All containers stored onsite will be secured, properly labeled, and shall remain for less than 90 days.

4.1.5 Labeling

In accordance with the document *Guidance for Remediation of Petroleum Contaminated Sites* (DOE, 2016) all containers will be labeled with the following information:

- Description of contents (soil, water, waste)
- Boring/Well source of material in container
- Date material was placed in container
- Company that did the work (Barr Engineering/Fulcrum)
- Company for which the investigation was conducted (OfficeMax/Owners)
- Contact information (Barr/Fulcrum)

4.1.6 Disposal

Contaminated material that requires off-site disposal will be transported to an appropriately licensed solid waste or hazardous waste disposal facility, as applicable. Waste characterization sampling will be conducted in coordination with the disposal facility. General arrangements with such facilities shall be made prior to conducting any Site investigation activities. Transportation will follow all state and local requirements and hauling documentation will be retained. OfficeMax/Owners will be the generators of the waste.

4.2 Equipment Decontamination

Sampling equipment used during soil sampling will be thoroughly decontaminated prior to each use by washing with alconox-type detergent, rinsing with potable water, and rinsing with deionized water. Dedicated Teflon tubing will be used at each location for groundwater sampling. A decontamination station will be constructed during test pitting and drilling activities to collect the wash water and related materials for proper management. The decontamination water will be containerized and properly labeled pending analytical testing. Drums or totes will be securely stored onsite prior to offsite disposal.

All soil and groundwater sampling will be conducted using disposable nitrile gloves. Gloves will be disposed of between samples to prevent cross contamination.

5.0 Reporting and Schedule

The RI Report will be prepared in accordance with Part VII.H of the AO that summarizes the nature and extent of impacts and supports the preparation of a Feasibility Study for selecting a cleanup action under WAC 173-340-360. The RI Report and deliverable schedule and format are described in Section 8 of the Work Plan.

A detailed investigation schedule for Stage 1 of the RI is provided as Appendix D of this SAP.

If Stage 2 RI work is determined to be necessary, it may be more efficient to update the approved Final RI Work Plan, SAP and QAPP with the new scope of work, rather than producing an entirely new work plan for Stage 2.

6.0 References

ASTM, 2014a. ASTM D4823-95 *Standard Guide for Core Sampling, Unconsolidated Sediments*, ASTM Subcommittee D19.07, 2014.

ASTM, 2014b. ASTM E1391-03 *Standard Guide for Collection, Storage, Characterization, and Manipulation of Sediments for Toxicological Testing and for Selection of Samplers Used to Collect Benthic Invertebrates*, ASTM Subcommittee E50.47, 2014.

Landau, 2013a. Report "*Phase I Environmental Site Assessment; Yakima (Cascade) Mill Site; 805 North 7th Street, Yakima, Washington.*" To: City of Yakima. From: Kathryn F. Hartley, Timothy L. Syverson, and Rosemary W. Trimmer, Landau Associates, Inc. November 26, 2013.

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Parametrix, 2008. Draft Report "*Phase II Environmental Site Assessment; Former Boise Cascade Mill Site; Yakima, Washington.*" To: Leelynn, Inc., & Wiley Mt., Inc. From: Parametrix. December, 2008.

Washington Department of Ecology (DOE), 2016. *Guidance for Remediation of Petroleum Contaminated Sites, Toxics Cleanup Program, Publication No. 10-09-057.* Published by the State of Washington Department of Ecology, June 2016 (Revised).

Tables

Table 1
Stage 1 Investigation and Sampling Rationale
Yakima Mill Site Remedial Investigation Work Plan
Yakima, Washington

Area of Concern	Description	Previous Investigations	Data Gaps / Environmental Concerns	Sampling Approach[1]	COCs[2]
Potential Wood Waste Landfill Remnant **(AOC 1)** Figure 13	The area north of the North First Lateral Drain is commonly referred to as the "pasture area", as a result of a former lease for cattle grazing. The easternmost portion of this area has been suggested as a remaining portion of an unpermitted wood waste landfill that was used for facility operations up until 1991. The presence of wood waste and the boundaries of the wood waste, if present in this area, has not been delineated. The landfill reportedly received wood waste, ash from the wood waste boiler, and other mill wastes. The majority of the wood waste landfill (5.6 acres) was closed by removing the waste material in 2003 and 2004. The closed portion of the landfill was sold for separate redeveloped. This AOC is the remaining portion of the landfill on the Mill Site.	No previous investigations within this area. Soil samples collected beneath the removed wood wastes during 2003 and 2004 investigations on the now closed and developed portion of the wood waste landfill were below MTCA cleanup levels for petroleum hydrocarbons (gasoline, diesel, kerosene, heavy fuel oil, and lubricating oil), RCRA metals, polycyclic aromatic hydrocarbons, and three phenolic compounds common to wood treating. The extent of wood waste on the Site beyond the boundary of the former wood waste landfill was identified as a potential environmental concern in the Landau Phase I ESA (Landau, 2013a) and as a data gap in the Landau data review memo (Landau, 2013c).	Wood waste may be present beyond the extent formerly established. If wood waste is present, the soil beneath wood waste landfill remnant materials may be impacted.	**Area-wide sampling:** evaluate soil quality by completing 6 test pits to determine if wood waste is present and evaluate soil quality; collect soil samples as described in Table 2.	• TPH – Dx • TPH – Gx • BTEX and Fuel Additives • Metals • VOCs • SVOCs • Chlorinated Pesticides/Herbicides
North First Lateral Drain **(AOC 2)** Figure 13	The North First Lateral Drain is the outfall of the Old Union Canal and the North First Lateral irrigation systems, which serve an area of predominately residential properties between North 4th and North 6th Street, northwest of the Mill Site. The Drain is a ditch across the Mill Site with water flowing from west to east across the Site, beneath I-82 and toward the Yakima River. The irrigation water for the Drain originates from the Naches River through the Old Union Canal. The North First Lateral Drain is present in aerial photographs by 1991 but likely dates to the late 1890s.	No investigations have been conducted on the North First Lateral Drain on the Mill Site and the Drain was not identified as a REC, area of potential environmental concern, or data gap in previous investigations.	The North First Lateral Drain passes through the Site and carries excess irrigation water to the Yakima River. No operational history was established that indicates that the North First Lateral Drain was a part of Site operations. However, potential exists for impact to ditch bottom soils within the drain from Site runoff or groundwater inflow. This AOC was added to the RI at direction of Ecology. A challenge will be to separate impacts from upstream sources from any impacts attributable to the Site and to collect samples of similar grainsize distribution and organic fraction.	**Focused sampling (operational feature):** evaluate quality of ditch bottom material from upgradient and downgradient sampling locations; collect samples as described in Table 2.	• TPH-Dx • Metals Samples also analyzed for TOC which is not a COC.
Equipment Boneyard **(AOC 3)** Figure 14	This area was historically used to store out-of-use but potentially usable equipment for future reuse, sale, or parts. The equipment boneyard once had a gravel covered surface which may explain the absence of vegetation in this area during much of the year. Previous uses have been limited to storage of lumber prior to shipment. The equipment boneyard is beyond the areas of the Mill Site used for log yards or water conveyance.	Oil staining of surface soils was observed in the 2003 Phase I (URS). One surface soil sample (SS-2) collected in 2008 by Parametrix had concentrations below MTCA cleanup levels for TPH, BTEX, metals, SVOCs, and PCBs. This area was identified as a potential environmental concern in the Landau Phase I ESA (Landau, 2013a) and as a data gap in the Landau data review memo (Landau, 2013c) because only one sample had been collected from the area.	Sufficient number/density of soil samples to evaluate potential releases to ground surface from out-of-use equipment.	**Area-wide sampling:** evaluate soil quality by completing 6 test pits to evaluate soil for the presence of potential contaminants associated with former storage of equipment; collect soil samples as described in Table 2.	• TPH – Dx • Metals • SVOCs • Chlorinated Pesticides/Herbicides (three locations)

Table 1
Stage 1 Investigation and Sampling Rationale
Yakima Mill Site Remedial Investigation Work Plan
Yakima, Washington

Area of Concern	Description	Previous Investigations	Data Gaps / Environmental Concerns	Sampling Approach[1]	COCs[2]
Dry Kiln **(AOC 4)** Figure 15	The dry kilns were a series of buildings used to dry the sawn lumber from the LLM and the SLM before cooling, final cutting (e.g., planing) and packaging and existed at this location since the 1960s. Equipment/machinery used in these buildings consisted primarily of metal rails on a concrete slab, cart racks to hold the sawn lumber, and steam heat exchangers and piping to add steam to the air and fans/blowers to circulate the air and to remove moisture in the air by venting. Lumber was transferred by a transfer rail line from the dry kilns to the planer shed located to the west of the Kiln. The dry kiln area is beyond the areas of the Mill Site used for log yards or water conveyance.	Potential petroleum impacts to surface soils were observed adjacent to the large dry kiln building during facility operations. The URS 2003 Phase I reported oil dripping from the kiln building roof onto the ground surface likely from the condensation off warm air being vented from the kiln (URS, 2003, Landau, 2013a). This condensate likely contained natural wood oils from the drying of wood in the kiln. The kiln building was considered to be a data gap in the Landau data review memo (Landau, 2013c). No soil samples have been collected near the dry kiln in previous investigations.	Surface soil quality where it was reported that oil was dripping from the roof and adjacent to the dry kiln in the transfer rail line where leaking hydraulic oil releases were known to have occurred during operations.	**<u>Focused sampling (operational feature):</u>** evaluate soil quality by completing 10 test pits around the perimeter of the Dry Kiln; collect soil samples as described in Table 2.	• TPH – Dx • TPH – Gx • BTEX and fuel additives • SVOCs
Kiln Ponds **(AOC 5)** Figure 15	The north kiln pond received steam condensate and "evaporates" from the dry kiln. The south kiln pond received exhaust scrubber water from the boiler house. The exhaust scrubber water contained ash which primarily settled out in the south kiln pond. The south kiln pond was at one time connected to the north kiln pond, or a similar water feature in use at the time, which was connected in the 1980s and 1990s to the center log pond and to the recycle pond. Water from these features would have eventually overflowed after significant dilution toward the Yakima River. The kiln ponds have been filled with common borrow fill from the Mill Site.	<u>North Kiln Pond</u> One surface water sample was collected during the 2008 Parametrix Phase II (KILN1-W) and analyzed for TPHs, BTEX, metals, and SVOCs. Motor oil-range TPH, total iron and manganese, and dissolved manganese were detected at concentrations greater than MTCA cleanup levels. <u>South Kiln Pond</u> One surface water sample was collected during the 2008 Parametrix Phase II (KILN2-W) and analyzed for TPHs, BTEX, metals, and SVOCs. Total iron, total manganese, and bis(2-ethylhexyl)phthalate were detected at concentrations greater than the MTCA cleanup levels. The kiln ponds were considered to be a data gap in the Landau data review memo (Landau, 2013c).	Kiln ponds received waters from the boiler scrubber, surface wash water, stormwater, and condensate (from the kilns). These sources may have resulted in contamination of pond bottoms, fill, soil quality, and groundwater beneath the former ponds.	**<u>Focused sampling (operational feature):</u>** evaluate soil, fill, and groundwater quality by completing 2 soil borings, one used as a temporary well, within each pond; collect soil samples as described in Table 2.	• TPH – Dx • TPH – Gx • BTEX and fuel additives • Metals • SVOCs • VOCs Groundwater sample also analyzed for TOC which is not a COC.

Table 1
Stage 1 Investigation and Sampling Rationale
Yakima Mill Site Remedial Investigation Work Plan
Yakima, Washington

Area of Concern	Description	Previous Investigations	Data Gaps / Environmental Concerns	Sampling Approach[1]	COCs[2]
North Log Pond Fill **(AOC 6)** Figure 16	This area has historically been used for a log pond (North Log Pond) and then a log deck. Photographs document that the north log pond was excavated beginning in the early 1900s. Excavated material was likely used to build dikes around the pond. The log pond was gradually filled beginning in the early 1960s. It is considered logical that the dike materials would have been pushed into the pond as fill. Log decks were constructed over the filled portions of the pond. Final closure of the remaining 6-acre portion of the pond occurred in 1994. Basalt rock fill was reportedly brought from a quarry near Naches, Washington for the final closure. Log yard material recovery has been conducted at the surface of the north log pond since cessation of mill operations in 2009.	Nine test trenches (TP-8, TP-14 through TP-17, TP-23 through TP-26) were completed into the fill material within or adjacent to the North Log Pond in 2008 by Parametrix. Soil samples were analyzed for TPH diesel and motor oil range. Soil sample concentrations from two of the test pits were above MTCA cleanup levels and soil sample concentrations from five test pits were below MTCA cleanup levels (two test pits were not sampled). A fly ash sample, collected near TP-15 in 2008, was analyzed for TPH, BTEX, metals, PCBs, and SVOCs. The fly ash sample had concentrations greater than MTCA cleanup levels for cadmium. Log yard material recovery has occurred over much of this AOC since the Parametrix investigation. The north log pond fill was considered to be a data gap in the Landau data review memo (Landau, 2013c).	Potential for impact from site operations on soil quality in the fill and in the native soil beneath the former log pond and log decks.	**Area-wide sampling:** evaluate fill and underlying soil by completing 16 test pits throughout and adjacent to the former pond to evaluate soil quality; collect soil samples as described in Table 2.	• TPH – Dx • TPH – Gx • BTEX and fuel additives • Metals • SVOCs • Chlorinated Pesticides/Herbicides (four locations)
Recycle Pond **(AOC 7)** Figure 17	The recycle pond is present on aerial photographs and site maps dating back to 1961. It originally received overflow from the north log pond and discharged to the east toward the Yakima River. The outfall from the recycle pond toward the Yakima River has been cut off since at least 1997. The recycle pond was used as part of the log deck sprinkling and water recycling system during the warm months of the year. The recycle pond collected log deck return water through a gravity ditch system. The collected water was put through a filter and reused through the log deck sprinkler system. Hypochlorite was added to the recycle pond to control algae growth. No other chemicals were known to be added to the pond.	A surface water sample was collected during the 2008 Parametrix Phase II (REC-W) and analyzed for diesel and gasoline range TPH, BTEX, and total and dissolved metals (arsenic barium, cadmium, calcium, chromium, lead, manganese, mercury, potassium, selenium, silver, and sodium). Diesel and motor oil range TPH were detected at concentrations above MTCA cleanup levels. Silica gel cleanup was not used in the analysis of the sample for TPH. The recycle pond was considered to be a data gap in the Landau data review memo (Landau, 2013c). Groundwater downgradient of the recycle pond has been evaluated through sampling at MW-5. Groundwater sample concentrations at MW-5 have been below MTCA cleanup levels.	Potential for impact from site operations to groundwater quality downgradient of the recycle pond.	**Focused sampling (operational feature)**: evaluate groundwater quality by collecting groundwater samples quarterly for 1 year from MW-5 (See AOC 25).	• TPH – Dx • TPH – Gx • BTEX and fuel additives • Metals • SVOCs • VOCs Also analyze for non-COCs: NO_3 SO_4 Fe, Mn, TOC
			Potential for impact from site operations to surface water quality in the recycle pond.	**Focused sampling (operational feature):** evaluate surface water by collecting 1 surface water sample from the recycle pond.	• TPH – Dx • Metals • SVOCs
			Potential for impact from site operations to pond bottom material quality.	**Focused sampling (operational feature):** evaluate pond bottom material quality by collecting a sample from pond bottoms, and soil immediately beneath pond bottoms (if a sample can be obtained); collect samples as described in Table 2.	• TPH – Dx • TPH – Gx • BTEX and fuel additives • Metals • SVOCs • VOCs • Chlorinated Pesticides/Herbicides also analyzed for TOC which is not a COC.

Table 1
Stage 1 Investigation and Sampling Rationale
Yakima Mill Site Remedial Investigation Work Plan
Yakima, Washington

Area of Concern	Description	Previous Investigations	Data Gaps / Environmental Concerns	Sampling Approach[1]	COCs[2]
Settling Pond **(AOC 8)** Figure 17	The settling pond is first visible on a 1991 aerial photo. The settling pond was used in the warm months of the year as part of the log deck sprinkling and recycling system. The settling pond collected log deck surface runoff through a gravity ditch system. The collected water was filtered and reused through the log deck sprinkler system. There is no record of or indication that a discharge to surface waters ever occurred from the settling pond. Hypochlorite was added to the settling pond to control algae growth. No other chemicals were known to be added to the pond.	A surface water sample was collected during the 2008 Parametrix Phase II (STL-W) and analyzed for diesel range TPH, motor oil range TPH gasoline range TPH, BTEX, metals, and lead. Diesel and motor oil range TPH were detected at concentrations greater than MTCA cleanup levels in the surface water. Silica gel cleanup was not used in the analysis of the sample for TPH. The settling pond was considered to be a REC in the Landau Phase I ESA (Landau 2013a) but was not considered to be a data gap in the Landau data review memo (Landau, 2013c). Groundwater downgradient of the settling pond has been evaluated through sampling at MW-6. Groundwater sample concentrations at MW-6 have been below MTCA cleanup levels.	Potential for impact from site operations to groundwater quality downgradient of the settling pond.	**Focused sampling (operational feature):** evaluate groundwater quality by collecting groundwater samples quarterly for 1 year from MW-6 (See AOC 25).	• TPH – Dx • TPH – Gx • BTEX and fuel additives • Metals • SVOCs • VOCs Also analyze for non-COCs: NO_3 SO_4 Fe, Mn, TOC.
			Potential for impact from site operations to surface water quality in the settling pond.	**Focused sampling (operational feature):** evaluate surface water by collecting 1 surface water sample from the settling pond.	• TPH – Dx • Metals • SVOCs
			Potential for impact from site operations to pond bottom material quality.	**Focused sampling (operational feature):** evaluate pond bottom material quality by collecting a sample from pond bottoms and soil immediately beneath pond bottoms (if a sample can be obtained); collect samples as described in Table 2.	• TPH – Dx • TPH – Gx • BTEX and fuel additives • Metals • SVOCs • VOCs • Chlorinated Pesticides/Herbicides Also analyze for TOC which is not a COC.
Fruitvale Wasteway **(AOC9)** Figure 17	The Fruitvale Wasteway is the outfall of the Fruitvale irrigation system. The Wasteway is in a corrugated metal culvert that runs west to east across the Mill Site and then across the Landfill Site. The culvert outlets to a ditch at the northeast corner of the Landfill Site and eventually discharges to the Yakima River after crossing beneath I-82. The Old Union Canal irrigation system is also connected to the Fruitvale Wasteway. The Fruitvale irrigation system receives water from the Naches River through the Fruitvale Canal. The Fruitvale Wasteway has also been referred to as the PP&L Ditch, the Old Union Ditch, and the Irrigation Culvert. The Fruitvale Wasteway has changed orientation across the Site over time but, the outfall location has remained constant.	Previous reports identified the potential that the Fruitvale Wasteway may have received process water or blowdown from the boiler house, which may have resulted in environmental impact (Landau, 2013a). The historical irrigation ditch has been replaced with a culvert that now carries the irrigation water across the Site. The location of the former ditch is unknown. The Fruitvale Wasteway (either as a ditch or a culvert) was not sampled in previous investigations. The irrigation ditch/culvert (aka Fruitvale Wasteway) was considered to be a data gap in the Landau data review memo (Landau, 2013c).	The Fruitvale Wasteway passes through the Site and carries excess irrigation water to the Yakima River. The Fruitvale Wasteway is contained in an underground culvert. The concern is the historical impact of the Site on the Fruitvale Wasteway. A challenge will be to separate impacts from upstream sources from impacts attributable to the Site	**Focused sampling (operational feature)**: evaluate soil quality at the Fruitvale Wasteway culvert discharge; collect soil samples as described in Table 2.	• TPH – Dx • TPH – Gx • BTEX and fuel additives • Metals • SVOCs • VOCs
Mill Transformers **(AOC 10)** Figures 15 & 18	Oil-filled transformers used for mill operations were present at the following six locations on the sawmill portion of the Site: 1) west of the large log sawmill, 2) east of the large log sawmill, 3) southwest corner of the small log sawmill, 4) south of the small log sawmill, 5) east of the dry kiln building, and 6) south of the dry kiln building.	The potential for the release of PCBs and/or mineral oil from the Mill Transformers was not identified as a REC, area of potential concern, or a data gap in previous investigations and has not been investigated in previously.	Previous mill operations included the use of PCB-containing mineral oils in transformers. While the majority of these units were previously removed, evaluation of soil quality did not occur in all locations. The data gap is the potential for PCB-containing mineral oils to have been released to the ground surface adjacent to the transformers.	**Focused sampling (operational feature):** evaluate soil quality near transformers by completing 1 boring at each transformer location; collect soil samples as described in Table 2.	• TPH – Dx • PCBs

Table 1
Stage 1 Investigation and Sampling Rationale
Yakima Mill Site Remedial Investigation Work Plan
Yakima, Washington

Area of Concern	Description	Previous Investigations	Data Gaps / Environmental Concerns	Sampling Approach[1]	COCs[2]
Large Log Sawmill (LLM) **(AOC 11)** Figure 18	The large log mill processed larger diameter logs. The LLM is shown to be present in a 1909 Sanborn map and was significantly expanded during Site operations. The shape of the building changed over the years as additions were constructed and modifications were made. Equipment included saws and conveyors to debark, cut, and move logs and lumber. Chemicals used at the sawmill primarily included lubricating oil and hydraulic oil. A dry well for steam condensate was located in the basement of the LLM.	Four test trenches (TP-10, TP-18, TP-19, TP-20) were completed outside of the LLM during the 2008 Parametrix Phase II to depths ranging from 7-10.5 feet bgs.TP-10 was located just east of a reported dry well located outside of the LLM, and TP-18, -19, and -20 were located east of TP-10 between the LLM and SLM. Oil was reported to be floating on the water at the base of test pits TP-10 and TP-18 (completed near the SE portion of the LLM) during the Parametrix Phase II ESA. Soil samples were collected from test trenches TP-10, and TP-20 at depths ranging from 5-13 feet bgs and were analyzed for one or more of the following: TPHs, BTEX, and SVOCs. Some samples were also analyzed for metals, PCBs, and VOCs. Diesel and motor oil range organics were detected above MTCA cleanup levels in both samples collected from test trench TP-10 (TP-10, 8 ft.; TP-10, 13 ft.). Detected concentrations were below cleanup levels in the sample collected from TP-20. Oil staining was observed on the concrete floor in the southern portion of the LLM in the vicinity of a dry well (URS, 2003). No samples were collected from this area. The LLM was considered to be a data gap in the Landau data review memo (Landau, 2013c).	Previous investigation identified the presence of petroleum impacted soil near TP-10 however, the extent of petroleum impacts in the area investigated in 2008 (TP-10 area) has not been determined	**<u>Focused sampling (delineate extent of impacts):</u>** evaluate soil and groundwater quality near the former dry well by completing 2 borings with temporary wells and 4 test pits; collect soil samples as described in Table 2.	• TPH – Dx
			Hydraulic and lubricating oils were used in LLM equipment and were observed during operations to be commonly pooled on the concrete floor surface. Potential impacts from hydraulic and lubricating oil used in the LLM and migrating through floor expansion joints and the dry well (if it can be located) inside the building.	**<u>Area-wide sampling:</u>** evaluate soil quality beneath the LLM floor by completing 6 soil borings through the concrete floor; collect soil samples as described in Table 2.	• TPH – Dx
			Potential exists for the presence of groundwater impacts from hydraulic and lubricating oils as a result of site operations in proximity of the sawmill area.	**<u>Area-wide sampling:</u>** evaluate groundwater quality by installing a new monitoring well south of the large log sawmill and sample quarterly as part of sitewide groundwater monitoring (AOC 25).	• TPH – Dx • TPH – Gx • BTEX and fuel additives • Metals • SVOCs • VOCs Also analyze for non-COCs: NO_3 SO_4 Fe, Mn, TOC
Small Log Sawmill (SLM) **(AOC 12)** Figure 18	The small log mill processed smaller diameter logs. The SLM was constructed as a new facility in the late 1980s and was powered by hydraulic equipment. Equipment included saws and conveyors to debark, cut, and move logs and lumber. Chemicals used at the sawmill included primarily lubricating oil and hydraulic oil. An oil dispensing room was located on the south side of the building. Oil was commonly present on the concrete floor of the building and asphalt surrounding the building. Used oil tanks were located outside the building (at the southwest corner) for storage of used hydraulic oils.	Hydraulic oils were used in the SLM and several storm drain features were identified that could have potentially carried oily water from the sawmill to the subsurface (Landau, 2013a). Hydraulic oil was also reported to be present on the concrete basement floor during facility operations (URS, 2003). The URS 2003 Phase I noted discharge of oily air compressor condensate to a storm drain north of a compressor room between the LLM and SLM. An oily sheen was observed on the standing water in the drain and the drain discharge point was unknown. The URS 2003 Phase I also noted oil from the oil dispensing room on the south side of building crossing an adjacent asphalt surface to soils adjacent to a log deck south of the room. A possible storm drain was observed in this area during a September 2016 site visit. These areas have not been investigated previously. The SLM was considered to be a data gap in the Landau data review memo (Landau, 2013c).	Potential exists for impacts to soil beneath the SLM from hydraulic and lubricating oil use in the SLM including leakage through expansion joints in the concrete floor.	**<u>Area-wide sampling:</u>** evaluate soil quality beneath the SLM floor by completing 3 soil borings through the concrete floor; collect soil samples as described in Table 2.	• TPH – Dx
			Potential exists for impacts to soil in the southwest corner of the SLM from used oil storage.	**<u>Focused sampling (operational feature):</u>** evaluate soil quality near the used oil containers by completing 1 soil boring; collect soil samples as described in Table 2.	• TPH – Dx • TPH – Gx • BTEX and fuel additives • SVOCs • Metals

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Area of Concern	Description	Previous Investigations	Data Gaps / Environmental Concerns	Sampling Approach[1]	COCs[2]
			Potential exists for releases to the storm drain from oil dispensing room to act as pathway for lubricating and hydraulic oils to reach soil and groundwater.	**Focused sampling (operational feature):** evaluate soil and groundwater quality by completing 2 soil borings and installing temporary wells adjacent to storm drain features; collect soil samples as described in Table 2.	- TPH – Dx
Boiler House **(AOC 13)** Figure 19	The boiler house was constructed by 1950 as shown on the Sanborn maps and provided steam generation during Site operations. Chemicals stored within this building included caustic and boiler water treatment chemicals. Boiler blow down water, water softener backwash and steam condensate were discharged to the City's sanitary sewer. Scrubber wash water was discharged to a ditch/culvert system leading to the south kiln pond. A pole-mounted capacitator is present near the boiler house.	Two surface soil samples (SS-3 and SS-4) were collected during the Parametrix 2008 Phase II and analyzed for TPHs, BTEX, metals, and SVOCs. Chromium and PAHs were detected above MTCA cleanup levels in both samples (Cr6), however chromium was not speciated. The 2003 Phase I ESA reported that in 1988 PCB-containing mineral oil was released to the ground from a capacitor southwest of the boiler house. The oil impact was reportedly cleaned up, but no laboratory results demonstrate current site conditions. The boiler house was considered to be a data gap in the Landau data review memo (Landau, 2013c).	Potential exists for soils beneath the former capacitor location to be impacted by PCB-containing mineral oils.	**Focused sampling (operational feature):** evaluate soil quality near capacitors by completing 1 boring at each potential capacitor location; collect soil samples as described in Table 2.	- TPH – Dx - PCBs
			Potential exists for soils at the boiler house to be impacted by caustic and water treatment chemical storage/use.	**Focused sampling (operational feature):** evaluate soil quality near the former boiler chemical storage areas by completing 3 soil borings; collect soil samples as described in Table 2.	- Metals - SVOCs - VOCs
Hog Fuel Pile **(AOC 14)** Figure 19	Wood waste (hog fuel) to be burned as fuel in the boiler house was stockpiled in an area south of the LLM and east of the boiler house. The hog fuel included wood waste, wood pallets/scrap wood, and wood debris used to clean up incidental spills of oil, plywood adhesive and similar. Used oil was reportedly occasionally dumped on the hog fuel pile prior to burning the hog fuel at the boiler house.	One test pit (TP-13) was completed near the location of the former Hog Fuel Pile to a depth of 8 feet bgs during the 2008 Parametrix Phase II. One soil sample was collected from TP-13 at a depth of 8 feet bgs and analyzed for TPH, BTEX, metals, VOCs, PCBs, and SVOCs. Detected concentrations were below MTCA cleanup levels. No buried waste was identified at TP-13. The hog fuel pile was not considered to be a REC, area of environmental concern, or a data gap in previous investigations	Potential exists for the incorporation of materials into the wood hog fuel pile, such as paints, oils, and other high BTU liquids and wastes that could have impacted soils beneath the hog fuel storage area.	**Area-wide sampling:** evaluate soil quality beneath the former hog fuel pile by completing 4 soil borings; collect soil samples as described in Table 2.	- TPH – Dx - TPH – Gx - BTEX and fuel additives - Metals - SVOCs - VOCs - Chlorinated Pesticides/Herbicides

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Area of Concern	Description	Previous Investigations	Data Gaps / Environmental Concerns	Sampling Approach[1]	COCs[2]
Paint, Machine, and Storage Shed **(AOC 15)** Figure 19	A small storage shed was present at this location from before the 1920s until about 1959 (as identified by Sanborn Maps). This building was used for the storage of paints, solvents, machinery, and for general storage.	Review of historic documentation identified the presence of a paint, machine, and storage shed at the site. While soil samples have been collected in the general area, no sampling has specifically targeted this location and the paint, machine and storage shed was not considered to be a REC, area of potential environmental concern, or a data gap in previous investigations.	Potential exists for the release of petroleum hydrocarbons, solvents, paints, and metals associated with former storage shed into site soils. Lack of soil data in the vicinity of this building.	**<u>Focused sampling (operational feature):</u>** evaluate soil and groundwater quality by completing 2 test pits and 1 soil boring with temporary well; collect soil samples as described in Table 2.	• TPH – Dx • TPH – Gx • BTEX and fuel additives • Metals • SVOCs • VOCs • Chlorinated Pesticides/Herbicides (soil only)
Fuel Distribution System **(AOC 16)** Figure 20	A fueling system has existed at the site since at least 1964 (Ecology's common default date for tanks of unknown installation) when three 10,000 to 20,000 gallon diesel and gasoline USTs were reported to be operational. A fourth UST was installed in 1981. These USTs were removed in 1989 and replaced with two 10,000 gallon diesel ASTs and one 10,000 gallon gasoline AST. Three fuel dispensing stations have been used at the Site - one diesel fuel dispenser island located west of the log yard shops, one diesel fuel dispenser located west of the machine shop, and one gasoline dispenser near the oil house. The USTs/ASTs and the dispensing pumps were connected with underground fuel lines.	A fuel distribution system connected three separate dispenser locations with three aboveground storage tanks. The general area of the aboveground storage tanks were investigation by Parametrix and Landau with no impacts identified. Elevated concentrations of diesel and oil range petroleum hydrocarbons have been detected in the soil and groundwater samples collected downgradient of the eastern portion of the fuel distribution system (Landau, 2015, Parametrix 2008). The far western portion of the fuel distribution system was investigated with no impacts identified (Landau 2013, 2015). Potential petroleum impacts along the fuel lines connecting the former USTs/ASTs with the fuel dispensers have not been systematically evaluated. The fuel lines were not identified as a REC, area of potential concern, or data gap in previous investigations. The ASTs and the fuel distribution system reportedly passed "tightness testing" in 2003, but records of the test are not available (URS, 2003).	Previous investigation has identified diesel range organics in TP-12, located west of the log yard shops fuel dispensers. The extent of TPH impacts to soil and groundwater associated with this location and generally in the eastern portion of the fuel distribution system has not been determined.	**<u>Focused sampling (operational feature and delineate extent of impacts):</u>** evaluate soil and groundwater quality near TP-12, the log yard fuel dispensers, and in the eastern portion of the fuel distribution system by completing 1 soil boring with temporary well immediately downgradient of the former diesel dispenser and 3 soil borings around area with known impacts (TP-12); collect soil samples as described in Table 2.	• TPH – Dx • TPH – Gx • BTEX and fuel additives
			Potential exists for a release of gasoline to have occurred at the gasoline dispenser near the machine shop.	**<u>Focused sampling (operational feature):</u>** evaluate soil and groundwater quality by completing 1 soil boring with temporary well immediately downgradient of the former gasoline dispenser; collect soil samples as described in Table 2.	• TPH – Dx • TPH – Gx • BTEX and fuel additives
			Potential exists for a release of diesel fuel to have occurred at the diesel fuel dispenser near the oil house.	**<u>Focused sampling (operational feature):</u>** evaluate soil and groundwater quality near the diesel fuel dispenser by completing 1 soil boring with temporary well immediately downgradient of the former diesel dispenser; collect soil samples as described in Table 2.	• TPH – Dx • TPH – Gx • BTEX and fuel additives
			Potential exists for releases of gasoline or diesel fuels to have occurred from buried fuel lines that connected the dispensers to the ASTs/USTs.	**<u>Focused sampling (operational feature):</u>** evaluate soil quality by completing test pits every 25 lineal feet along the fuel distribution piping; collect soil samples as described in Table 2.	• TPH – Dx • TPH – Gx • BTEX and fuel additives
			Potential exists for petroleum impacts from the fuel distribution system to impact groundwater downgradient of the fuel distribution system.	**<u>Area-wide sampling:</u>** evaluate groundwater quality from the fuel distribution system by sampling existing monitoring wells TP-MW-1 and TP-MW-2, and a new monitoring well quarterly as part of site-wide groundwater monitoring (AOC25)	• TPH – Dx • TPH – Gx • BTEX and fuel additives • Metals • SVOCs • VOCs Also analyze for non-COCs: NO_3 SO_4 Fe, Mn, TOC

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Mill Supply Warehouse and Auto Repair Shop **(AOC 17)** Figure 21	The mill supply warehouse and auto repair shop was originally constructed and used as a barn for horses used at the mill. The building is first shown in a 1920 Sanborn map and has served a variety of uses. Prior to construction of the building, the original sawmill was present at this location. The building is referenced as a storehouse until 1959 and then as equipment storage beginning in 1962. An auto lube pit was installed at some point in the eastern portion of the building. Petroleum storage, including lubricants, hydraulic oils, and used oil, occurred in the auto shop. A lubricating oil tank, hydraulic oil tank, and used oil tank were present in the northeast corner of the building.	Oil staining was observed on the pavement during the 2003 Phase I (URS, 2003) and within the lube pit. No floor drains were identified.One soil boring (B-5) was completed east of the building during the Parametrix, 2008 Phase II to a depth of 15 feet bgs. One soil sample was collected at 10.5 feet bgs and analyzed for TPHs, BTEX, metals, VOCs, and SVOCs. Detected concentrations in soil were less than MTCA cleanup levels. The auto repair shop was considered to be a data gap as part of the Triangular Parcel in the Landau data review memo (Landau, 2013c).	Potential exists for observed oil staining or the release of other petroleum products to have impacted soil near petroleum storage and use areas (eastern portion of auto shop). Define any impacts to soil associated with auto maintenance activities that occurred in the building.	**Focused sampling (operational features):** evaluate soil quality near the auto repair shop by advancing 4 soil borings through the concrete floor and outside of the building footprint; collect soil samples as described in Table 2.	• TPH – Dx • TPH – Gx • BTEX and fuel additives • Metals • SVOCs • VOCs
Oil House/ Service Pit **(AOC 18)** Figure 21	An oil storage building and an adjacent vehicle service pit were present northeast of the mill service warehouse and auto repair shop. The oil house was historically used for the storage of new and used oil. The oil house is located adjacent to the gasoline fuel dispenser.	One surface soil sample was collected near the former service pit located north of the Oil House during the 2008 Parametrix Phase II (SS-1). Diesel range TPH, motor oil range TPH, and chromium exceeded screening criteria in surface soil sample SS-1 on the north side of the building. Five soil borings were completed during the Landau 2013 Phase II to depths ranging from 5-20 feet bgs . Four soil samples were collected from soil borings at depths ranging from 2-16 feet bgs. Soil samples were analyzed for one or more of the following: diesel range TPH, gasoline range TPH, BTEX, metals, VOCs, and SVOCs. Detected concentrations in soil samples collected from the soil borings were below MTCA cleanup levels. The oil house and service pit was identified as a potential environmental concern and as a data gap in the Landau Phase I and data review memo (Landau 2013a, Landau 2013c).	Determine the extent of petroleum impacted soil at the oil house/service pit including the SS-1 sample location.	**Focused sampling (delineate extent of impacts):** evaluate the extent of petroleum impacted soils by completing 2 borings at the oil house/service pit (including the SS-1 sample location) to further delineate soil impacts; collect soil samples as described in Table 2.	• TPH – Dx • TPH – Gx • BTEX and fuel additives • Metals • SVOCs • VOCs

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Log Yard Shop **(AOC 19)** Figure 21	The log yard shop area was used to perform maintenance on log yard equipment. Log yard equipment was steam cleaned outside the west side of the building. Smaller equipment and vehicles were cleaned in the steam clean shed. Lubricating oil and hydraulic oil were stored near the southwest corner of the building. Used oil was stored along the northern edge of the building.	One soil boring (B-9) was completed northeast of the Log Yard Shop to a depth of 15 feet bgs during the 2008 Parametrix Phase II. Two soil samples were collected at 7 and 12 feet bgs and analyzed for TPHs, BTEX, metals, and SVOCs. Detected concentrations in soil were less than MTCA cleanup levels but the samples may not have been collected in the areas most likely to have been impacted by releases from this AOC. Potential petroleum impacts near the log yard shop were observed in 2013 (Landau, 2013a). The log yard shop was identified as potential environmental concern and as a data gap in the Landau Phase I ESA and in the data review memo (Landau 2013a, Landau 2013c).	Investigate the potential for impact to soils in and around the log yard shop for petroleum, solvent, used oil and metals impacts. Evaluate deeper soils and groundwater at the log yard shop for petroleum and solvent impacts.	**<u>Focused sampling (operational features):</u>** evaluate the potential for contamination to Site soils and groundwater at the log yard shop by completing 7 borings with 1 completed as a temporary well; collect soil samples as described in Table 2.	• TPH – Dx • TPH – Gx • BTEX and fuel additives • Metals • SVOCs • VOCs
Plywood Plant **(AOC 20)** Figure 22	A plywood plant was constructed at the site in approximately 1960. The plywood plant area was constructed at the northwest corner of the former southern log pond which was filled to construct the plant and associated buildings (e.g., VATs, plywood barker, etc.). Previous investigations establish that the pond fill beneath the plywood plant consists of compacted soil. The plant included a number of ASTs (caustic, resin, adhesive, lubricating oil, chain oil, hydraulic oil, used oi). Equipment (lathe) peeled the de-barked logs into veneer for plywood sheets, dried the veneer, applied the glue, and pressed the veneer into plywood sheets that were trimmed for product and shipped off-site by truck and rail. Approximately 15-foot deep pits were located beneath the two hydraulic presses. An approximately 15-foot deep pit was located beneath the lathe in the northeast corner of the plant. Marine-grade plywood was once manufactured but the details of the process are unknown. Drums and totes of hydraulic oil and lubricating oil were stored near the lathe pit on the northeastern portion of the plant and in a storage room at the northwestern portion of the plant. Resin, adhesive, and adhesive/water mixtures were stored on the eastern edge of the plant.	A large number of soil and groundwater samples have been collected in the vicinity of the plywood plant. Samples collected on the western portion of the plywood plant area have shown no evidence of impacts above MTCA cleanup levels in soil or groundwater (Parametrix 2008; Landau 2013b; Landau 2015). This included groundwater samples that have been analyzed for SVOCs including phenols consistent with the chemical used in the manufacturing of marine-grade and exterior-grade plywood. Elevated concentrations of diesel range and oil range petroleum hydrocarbons have been detected in soil and groundwater samples collected in the eastern portion of the plywood plant, especially in the northeast corner adjacent to the lathe pit (Parametrix 2008; Landau, 2013b; Landau, 2015). The plywood plant was identified as potential environmental concern and as a data gap in the Landau Phase I ESA and the data review memo (Landau 2013a, Landau 2013c. Fourteen soil borings were completed to depths ranging from 14-25 feet bgs near the lathe pit. An additional 16 soil borings were completed to depths ranging from 9-25 feet bgs and three surface soil samples were collected in other areas around the Plywood Plant. 39 soil samples were collected at depths ranging from 1.5-23 feet bgs and analyzed for one or more of the following: TPHs, BTEX, metals, VOCs, SVOCs, and PCBs. Benzene exceeded MTCA cleanup levels in one duplicate sample. Motor oil exceeded MTCA cleanup levels in four samples. Soil samples collected below two of the samples with motor oil exceedances were less	Complete additional investigation of soil and groundwater to define the magnitude and extent of impacted soil and groundwater in the northeast corner of the plywood plant.	**<u>Focused sampling (delineate extent of impacts):</u>** define the extent of petroleum impacted soil and groundwater at the northeast portion of the plywood plant by completing 3 soil borings near the lathe pit; collect soil samples as described in Table 2.	• TPH – Dx • SVOCs
			Potential exists for a release of petroleum constituents or adhesives near the former press pits and at the resin storage area.	**<u>Focused sampling (operational features):</u>** evaluate soil quality near the former press pits and resin storage areas by completing 3 soil borings through the concrete floor; collect soil samples as described in Table 2.	• TPH – Dx • SVOCs • Metals
			Determine the extent of impacted soil as previously identified by sampling near location SS-5.	**<u>Focused sampling (delineate extent of impacts):</u>** determine the extent of potentially impacted soil near SS-5 by completing 1 soil boring through the concrete floor; collect soil samples as described in Table 2.	• TPH – Dx • TPH – Gx • BTEX and fuel additives • Metals • SVOCs

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		than screening criteria. Chromium and PAHs exceeded MTCA cleanup levels in surface soil sample SS-5 at 2 feet bgs.Two soil borings were completed to a depth of 20 feet bgs near the VAT building east of the plywood plant. Two soil samples were collected at depths ranging from 5-16 feet bgs and analyzed for one or more of the following: diesel range TPH, gasoline range TPH, metals, VOCs, and SVOCs. Motor oil exceeded the MTCA cleanup levels in one sample. The remaining samples were below MTCA cleanup levels for SVOCs, VOCs, metals, and PCBs.	Potential exists for impacts to soil in the SE corner of the plywood plant from used oil storage.	**Focused sampling (operational features):** evaluate potential impacts to soil from used oil storage by completing 1 soil boring; collect soil samples as described in Table 2.	• TPH – Dx • TPH – Gx • BTEX and fuel additives • Metals • SVOCs
Equalization Pond **(AOC 21)** Figure 22	The equalization pond was constructed south of the plywood plant and received veneer dryer wash water, ESP blowdown, steam system condensate, and adhesive system wash water from the plywood plant and non-contact cooling water from the log utilization center. Discharge from the equalization pond went to the City of Yakima POTW (under a State Disposal System Permit since at least 1997). The pond was reportedly dredged annually with the dredged material dewatered and sent to a permitted landfill. The pond was filled after operations ceased.	Two soil borings were completed to a depth of 20 feet bgs (FPP-B20, FPP-B24) and one groundwater monitoring well was installed (FPP-MW-3) at and nearby the former equalization pond during the 2013 Landau Phase II. Three soil samples were collected at depths ranging from 10-16.5 feet bgs and analyzed for one or more of the following: TPHs, BTEX, metals, VOCs, SVOCs, PCBs, and hexavalent chromium. Detected concentrations in soil were less than MTCA cleanup levels. Two surface water samples were collected during the 2008 Parametrix Phase II and analyzed for diesel range TPH, motor oil range TPH gasoline range TPH, BTEX, metals, VOC, PCBs, SVOCs, and lead. Diesel and motor oil range TPH were detected at concentrations greater than MTCA cleanup levels in the surface water in both samples. Well FPP-MW-03 was placed downgradient of the former equalization pond in the 2013 Landau Phase II as described above. A sample collected in 2013 had low levels of diesel range TPH but no detectable concentrations have been present in more recent samples. The equalization pond was identified as a data gap in the Landau data review memo (Landau 2013c).	Potential exists for soil fill, pond bottoms and underlying soils to be impacted by site operations associated with use of the former equalization pond.	**Focused sampling (operational feature):** evaluate soil and fill quality by competing 1 soil boring in the former pond; collect soil samples as described in Table 2.	• TPH – Dx • TPH – Gx • BTEX and fuel additives • Metals • SVOCs • VOCs • Chlorinated Pesticides/Herbicides

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Plywood Transformers **(AOC 22)** Figure 22	Oil-filled transformers used for plywood plant operations were present at three locations: 1) east of the plywood plant, 2) southwest corner of the plywood plant, and 3) east of the barker building.	The potential for the release of PCBs and/or mineral oil from the plywood plant transformers was not identified as a REC, area of potential environmental concern, or a data gap in previous investigations and has not been investigated in previously	Previous Site operations have included the use of PCB-containing mineral oils in transformers and capacitors. While the majority of these units were previously removed, evaluation of soil quality has not occurred in all locations. The data gap is the potential for PCB-containing mineral oils to have been released to the ground surface adjacent to the transformers.	**Focused sampling (operational feature):** evaluate the potential for PCB-containing mineral oil impact to soils by completing 1 boring at each transformer location; collect soil samples as described in Table 2.	• TPH – Dx • PCBs
Barker Building **(AOC 23)** Figure 22	The plywood barker building was used to remove bark from the logs prior to cutting to length and soaking in hot water in the vat building and peeling of the logs for plywood veneer.	Six soil borings were completed at and near the former barker building to depths ranging from 15-25 feet bgs during the 2013 Landau Phase II. Five soil samples were collected from five soil borings at depths ranging from 14-16 feet bgs. Soil samples were analyzed for diesel range TPHs and metals. One soil sample was also analyzed for PCBs Two groundwater samples were collected from temporary wells placed in two borings. Groundwater samples were analyzed for diesel range TPHs and dissolved metals. Oil range TPH was detected at concentrations greater than the MTCA cleanup levels in one soil sample at 15-16 feet bgs. Arsenic and sodium were detected at concentrations greater than the MTCA cleanup levels in both groundwater samples, and oil range and diesel range TPH were detected at concentrations greater than the MTCA cleanup levels in the groundwater sample collected from one temporary well Petroleum staining was reported on the ground and floor surface within and outside of the barker building and elevated concentrations of petroleum constituents in soil and petroleum constituents, arsenic, iron, and manganese in groundwater have been detected at the barker building (Landau, 2013b; Landau, 2015). The barker building was not identified as a data gap in the Landau data summary memo (Landau 2013c). Liquid with petroleum sheen and odor on the ground surface southeast of the former plywood barker building at the plywood plant and staining on the floor of the building was identified as a REC in the Landau Phase I (Landau 2013a).	Delineate diesel and oil range petroleum impacts to soil and groundwater downgradient of petroleum impacts.	**Focused sampling (delineate extent of impacts):** evaluate Site soil and groundwater quality downgradient of the lathe pit by completing 1 boring with temporary well near eastern margin of the known petroleum impacts; collect soil samples as described in Table 2.	• TPH – Dx
			Potential exists for observed soil staining east of the Barker Building to have impacted site soils. Evaluate the soil for potential petroleum impacts at locations with concrete or asphalt staining within the barker building area. Collect samples at randomly spaced locations within the barker building operational area.	**Area-wide sampling:** evaluate Site soils for the presence of diesel and oil range petroleum hydrocarbon impacts to Site soils by completing 6 soil borings through the concrete floor and 1 soil boring in an area with oil staining outside of the building; collect soil samples as described in Table 2.	• TPH – Dx

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Area of Concern	Description	Previous Investigations	Data Gaps / Environmental Concerns	Sampling Approach[1]	COCs[2]
Southwest Area **(AOC 24)** Figure 23	The southwest area of the former mill property was in residential use or was vacant up until the plywood plant was constructed in about 1960. After plywood plant construction, portions of the area were used for truck parking and wood storage.	The southwest area was not identified as a REC, area of concern, or a data gap in previous investigations. Soil, soil gas and groundwater investigations have been conducted in the southwest area. Methane was not present in five gas probes located in the area. No metals or TPH were identified above levels of concern in the soil samples. Field logs from one boring indicated faint petroleum odors in soils. Groundwater sampling identified low and sporadic concentrations of endosulfan II, chloroform, and naphthalene.	Potential exists for impact to soils in gravel covered areas that may have been used for truck parking. This area was added as an AOC at the direction of Ecology.	**<u>Focused sampling (delineate extent of impacts):</u>** evaluate the potential for truck parking to have resulted in contaminated surface soils by completing 2 soil borings at the truck parking area; collect soil samples as described in Table 2. Well MW-100 is in the monitoring well network and will be sampled for groundwater COCs (AOC 25).	Soils • TPH – Dx • TPH – Gx • BTEX and fuel additives • Chlorinated Pesticides/Herbicides Groundwater • TPH – Dx • TPH – Gx • BTEX and fuel additives • Metals • SVOCs • VOCs Also analyze for non-COCs: NO_3 SO_4 Fe, Mn, TOC
Site wide Groundwater **(AOC 25)** Figure 24	An original network of four monitoring wells was installed to investigate the wood waste landfill in the mid-1990s. These wells were supplemented with an additional six monitoring wells during the 1997 hydrogeologic study of the Boise Cascade Mill and Plywood Plant required under the 1997 State Disposal System Permit. Of the original four landfill related wells, only MW-01 remains. All of the six monitoring wells installed in 1997 remain; however, MW-09 has been removed from use and was replaced in 2008 by MW-09A. Additional wells were added to the plywood plant parcel and triangular parcel during investigations by SLR (2009) and Landau (2013 and 2015). Except for one of these wells, all remain in use. Numerous wells have also been installed on and downgradient of the Landfill Site. While the existing network of groundwater monitoring wells provides a general understanding of groundwater conditions, the existing network does not provide sufficient monitoring points to define groundwater quality and gradients/direction of flow across the Site.	Total and dissolved iron and manganese concentrations above the secondary MCLs and low pH have been measured in monitoring well samples since the 1990s (Landau, 2015). Elevated arsenic was identified in groundwater samples during Site-wide groundwater monitoring in 2013 and 2014 and during completion of the Supplemental RI for the Landfill Site (Fulcrum, 2013; Landau, 2015). Monitoring identified petroleum-impacted groundwater in the TP-10 area by the LLM. Monitoring identified petroleum-impacted groundwater above MTCA cleanup levels on the eastern portion of the Triangular Parcel and in the northeastern portion of the plywood plant (diesel and oil). Downgradient extent is defined by several existing wells. The need for additional groundwater information was identified as a data gap in the Landau data summary memo (Landau 2013c) and metals in groundwater was identified as a REC in the Landau Phase I investigation (Landau 2013a).	The current monitoring well network and data set do not provide sufficient information to: • Evaluate conditions in the north, northwest, northeast and west portions of the Site, upgradient of current or former buildings and operations at the Site and to augment the groundwater data that has been collected since the 1990s. • Evaluate the geochemistry of the groundwater on the Site. • Measure iron, manganese, and arsenic concentrations in the former operation area north of the CBR tracks. • Measure the magnitude and extent of groundwater impacted by historical operations on the Site. • Evaluate the potential impact of Site groundwater on surface waters on the Site and the Yakima River east of the Site. • Evaluate the potential connectivity between impacted groundwater on the Site and domestic water supply wells located west of the Site. There is no information from previous investigations at the Site to assess whether the Yakima River is gaining or losing flow in the reach adjacent to the Site and whether groundwater from the northeastern portion of the Site flows to the River.	**<u>Area-wide sampling:</u>** evaluate Site groundwater by collecting groundwater samples from 21 monitoring wells located throughout the Site to assess groundwater quality and flow direction/gradient. Water level measuring gages will be placed in the Yakima River at three locations near the Site. These gages will be surveyed so that river elevations at the gage locations can be recorded during groundwater sampling events. River elevations recorded at the gage locations during groundwater sampling events will be used in conjunction with groundwater elevations measured during these sampling events to assess whether the River is gaining or losing flow and whether groundwater at the Site flows to the River.	• TPH – Dx • TPH – Gx • BTEX and fuel additives • Metals • SVOCs • VOCs Also analyze for non-COCs: NO_3 SO_4 Fe, Mn, TOC
Site wide Methane **(AOC 26)** Figure 25	Soil gas probes have been installed in the Landfill Site RI and for the City's right-of-way development planning but have not been installed at the Site to evaluate the potential for methane generation at the Mill Site from log yard materials, or under various conditions involving thickness of log yard materials, proximity to MSW, etc.	Soil gas probes have been installed in the vicinity of the plywood plant in the City's investigations of the Landfill Site and across a strip of the Site for the City's right-of-way investigation Elevated methane concentrations in soil gas have been measured at soil gas probes completed on the southern	Potential exists for the generation of methane from buried log yard materials. The source(s) (e.g., MSW, petroleum in soil and groundwater, log yard materials, or another source) and the presence and extent of the methane at the Site have	**<u>Area-wide sampling:</u>** evaluate soil gas conditions at the Site by collecting soil gas samples from 23 soil gas wells located throughout the Site to assess methane concentrations using a landfill gas analyzer; collect samples quarterly for 1 year; includes installation of 9 new soil gas monitoring wells and use of 14 existing	• Methane (also analyze for non-COCs: CO, O_2, CO_2, H_2S using landfill gas analyzer and 4-gas meter)

Table 1
Stage 1 Investigation and Sampling Rationale
Yakima Mill Site Remedial Investigation Work Plan
Yakima, Washington

Area of Concern	Description	Previous Investigations	Data Gaps / Environmental Concerns	Sampling Approach[1]	COCs[2]
		portion of the Site, primarily south of the CBR tracks (Parametrix, 2008; Landau, 2013b, Landau, 2015). Methane has been detected in the former Plywood Plant area at concentrations greater than the lower explosive limit in previous investigations associated with the Site (e.g., 2008 Parametrix Phase II, 2013 Landau Phase II) and investigations at the Site associated with the adjacent landfill (investigations completed by SLR and Landau since 2009). Methane generation has not been identified on the central and northern portions of the Site. Methane was not detected in the three northernmost gas probes placed for the City's right-of-way investigation. These probes were not identified as having been placed in log yard materials. Soil gas probes have not been installed at other locations with log yard materials across the Site. The need for additional soil gas/methane information was identified as a data gap by Landau (Landau 2013c) and the potential for methane generation from wood debris was identified as a REC in the Landau Phase II investigation (Landau 2013a).	not been determined.	soil gas wells (GP-3, GP-6, GP-10, GP-11, GP-23, GP-24, GP-25, GP-26, GP-32, GP-33, GP-34, GP-35, GP-36, GP-37).	
Machine Shop Pit **(AOC 27)** Figure 19	The 2003 URS Phase I Investigation identified a 1 to 2 foot deep pit in the northwest corner of a store room in the carpenter's shop located along the north wall of the machine shop. The pit contained oily sawdust. The lack of information regarding how the pit was closed and the lack of information on soil and groundwater in this area was considered a data gap in the Landau data review memo (Landau 2013c). Ecology requested that this pit be added as an AOC in comments to the December 2017 Final RI Work Plan.	No investigations have been conducted in the vicinity of the machine shop pit. The machine shop was identified as a data gap by Landau (Landau 2013) and as a potential environmental concern in the Landau Phase I (Landau 2013a).	This AOC was added at the direction of Ecology. Potential exists for releases from the pit into underlying soils.	**Focused sampling (operational features):** evaluate the potential for impacts to soil quality beneath the machine shop pit by advancing 2 soil borings, one immediately east of the pit and one immediately west of the pit, to evaluate soil quality; collect soil samples as described in Table 2.	• TPH – Dx • TPH – Gx • BTEX and fuel additives • Metals • SVOCs • VOCs

Footnote 1:

- Details on the sampling design and soil sampling intervals are provided in the SAP and Table 2, respectively

Footnote 2:

- **TPH-Dx** (includes heavy oil range) - analyzed by NWTPH-Dx/Dx Ext (with and without silica gel cleanup)
- **TPH-Gx** - analyzed by NWTWH-Gx
- **BTEX & Fuel Additives** (includes benzene; toluene; ethylbenzene; xylenes; EDB; EDC; MTBE; and lead) – BTEX, EDB, EDC, and MTBE analyzed by EPA Method 8260; lead analyzed by EPA Method 6020
- **Metals** (includes Cd; Cr_6; (soil only); Cu; Pb; Ni; Zn; Ag; and As) – Cd, Cu, Pb, Ni, Zn, Ag, As analyzed by EPA Method 6020; Cr_6 analyzed by EPA Method 7196
- **VOCs** (includes acetone; MEK; carbon tetrachloride; chloroform; methylene chloride; tetrachloroethene; trichloroethene; and vinyl chloride) – analyzed by EPA Method 8260
- **SVOCs** (includes bis(2-ethylhexyl)phthalate; butyl benzyl phthalate; naphthalene; pentachlorophenol; benzo(a)anthracene; benzo(a)pyrene; benzo(b)fluoranthene; chrysene; dibenz(a,h)anthracene; and indeno(1,2,3-cd)pyrene) – analyzed by EPA Method 8270
- **Chlorinated Pesticides** (includes 4,4´-DDD; 4,4´-DDE; 4,4´-DDT; aldrin; alpha BHC; alpha-Chlordane; beta BHC; delta BHC; dieldrin; endosulfan I; endosulfan II; endosulfan sulfate; endrin; endrin aldehyde; endrin ketone; gamma BHC (Lindane); gamma-Chlordane; heptachlor; heptachlor epoxide; methoxychlor; and toxaphene) – analyzed by EPA Method 8081
- **Chlorinated Herbicides** (includes 2,4,5-T; 2,4,5-TP (Silvex); 2,4-D; 2,4-DB; 3,5-Dichlorobenzoic acid; 4-Nitrophenol; acifluorfen; bentazon; chloramben; dacthal (DCPA); dalapon; dicamba; 2,4-DP; dinoseb; MCPA; MCPP; picloram) – analyzed by EPA Method 8151A
- **PCBs** (includes Aroclor 1016; Aroclor 1221; Aroclor 1232; Aroclor 1242; Aroclor 1248; Aroclor 1254; Aroclor 1260; Aroclor 1262; Aroclor 1268) – analyzed by EPA Method 8082

Non-COC analytes are also included in this column for completeness. The analytical methods are in the QAPP (Exhibit B)

Table 2
Stage 1 Soil Sampling Intervals
Yakima Mill Site Remedial Investigation Work Plan
Yakima, Washington

Area of Concern	Sampling Intervals	COCs[1]
Potential Wood Waste Landfill Remnant **(AOC 1)** Figure 13	**Fill:** • Soil o Uppermost 2 feet of native soil	• TPH – Dx • TPH – Gx • BTEX and fuel additives • Metals • VOCs • SVOCs • Chlorinated Pesticides/Herbicides
North First Lateral Drain **(AOC 2)** Figure 13	**Drainage Feature:** • Ditch Bottom Material o 0-1 feet bgs within the drain	• TPH-Dx • Metals
Equipment Boneyard **(AOC 3)** Figure 14	**Equipment Staging:** • Soil o 0-2 feet bgs o 5-7 feet bgs	• TPH – Dx • Metals • SVOCs • Chlorinated Pesticides/Herbicides (three locations)
Dry Kiln **(AOC 4)** Figure 15	**Roof Condensate:** • Soil o 0-2 feet bgs o 5-7 feet bgs	• TPH – Dx • TPH – Gx • BTEX and fuel additives • SVOCs
Kiln Ponds **(AOC 5)** Figure 15	**Pond Fill / Pond Bottoms:** o 0-2 feet bgs o 5-7 feet bgs o Pond bottoms o Uppermost 2 feet of native soil below pond bottoms	• TPH – Dx • TPH – Gx • BTEX and fuel additives • Metals • SVOCs • VOCs
North Log Pond Fill **(AOC 6)** Figure 16	**Fill:** • Soil o 0-2 feet bgs o 5-7 feet bgs within fill (if fill is present) o 13-15 feet bgs within fill (if fill is present) or above the water table, whichever is less o Uppermost 2 feet of native soil below fill (if less than 15 feet bgs)	• TPH – Dx • TPH – Gx • BTEX and fuel additives • Metals • SVOCs • Chlorinated Pesticides/Herbicides (four locations)
Recycle Pond **(AOC 7)** Figure 17	**Pond Bottoms:** • Soil o Uppermost 2 feet of pond bottoms o Uppermost 2 feet of native soil below pond bottoms	• TPH – Dx • TPH – Gx • BTEX and fuel additives • Metals • SVOCs • VOCs • Chlorinated Pesticides/Herbicides

Table 2
Stage 1 Soil Sampling Intervals
Yakima Mill Site Remedial Investigation Work Plan
Yakima, Washington

Area of Concern	Sampling Intervals	COCs[1]
Settling Pond **(AOC 8)** Figure 17	**<u>Pond Bottoms:</u>** • Soil o Uppermost 2 feet of pond bottoms o Uppermost 2 feet of native soil below pond bottoms	• TPH – Dx • TPH – Gx • BTEX and fuel additives • Metals • SVOCs • VOCs • Chlorinated Pesticides/Herbicides
Fruitvale Wasteway **(AOC9)** Figure 17	**<u>Culvert Discharge:</u>** • Soil o 0-2 feet bgs at the wasteway discharge o 3-5 feet bgs if in sediment	• TPH – Dx • TPH – Gx • BTEX and fuel additives • Metals • SVOCs • VOCs
Mill Transformers **(AOC 10)** Figures 15 & 18	**<u>Transformers:</u>** • Soil o 0-2 feet bgs	• TPH – Dx • PCBs
Large Log Sawmill (LLM) **(AOC 11)** Figure 18	**<u>Dry Well:</u>** • Soil o 2-foot interval at depth of dry well (visually identified) o 2-foot interval with highest field screening impacts, if impacts are identified o Uppermost non-impacted interval, or interval immediately above the water table, or 13-15 feet bgs, whichever is shallower	• TPH – Dx
	<u>LLM surface staining:</u> • Soil o Uppermost 2 feet beneath floor o 2-foot interval with highest field screening impacts, if impacts are identified o Uppermost non-impacted interval, or interval immediately above the water table, or 13-15 feet bgs, whichever is shallower	• TPH – Dx
Small Log Sawmill (SLM) **(AOC 12)** Figure 18	**<u>SLM surface staining:</u>** • Soil o Uppermost 2 feet beneath floor o 2-foot interval with highest field screening impacts, if impacts are identified o Uppermost non-impacted interval, or interval immediately above the water table, or 13-15 feet bgs, whichever is shallower	• TPH – Dx

Table 2
Stage 1 Soil Sampling Intervals
Yakima Mill Site Remedial Investigation Work Plan
Yakima, Washington

Area of Concern	Sampling Intervals	COCs[1]
	Used Oil Containers: • Soil o Uppermost 2 feet beneath asphalt o 2-foot interval with highest field screening impacts, if impacts are identified o Uppermost non-impacted interval, or interval immediately above the water table, or 13-15 feet bgs, whichever is shallower	• TPH – Dx • TPH – Gx • BTEX and fuel additives • SVOCs • Metals
	Storm Drains: • Soil o 2-foot interval at depth of storm drain o 2-foot interval with highest field screening impacts, if impacts are identified o Uppermost non-impacted interval, or immediately above the water table, or 13-15 feet bgs, whichever is shallower	• TPH – Dx
Boiler House **(AOC 13)** Figure 19	**Capacitor:** • Soil o 0-2 feet bgs	• TPH – Dx • PCBs
	Boiler Chemical Storage: • Soil o 0-2 feet bgs o 5-7 feet bgs	• Metals • SVOCs • VOCs
Hog Fuel Pile **(AOC 14)** Figure 19	**Hog Fuel Pile:** • Soil o 0-2 feet bgs o 5-7 feet bgs o 13-15 feet bgs or interval immediately above water table, whichever is shallower	• TPH – Dx • TPH – Gx • BTEX and fuel additives • Metals • SVOCs • VOCs • Chlorinated Pesticides/Herbicides
Paint, Machine, and Storage Shed **(AOC 15)** Figure 19	**Chemical Storage:** • Soil o 0-2 feet bgs o 5-7 feet bgs	• TPH – Dx • TPH – Gx • BTEX and fuel additives • Metals • SVOCs • VOCs • Chlorinated Pesticides/Herbicides

Table 2
Stage 1 Soil Sampling Intervals
Yakima Mill Site Remedial Investigation Work Plan
Yakima, Washington

Area of Concern	Sampling Intervals	COCs[1]
Fuel Distribution System **(AOC 16)** Figure 20	**Log Yard Fuel Dispensers:** - Soil o 0-2 feet bgs o 2-foot interval with highest field screening impacts, if impacts are identified o Uppermost non-impacted interval, or interval immediately above the water table, or 13-15 feet bgs, whichever is shallower	- TPH – Dx - TPH – Gx - BTEX and fuel additives
	Gasoline Dispenser: - Soil o 0-2 feet bgs o 2-foot interval with highest field screening impacts, if impacts are identified o Uppermost non-impacted interval, or interval immediately above the water table, or 13-15 feet bgs, whichever is shallower	- TPH – Dx - TPH – Gx - BTEX and fuel additives
	Diesel Fuel Dispenser: - Soil o 0-2 feet bgs o 2-foot interval with highest field screening impacts, if impacts are identified o Uppermost non-impacted interval, or interval immediately above the water table, or 13-15 feet bgs, whichever is shallower	- TPH – Dx - TPH – Gx - BTEX and fuel additives
	Distribution Piping: - Soil o 2-foot interval at depth of distribution piping (approximately 3-5 feet bgs) o 2-foot interval with highest field screening impacts, if impacts are identified o Uppermost non-impacted interval, or interval immediately above the water table, or 13-15 feet bgs, whichever is shallower	- TPH – Dx - TPH – Gx - BTEX and fuel additives
Mill Supply Warehouse and Auto Repair Shop **(AOC 17)** Figure 21	**Auto Repair Shop Surface Releases:** - Soil o 0-2 feet bgs o 5-7 feet bgs	- TPH – Dx - TPH – Gx - BTEX and fuel additives - Metals - SVOCs - VOCs

Table 2
Stage 1 Soil Sampling Intervals
Yakima Mill Site Remedial Investigation Work Plan
Yakima, Washington

Area of Concern	Sampling Intervals	COCs[1]
Oil House/ Service Pit **(AOC 18)** Figure 21	**Oil Storage:** • Soil o 0-2 feet bgs o 5-7 feet bgs	• TPH – Dx • TPH – Gx • BTEX and fuel additives • Metals • SVOCs • VOCs
Log Yard Shop **AOC 19)** Figure 21	**Chemical Use/Storage:** • Soil o 0-2 feet bgs o 5-7 feet bgs o 13-15 feet bgs (if fill is present)	• TPH – Dx • TPH – Gx • BTEX and fuel additives • Metals • SVOCs • VOCs
Plywood Plant **(AOC 20)** Figure 22	**Lathe Pit:** • Soil o 13-15 feet bgs (approximate depth of bottom of lathe pit)	• TPH – Dx • SVOCs
	Press Pits and Resin Storage Area: • Soil o 0-2 feet bgs o 5-7 feet bgs o 13-15 feet bgs	• TPH – Dx • SVOCs • Metals
	Data Gap from previous sample SS-5: • Soil o 0-2 feet bgs o 5-7 feet bgs	• TPH – Dx • TPH – Gx • BTEX and fuel additives • Metals • SVOCs
	Used Oil Storage: • Soil o 0-2 feet bgs o 5-7 feet bgs	• TPH – Dx • TPH – Gx • BTEX and fuel additives • Metals • SVOCs
Equalization Pond **(AOC 21)** Figure 22	**Pond Fill / Pond Bottoms:** • Soil o 0-2 feet bgs o 5-7 feet bgs o Pond bottoms o Uppermost 2 feet of native soil below pond bottoms	• TPH – Dx • TPH – Gx • BTEX and fuel additives • Metals • SVOCs • VOCs • Chlorinated Pesticides/Herbicides
Plywood Transformers **(AOC 22)** Figure 22	**Transformers:** • Soil o 0-2 feet bgs	• TPH – Dx • PCBs

Table 2
Stage 1 Soil Sampling Intervals
Yakima Mill Site Remedial Investigation Work Plan
Yakima, Washington

Area of Concern	Sampling Intervals	COCs[1]
Barker Building **(AOC 23)** Figure 22	**Downgradient of lathe pit:** • Soil o 0-2 feet bgs o 2-foot interval with highest field screening impacts, if impacts are identified o Uppermost non-impacted interval, or interval immediately above the water table, or 13-15 feet bgs, whichever is shallower	• TPH – Dx
	Oil use/staining: • Soil o 0-2 feet bgs o 2-foot interval with highest field screening impacts, if impacts are identified o Uppermost non-impacted interval, or interval immediately above the water table, or 13-15 feet bgs, whichever is shallower	• TPH – Dx
Southwest Area **(AOC 24)** Figure 23	**Truck Parking:** • Soil o 0-2 feet bgs o 5-7 feet bgs o 13-15 feet bgs	• TPH – Dx • TPH – Gx • BTEX and fuel additives • Chlorinated Pesticides/Herbicides
Machine Shop Pit **(AOC 27)** Figure 19	**Pit:** • Soil o 0-2 feet bgs o 5-7 feet bgs	• TPH – Dx • TPH – Gx • BTEX and fuel additives • Metals • SVOCs • VOCs

Footnote 1:

- **TPH-Dx** (includes heavy oil range) - analyzed by NWTPH-Dx/Dx Ext (with and without silica gel cleanup)
- **TPH-Gx** - analyzed by NWTWH-Gx
- **BTEX & Fuel Additives** (includes benzene; toluene; ethylbenzene; xylenes; EDB; EDC; MTBE; and lead) – BTEX, EDB, EDC, and MTBE analyzed by EPA Method 8260; lead analyzed by EPA Method 6020
- **Metals** (includes Cd; Cr_6 ; Cu; Pb; Ni; Zn; Ag; and As) – Cd, Cu, Pb, Ni, Zn, Ag, As analyzed by EPA Method 6020; Cr_6 analyzed by EPA Method 7196
- **VOCs** (includes acetone; MEK; carbon tetrachloride; chloroform; methylene chloride; tetrachloroethene; trichloroethene; and vinyl chloride) – analyzed by EPA Method 8260
- **SVOCs** (includes bis(2-ethylhexyl)phthalate; butyl benzyl phthalate; naphthalene; pentachlorophenol; benzo(a)anthracene; benzo(a)pyrene; benzo(b)fluoranthene; chrysene; dibenz(a,h)anthracene; and indeno(1,2,3-cd)pyrene) – analyzed by EPA Method 8270
- **Chlorinated Pesticides** (includes 4,4´-DDD; 4,4´-DDE; 4,4´-DDT; aldrin; alpha BHC; alpha-Chlordane; beta BHC; delta BHC; dieldrin; endosulfan I; endosulfan II; endosulfan sulfate; endrin; endrin aldehyde; endrin ketone; gamma BHC (Lindane); gamma-Chlordane; heptachlor; heptachlor epoxide; methoxychlor; and toxaphene) – analyzed by EPA Method 8081

- **Chlorinated Herbicides** (includes 2,4,5-T; 2,4,5-TP (Silvex); 2,4-D; 2,4-DB; 3,5-Dichlorobenzoic acid; 4-Nitrophenol; acifluorfen; bentazon; chloramben; dacthal (DCPA); dalapon; dicamba; 2,4-DP; dinoseb; MCPA; MCPP; picloram) – analyzed by EPA Method 8151A
- **PCBs** (includes Aroclor 1016; Aroclor 1221; Aroclor 1232; Aroclor 1242; Aroclor 1248; Aroclor 1254; Aroclor 1260; Aroclor 1262; Aroclor 1268) – analyzed by EPA Method 8082

Non-COC analytes not shown on this table

Table 3 Sample containers, preservation, and holding times – Soil*

Parameter	Matrix	Weight of Sample (g)	Container^	Preservative	Holding Time
TPH-Gx: Gasoline	Soil	5, 10, or 25	2-40 mL VOA vials with Teflon septum cap collected by field coring device kit	Cool, ≤ 6 °C, 1:1 w/chemical preservation (e.g., methanol, sodium bisulfate). Additional unpreserved for %moisture if preservation used	Analyze within 14 Days
TPH-Dx: Diesel and Heavy Oil	Soil	Full, no headspace	4 oz. jar w/ PTFE-lined lid	Cool, ≤ 6 °C	Extract within 14 Days / Analyze within 40 Days of Extraction
VOCs	Soil	5, 10, or 25	2-40 mL VOA vials with Teflon septum cap collected by field coring device kit	Cool, ≤ 6 °C, 1:1 w/chemical preservation (e.g., methanol, sodium bisulfate). Additional unpreserved for %moisture if preservation used	Analyze within 14 Days
SVOCs	Soil	Full, no headspace	4 oz. jar w/ PTFE-lined lid	Cool, ≤ 6 °C	Extract within 14 Days / Analyze within 40 Days of Extraction
Metals	Soil	Full, no headspace	4 oz. jar w/ PTFE-lined lid	None	Analyze within 6 months
Hexavalent Chromium	Soil	Full, no headspace	4 oz. jar w/ PTFE-lined lid	Cool, ≤ 6 °C	Analyze within 28 days
PCBs	Soil	Full, no headspace	4 oz. jar w/ PTFE-lined lid	Cool, ≤ 6 °C	None
Chlorinated Pesticides/Herbicides	Soil	Full, no headspace	4 oz. jar w/ PTFE-lined lid	Cool, ≤ 6 °C	Extract within 14 Days / Analyze within 40 Days of Extraction

* Containers are the same for soil and sediment sampling

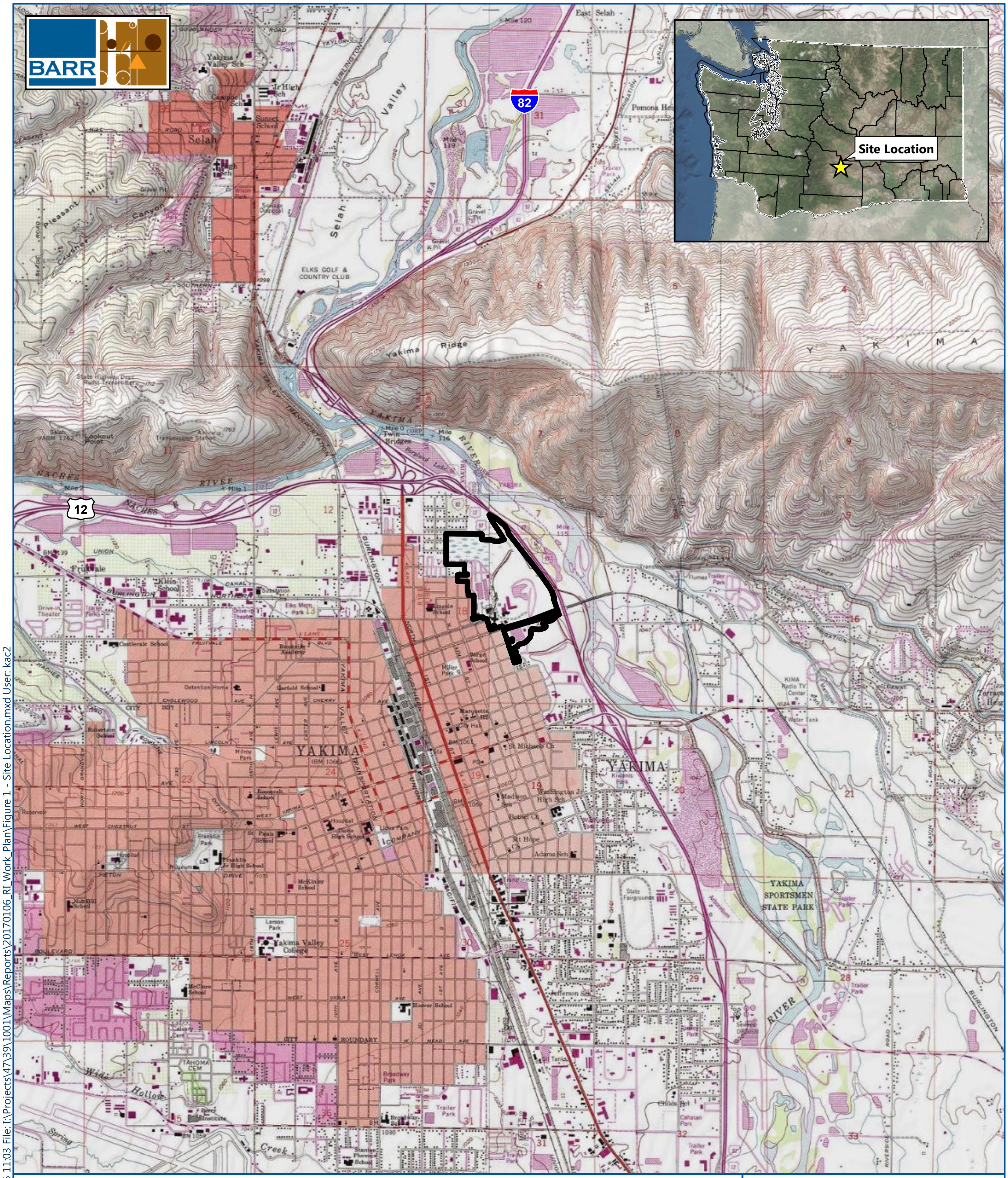
^ Sample volume noted. Additional volume will be required for laboratory QC.

Table 4 Sample containers, preservation, and holding times – Water*

Parameter	Matrix	Size and Number of Containers	Container	Preservative	Holding Time
TPH-Gx: Gasoline	Water	3-40 mL	VOA glass vials, Teflon septum cap	HCl, pH < 2, Zero Headspace; Cool, ≤ 6 °C	Analyze within 14 Days, 7 Days if pH > 2
TPH-Dx: Diesel and Heavy Oil	Water	1 L	Amber glass, Teflon septum cap	Cool, ≤ 6 °C	Analyze within 7 Days / Analyze within 40 Days of Extraction
VOCs	Water	3-40 mL	VOA glass vials, Teflon septum cap	HCl, pH < 2, Zero Headspace; Cool, ≤ 6 °C	Analyze within 14 Days, 7 Days if pH > 2
SVOCs	Water	2 L	Amber glass, Teflon septum cap	Cool, ≤ 6 °C	Analyze within 7 Days / Analyze within 40 Days of Extraction
Metals (collect field filtered and unfiltered)	Water	500 mL	Polyethylene	HNO3, pH < 2	Analyze within 6 months
Anion Parameters: Nitrate, Sulfate	Water	250 mL	Polyethylene	Cool, ≤ 6 °C	**Nitrate: Analyze within 48 hours** Sulfate: Analyze within 28 days
TOC	Water	250 mL	Amber glass	H_2SO_4, protect from sunlight; Cool, ≤ 6 °C	Analyze within 28 days

*Water containers are the same for groundwater and surface water sampling

Figures



▭ Yakima Mill Site Boundary

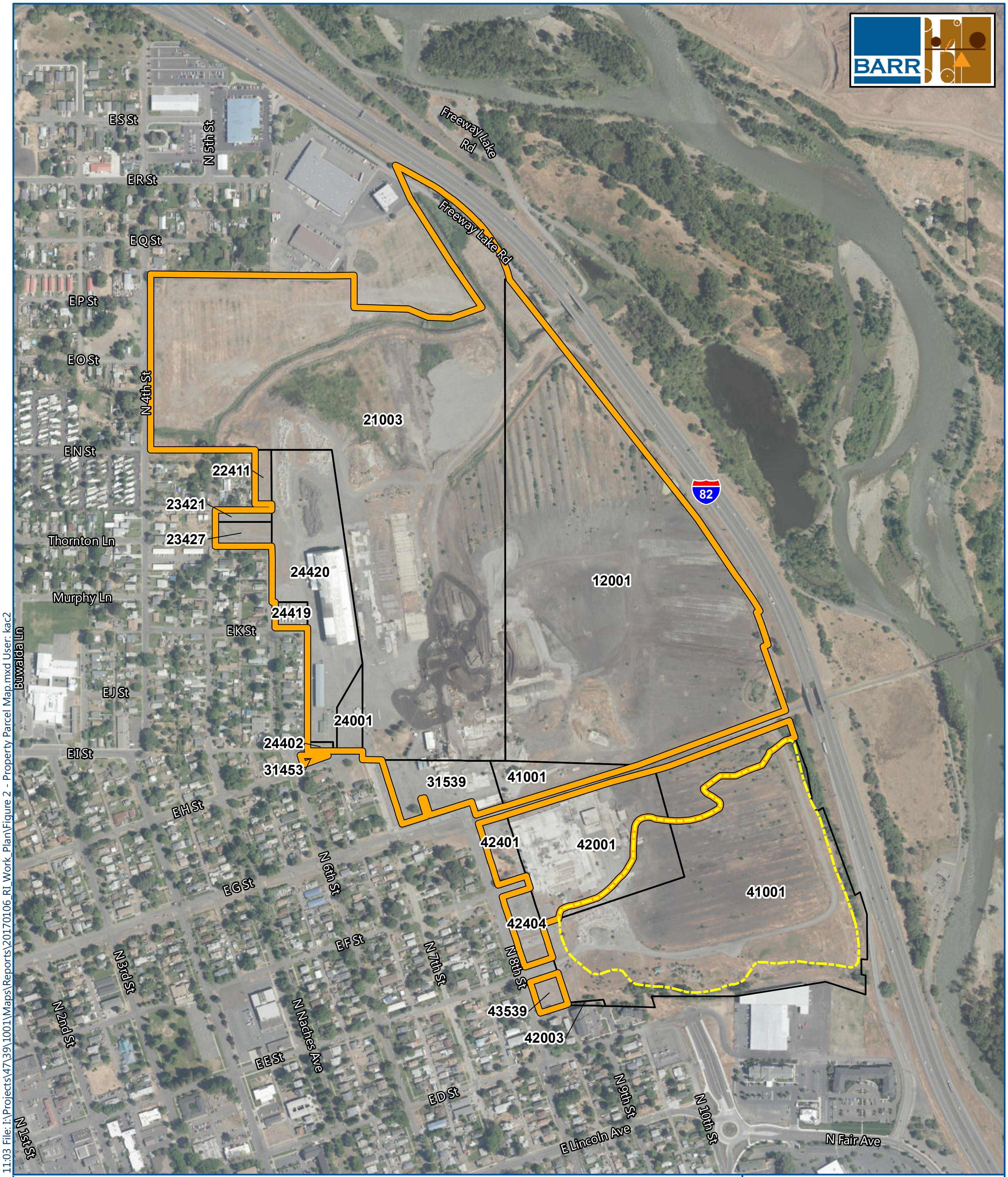
Background Data: USGS 24k Quad (Copyright:© 2013 National Geographic Society, i-cubed); Aerial Imagery (Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community)

N

0 4,000 8,000
Feet

SITE LOCATION
Revised Final RI Work Plan-
January 2019
Yakima Mill Site
Yakima, WA

FIGURE 1



▭ Yakima Mill Site Boundary (Site)

▭ Approximate Extent of Municipal Solid Waste (Landfill Site)

▭ Tax Parcel Boundary and Parcel Number (191318-XXXXX)

Background Aerial Imagery Source: City of Yakima (June 2017)

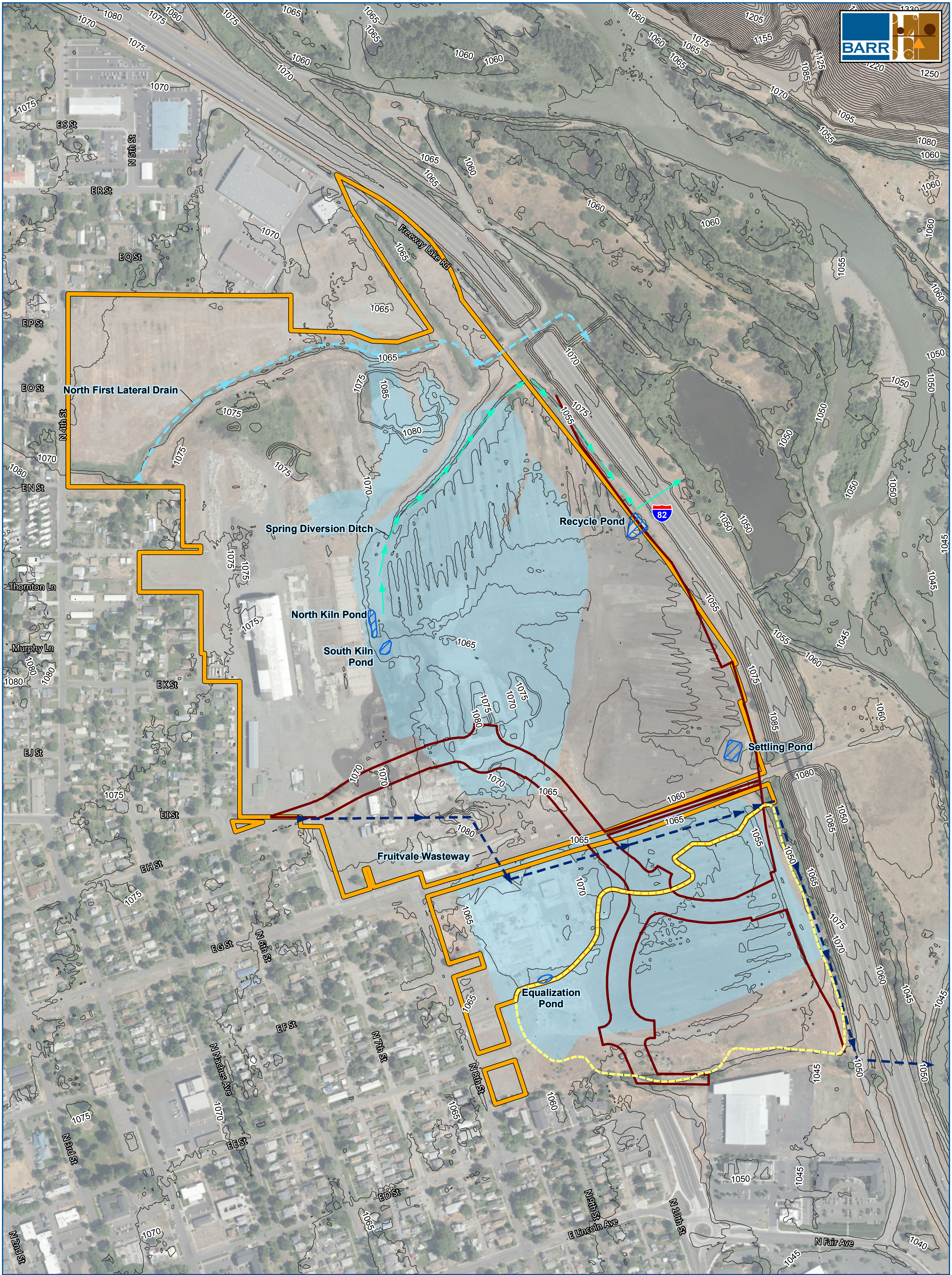
N

0 700 1,400
Feet

PROPERTY PARCEL MAP
Revised Final RI Work Plan-
January 2019
Yakima Mill Site
Yakima, WA

FIGURE 2

Barr Footer: ArcGIS 10.6, 2018-12-26 11:04 File: I:\Projects\47\39\1001\Maps\Reports\20170106_RI_Work_Plan\Figure 3 - Site Layout.mxd User: kac2



▭	Yakima Mill Site Boundary
▭	Approximate Extent of Municipal Solid Waste (Landfill Site)
▨	Former Mill Operation Ponds
▨	Historical Log Pond Extent (1947)
- - -	Fruitvale Wasteway
- - -	North First Lateral Drain
- - -	Spring Diversion Ditch
~	5ft Contour (Puget Sound LiDAR Consortium (PSLC), 2005)
—	Proposed Roadway Right-of-Way

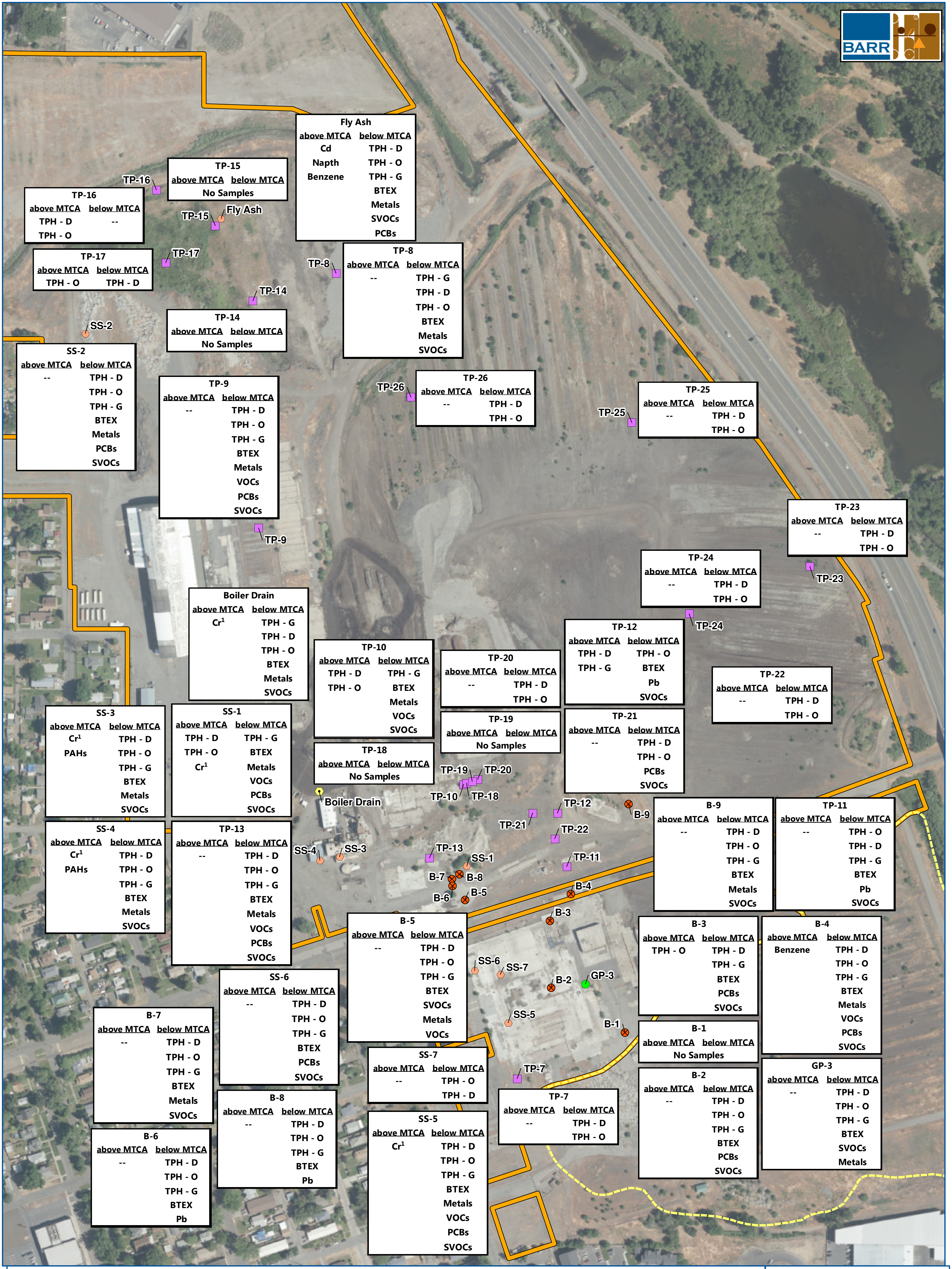
Note: Log yard material recovery has resulted in changes in topography relative to 2005 survey.

0 450 900
Feet

Background Aerial Imagery Source:
City of Yakima (June 2017)

SITE LAYOUT
Revised Final RI Work Plan-
January 2019
Yakima Mill Site
Yakima, WA

FIGURE 3



Yakima Mill Site Boundary

Approximate Extent of Municipal Solid Waste (Landfill Site)

Sampling Locations

- Soil Boring
- Soil Gas
- Soil Sample
- Surface Soil Sample
- Test Pit

Note: Soil sample concentrations compared to MTCA Method A, MTCA Method B cleanup levels or screening levels.

¹ Cr not speciated but compared to MTCA Cr(6) CUL.

Background Aerial Imagery Source: City of Yakima (June 2017)

0 300 600

Feet

HISTORICAL SOIL SAMPLING RESULTS - PARAMETRIX 2008
Revised Final RI Work Plan-
January 2019
Yakima Mill Site
Yakima, WA

FIGURE 4

▭ Yakima Mill Site Boundary

▭ Approximate Extent of Municipal Solid Waste (Landfill Site)

Sampling Locations

◆ Surface Water Sampling Location

⌖ Groundwater Sampling Location

Note: Soil sample concentrations compared to MTCA Method A, MTCA Method B cleanup levels or screening levels.

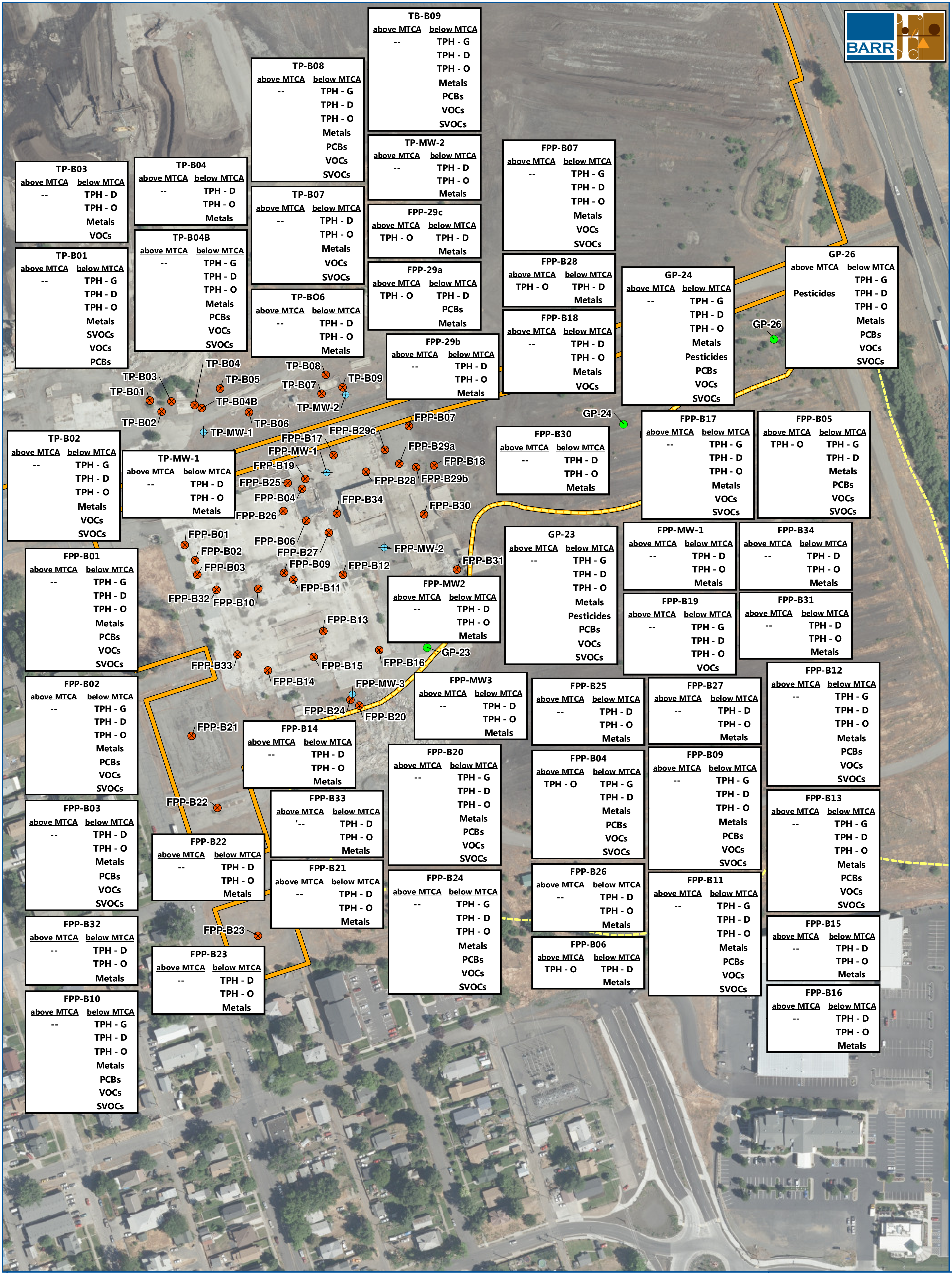
Background Aerial Imagery Source:
City of Yakima (June 2017)

N

0 350 700
Feet

HISTORICAL SURFACE WATER AND GROUNDWATER SAMPLING RESULTS - PARAMETRIX 2008
Revised Final RI Work Plan-
January 2019
Yakima Mill Site
Yakima, WA

FIGURE 5



▭ Yakima Mill Site Boundary

▭ Approximate Extent of Municipal Solid Waste (Landfill Site)

Sampling Locations

⊗ Soil Boring

● Soil Gas

⊕ Well (Active)

Note: Soil sample concentrations compared to MTCA Method A, MTCA Method B cleanup levels or screening levels.

N

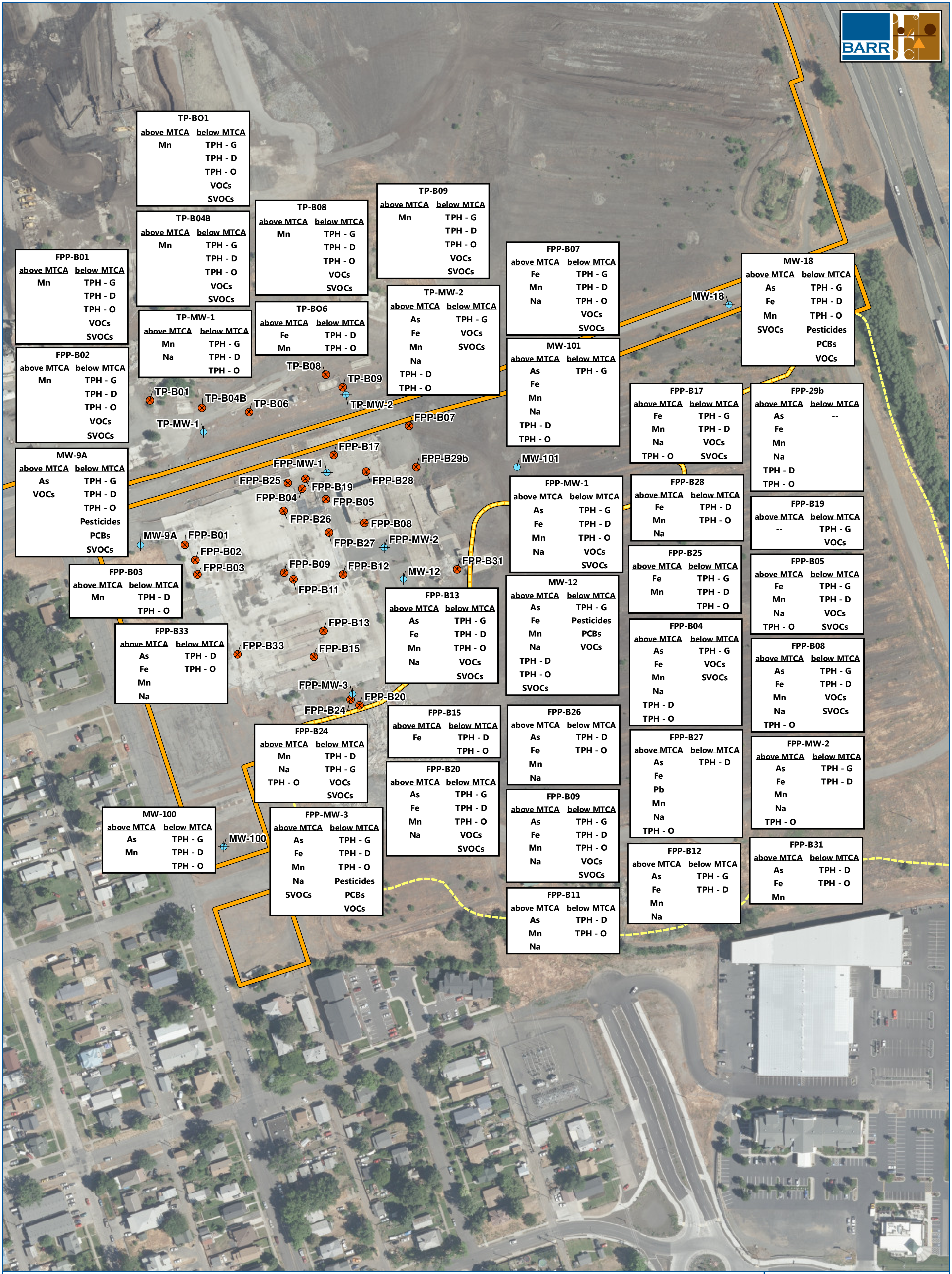
0 200 400

Feet

Background Aerial Imagery Source: City of Yakima (June 2017)

HISTORICAL SOIL SAMPLING RESULTS - LANDAU 2013-2015
Revised Final RI Work Plan-
January 2019
Yakima Mill Site
Yakima, WA

FIGURE 6



▭ Yakima Mill Site Boundary

▭ Approximate Extent of Municipal Solid Waste (Landfill Site)

Sampling Locations

⊗ Soil Boring

⌖ Well (Active)

Note: Soil sample concentrations compared to MTCA Method A, MTCA Method B cleanup levels or screening levels.

Background Aerial Imagery Source:
City of Yakima (June 2017)

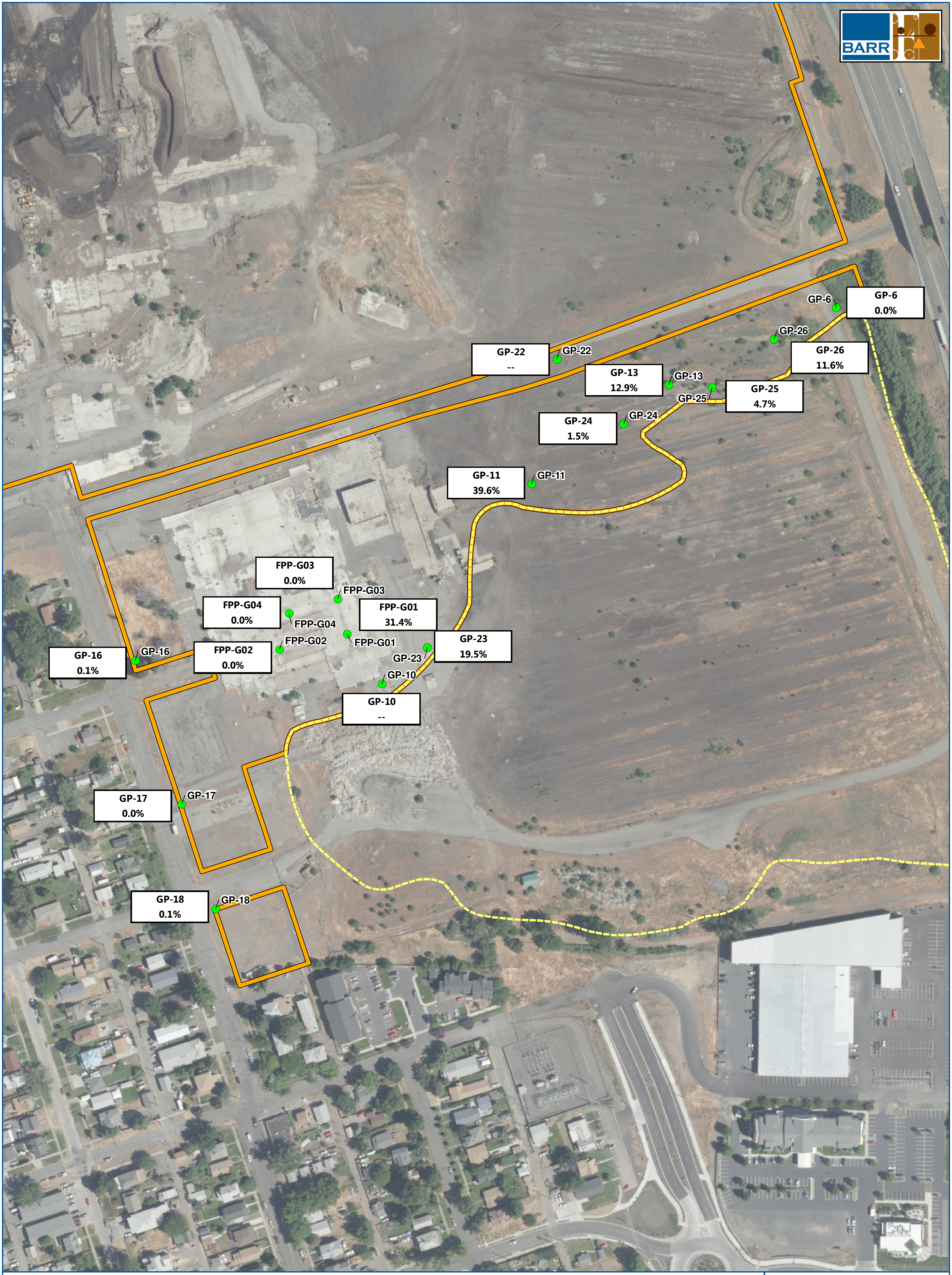
N

0 200 400
Feet

HISTORICAL GROUNDWATER SAMPLING RESULTS- LANDAU 2013-2015

Revised Final RI Work Plan-
January 2019
Yakima Mill Site
Yakima, WA

FIGURE 7



Background Aerial Imagery Source: City of Yakima (June 2017)

▭ Yakima Mill Site Boundary

▭ Approximate Extent of Municipal Solid Waste (Landfill Site)

Sampling Locations

● Soil Gas

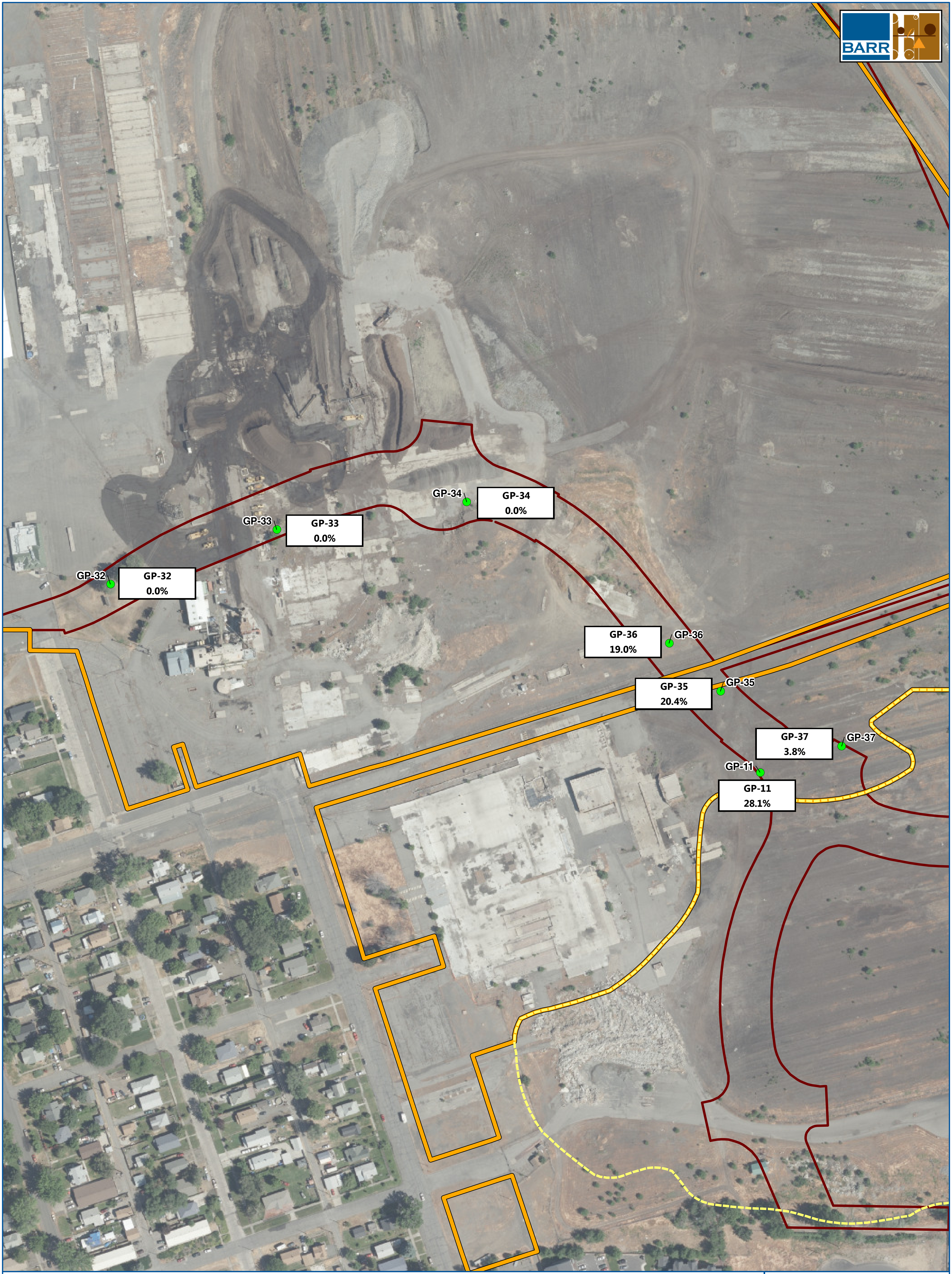
Note: Maximum methane concentration (%) from June 2013, January 2015 or June 2015 sampling events is shown.

0 200 400

Feet

HISTORICAL METHANE SAMPLING RESULTS- LANDAU 2013-2015
Revised Final RI Work Plan- January 2019
Yakima Mill Site
Yakima, WA

FIGURE 8



▭ Yakima Mill Site Boundary

▭ Approximate Extent of Municipal Solid Waste (Landfill Site)

— Proposed Roadway Right-of-Way

Sampling Locations

● Soil Gas

Note: Maximum methane concentration (%) from October 2016, November 2016, December 21, 2016 or December 29, 2016 sampling event is shown.

N

0 200 400
Feet

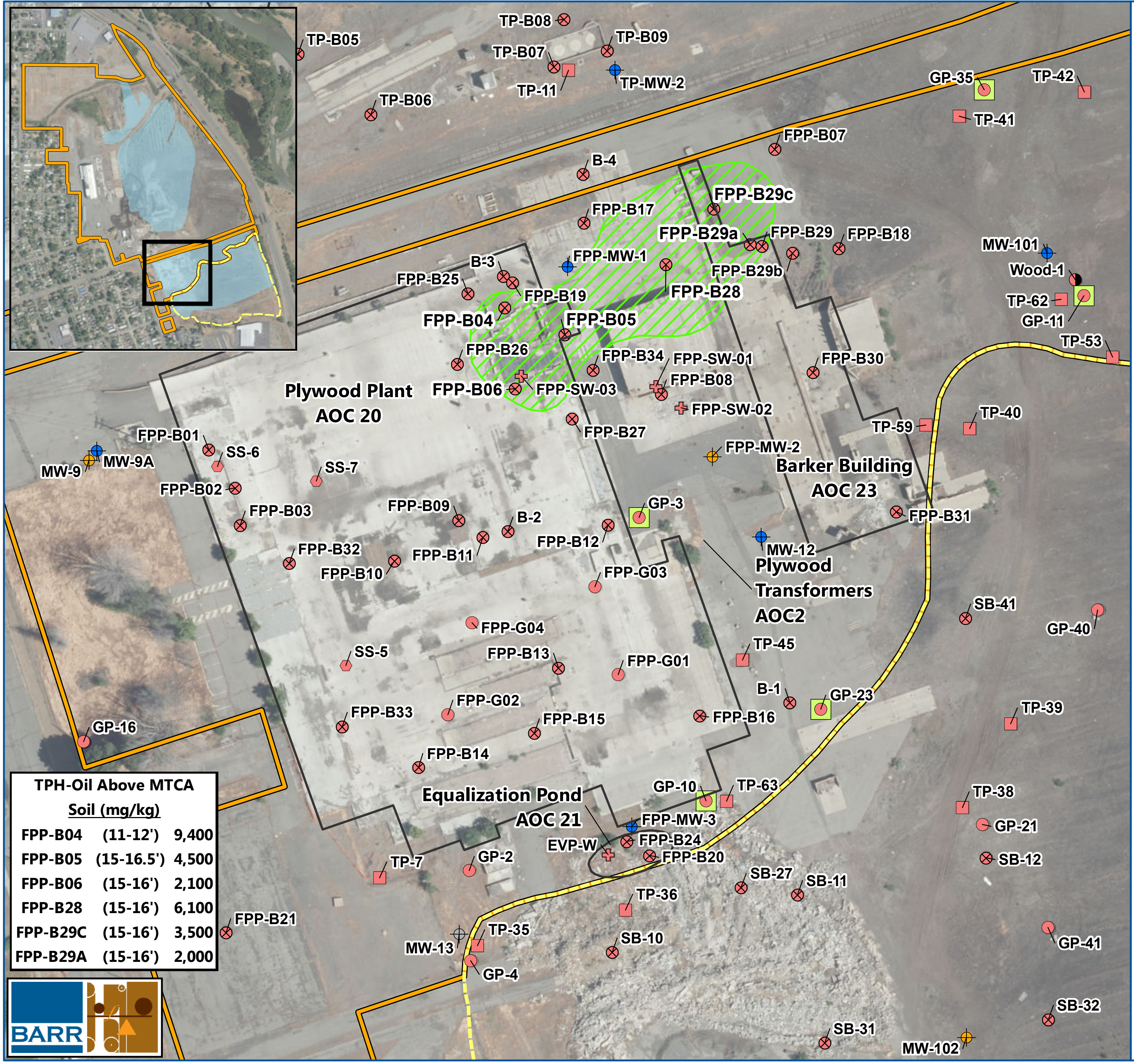
Background Aerial Imagery Source:
City of Yakima (June 2017)

METHANE SAMPLING RESULTS - LANDAU 2016

Revised Final RI Work Plan-
January 2019
Yakima Mill Site
Yakima, WA

FIGURE 9

Barr Footer: ArcGIS 10.6, 2018-12-26 11:14 File: I:\Projects\47\39\1001\Maps\Reports\20170106_RI_Work_Plan\Figure 10 - Extent of Soil Exceeding MTCA TPH Cleanup Levels - Plywood Plant Barker Building.mxd User: kac2



TPH-Oil Above MTCA Soil (mg/kg)

FPP-B04	(11-12')	9,400
FPP-B05	(15-16.5')	4,500
FPP-B06	(15-16')	2,100
FPP-B28	(15-16')	6,100
FPP-B29C	(15-16')	3,500
FPP-B29A	(15-16')	2,000

Yakima Mill Site Boundary

Approximate Extent of Municipal Solid Waste

Historical Log Pond Extent

Historical Site Feature

Est. TPH-Oil Concentration Above 2,000 mg/kg (MTCA CUL)

Previous Investigation Location
- ⊗ Soil Boring
- ● Soil Gas Point (Not Monitored in RI)
- ⬢ Surface Soil Sample
- ■ Test Pit
- ✚ Surface Water Sample
- ◐ Wood Waste Sample

Existing Well
- ⊕ Monitoring Well (To be Sampled in RI)
- ⊕ Well (Not Sampled in RI)
- ⊕ Monitoring Well (Abandoned)

N

0 120 240

Feet

Background Aerial Imagery Source:
City of Yakima (June 2017)

EXTENT OF SOIL EXCEEDING
MTCA TPH CLEANUP LEVELS -
PLYWOOD PLANT / BARKER
BUILDING
Revised Final RI Work Plan-
January 2019
Yakima Mill Site
Yakima, WA

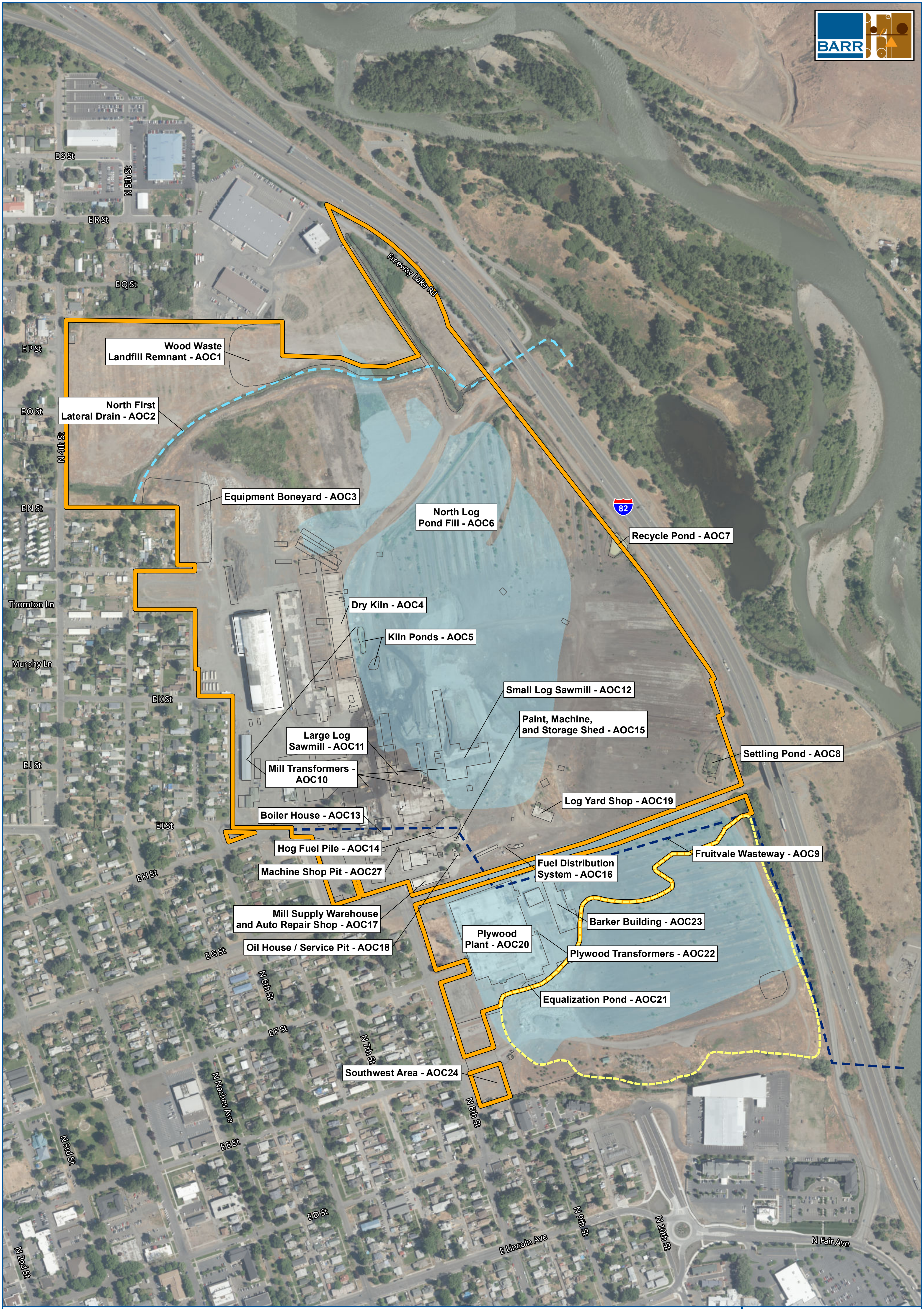
FIGURE 10

Results reported in **BOLD** are above the MTCA Method A Cleanup Level of 500 µg/L.

Background Aerial Imagery Source:
City of Yakima (June 2017)

TPH (DIESEL AND OIL RANGE) IN GROUNDWATER - LANDAU 2013-2015
Revised Final RI Work Plan-
January 2019
Yakima, WA

FIGURE 11

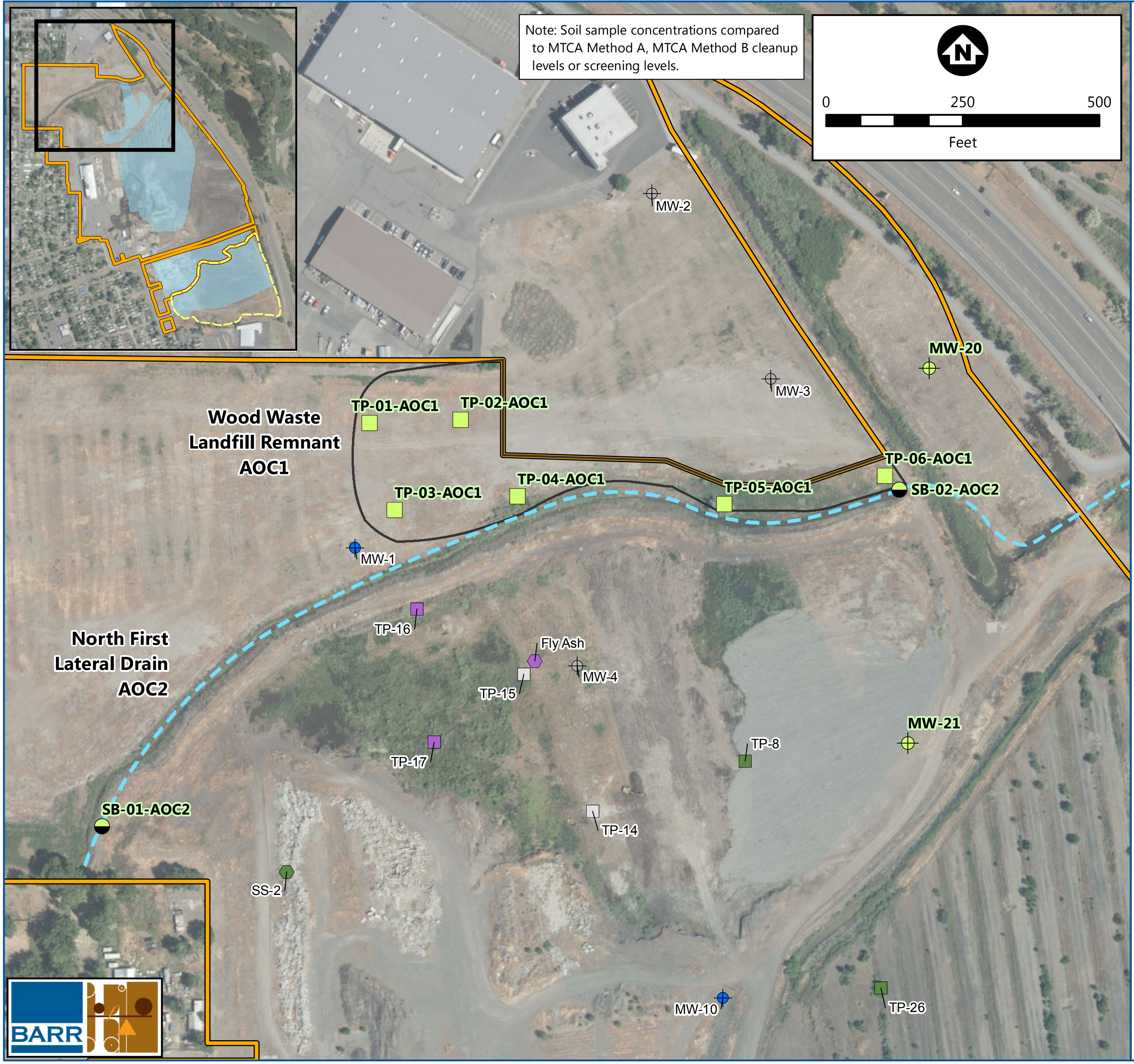


- ▭ Approximate Extent of Municipal Solid Waste (Landfill Site)
- ▭ Yakima Mill Site Boundary
- ● Historical Log Pond Extent
- ▭ Historical Site Feature
- --- Fruitvale Wasteway
- --- North First Lateral Drain

Background Aerial Imagery Source: City of Yakima (June 2017)

AREAS OF CONCERN
Revised Final RI Work Plan-
January 2019
Yakima Mill Site
Yakima, WA

FIGURE 12



Note: Soil sample concentrations compared to MTCA Method A, MTCA Method B cleanup levels or screening levels.

▭ Yakima Mill Site Boundary

▭ Approximate Extent of Municipal Solid Waste

Historical Log Pond Extent

▭ Historical Site Feature

- - North First Lateral Drain

Proposed Investigation Location

◓ Ditch Bottom Sample

⊕ Monitoring Well

🟩 Test Pit

Previous Investigation Location

⬡ Surface Soil Sample

☐ Test Pit

🟪 Location Above MTCA Cleanup Levels

🟩 Location Below MTCA Cleanup Levels

⬜ No Sample Collected

Existing Well

⊕ Monitoring Well (To be Sampled in RI)

⊕ Monitoring Well (Abandoned)

Background Aerial Imagery Source: City of Yakima (June 2017)

WOOD WASTE LANDFILL REMNANT AND NORTH FIRST LATERAL DRAIN
Proposed RI Investigation Locations
Revised Final RI Work Plan-
January 2019
Yakima Mill Site
Yakima, WA

FIGURE 13

Barr Footer: ArcGIS 10.6, 2018-12-26 11:16 File: I:\Projects\47\39\1001\Maps\Reports\20170106_RI_Work_Plan\Figure 14 - Equipment Boneyard Area.mxd User: kac2

Yakima Mill Site Boundary

Approximate Extent of Municipal Solid Waste

Historical Log Pond Extent

Historical Site Feature

Proposed Investigation Location

🟩 Test Pit

Location Above MTCA Cleanup Levels

Location Below MTCA Cleanup Levels

No Sample Collected

Note: Soil sample concentrations compared to MTCA Method A, MTCA Method B cleanup levels or screening levels.

N

0 100 200

Feet

Background Aerial Imagery Source:
City of Yakima (June 2017)

EQUIPMENT BONEYARD AREA
Proposed RI Investigation Locations
Revised Final RI Work Plan-
January 2019
Yakima Mill Site
Yakima, WA

FIGURE 14

Barr Footer: ArcGIS 10.6, 2018-12-26 11:15 File: I:\Projects\47\39\1001\Maps\Reports\20170106_RI_Work_Plan\Figure 15 - Dry Kiln Area.mxd User: kac2

Note: Soil sample concentrations compared to MTCA Method A, MTCA Method B cleanup levels or screening levels.

- ▭ Yakima Mill Site Boundary
- ▭ Approximate Extent of Municipal Solid Waste
- Historical Log Pond Extent
- ▭ Historical Site Feature

Proposed Investigation Location

- ⊗ Soil Boring
- ◆ Soil Boring and Temporary Well
- ■ Test Pit

Previous Investigation Location

- ☐ Test Pit
- ✣ Surface Water Sample
- 🟪 Location Above MTCA Cleanup Levels
- 🟩 Location Below MTCA Cleanup Levels
- ⬜ No Sample Collected

Existing Well

- ⊕ Monitoring Well (To be Sampled in RI)

N

0 100 200

Feet

Background Aerial Imagery Source:
City of Yakima (June 2017)

DRY KILN AREA
Proposed RI Investigation Locations
Revised Final RI Work Plan-
January 2019
Yakima Mill Site
Yakima, WA

FIGURE 15

Note: Soil sample concentrations compared to MTCA Method A, MTCA Method B cleanup levels or screening levels.

- ▭ Yakima Mill Site Boundary
- ▭ Approximate Extent of Municipal Solid Waste
- ▨ Historical Log Pond Extent
- ▭ Historical Site Features

Previous Investigation Location

- ⊗ Soil Boring
- ⊙ Soil Sample
- ○ Soil Gas Point (Not Monitored in RI)
- ▣ Soil Gas Point (To Be Monitored in RI)
- ○ Surface Soil Sample
- ☐ Test Pit
- ✚ Surface Water Sample
- 🟪 Location Above MTCA Cleanup Levels
- 🟩 Location Below MTCA Cleanup Levels
- ☐ No Sample Collected

Existing Well

- ⊕ Monitoring Well (To be Sampled in RI)
- ⊕ Well (Not Sampled in RI)
- ⊕ Monitoring Well (Abandoned)

Proposed Investigation Location

- ⊗ Soil Boring
- ◊ Soil Boring and Temporary Well
- ⊕ Monitoring Well
- 🟩 Test Pit

N

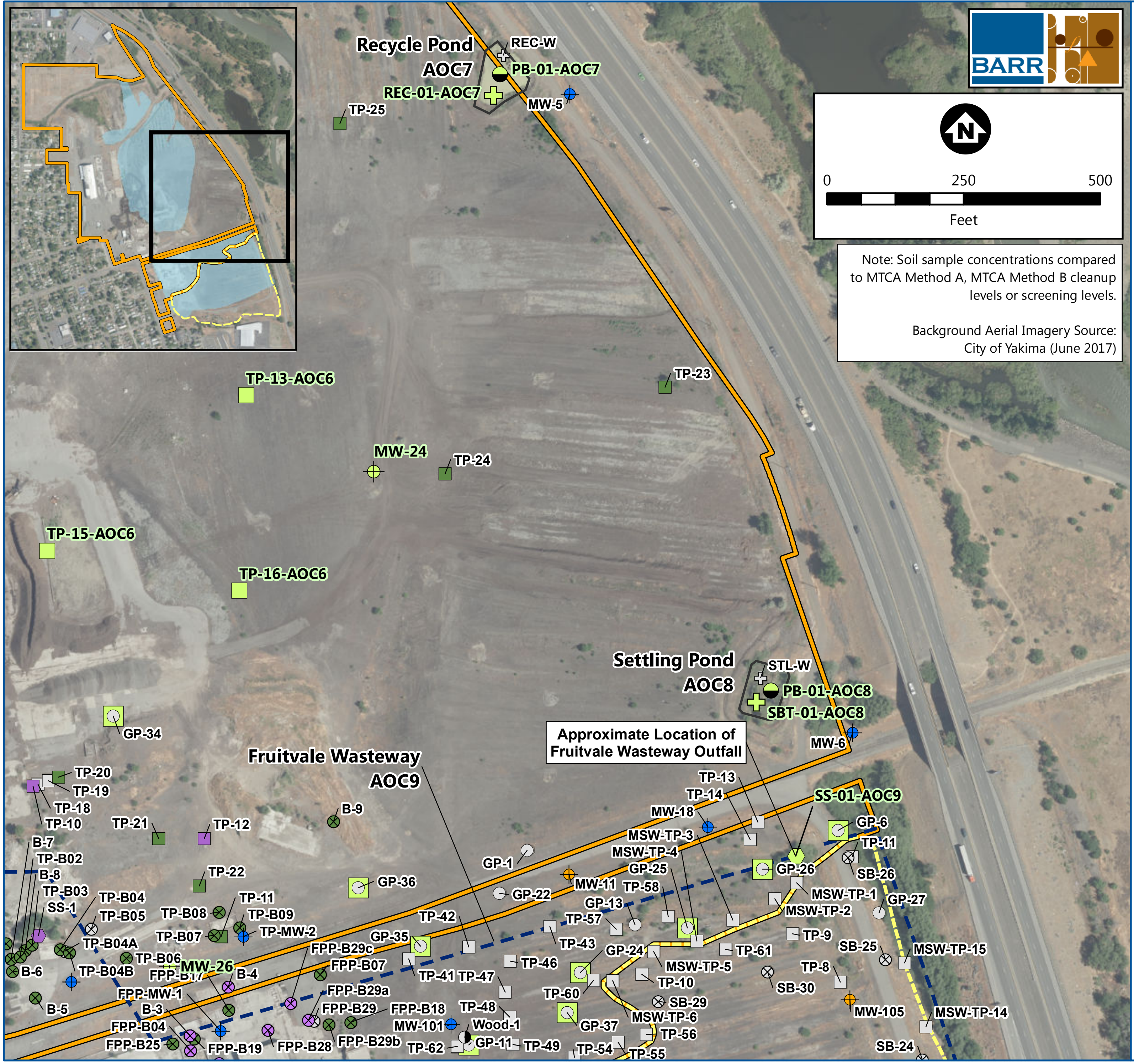
0 250 500

Feet

Background Aerial Imagery Source: City of Yakima (June 2017)

NORTH LOG POND FILL
Proposed RI Investigation Locations
Revised Final RI Work Plan-
January 2019
Yakima Mill Site
Yakima, WA

FIGURE 16



Note: Soil sample concentrations compared to MTCA Method A, MTCA Method B cleanup levels or screening levels.

Background Aerial Imagery Source: City of Yakima (June 2017)

▭ Yakima Mill Site Boundary

▭ Approximate Extent of Municipal Solid Waste

Historical Log Pond Extent

▭ Historical Site Feature

- - - Fruitvale Wasteway

Proposed Investigation Location

◒ Pond Bottom Sample

⬡ Surface Soil Sample

⊕ Monitoring Well

■ Test Pit

✚ Surface Water Sample

Previous Investigation Location

⊗ Soil Boring

○ Soil Gas Point (Not Monitored in RI)

◎ Soil Gas Point (To Be Monitored in RI)

⬡ Surface Soil Sample

☐ Test Pit

✚ Surface Water Sample

◐ Wood Waste Sample

🟪 Location Above MTCA Cleanup Levels

🟩 Location Below MTCA Cleanup Levels

⬜ No Sample Collected

Existing Well

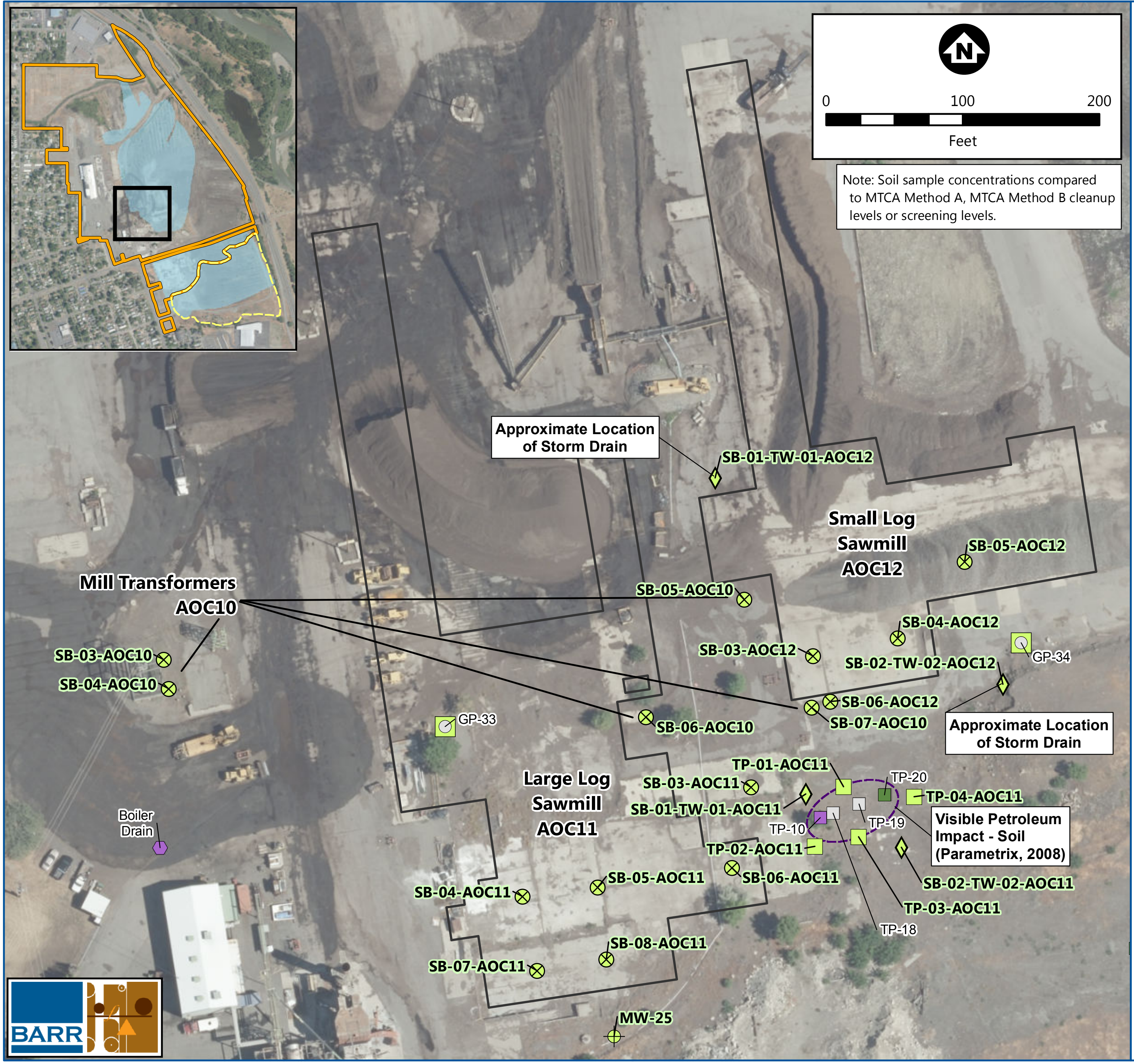
⊕ Monitoring Well (To be Sampled in RI)

⊕ Well (Not Sampled in RI)

RECYCLE AND SETTLING PONDS AND FRUITVALE WASTEWAY
Proposed RI Investigation Locations
Revised Final RI Work Plan-
January 2019
Yakima Mill Site
Yakima, WA

FIGURE 17

Barr Footer: ArcGIS 10.6, 2018-12-26 11:31 File: I:\Projects\47\39\1001\Maps\Reports\20170106_RI_Work_Plan\Figure 18 - Sawmill Area.mxd User: kac2



Note: Soil sample concentrations compared to MTCA Method A, MTCA Method B cleanup levels or screening levels.

▭	Yakima Mill Site Boundary
▭	Approximate Extent of Municipal Solid Waste
▨	Historical Log Pond Extent
▭	Historical Site Feature

Proposed Investigation Location

⊗	Soil Boring
◆	Soil Boring and Temporary Well
⊕	Monitoring Well
🟩	Test Pit

Previous Investigation Location

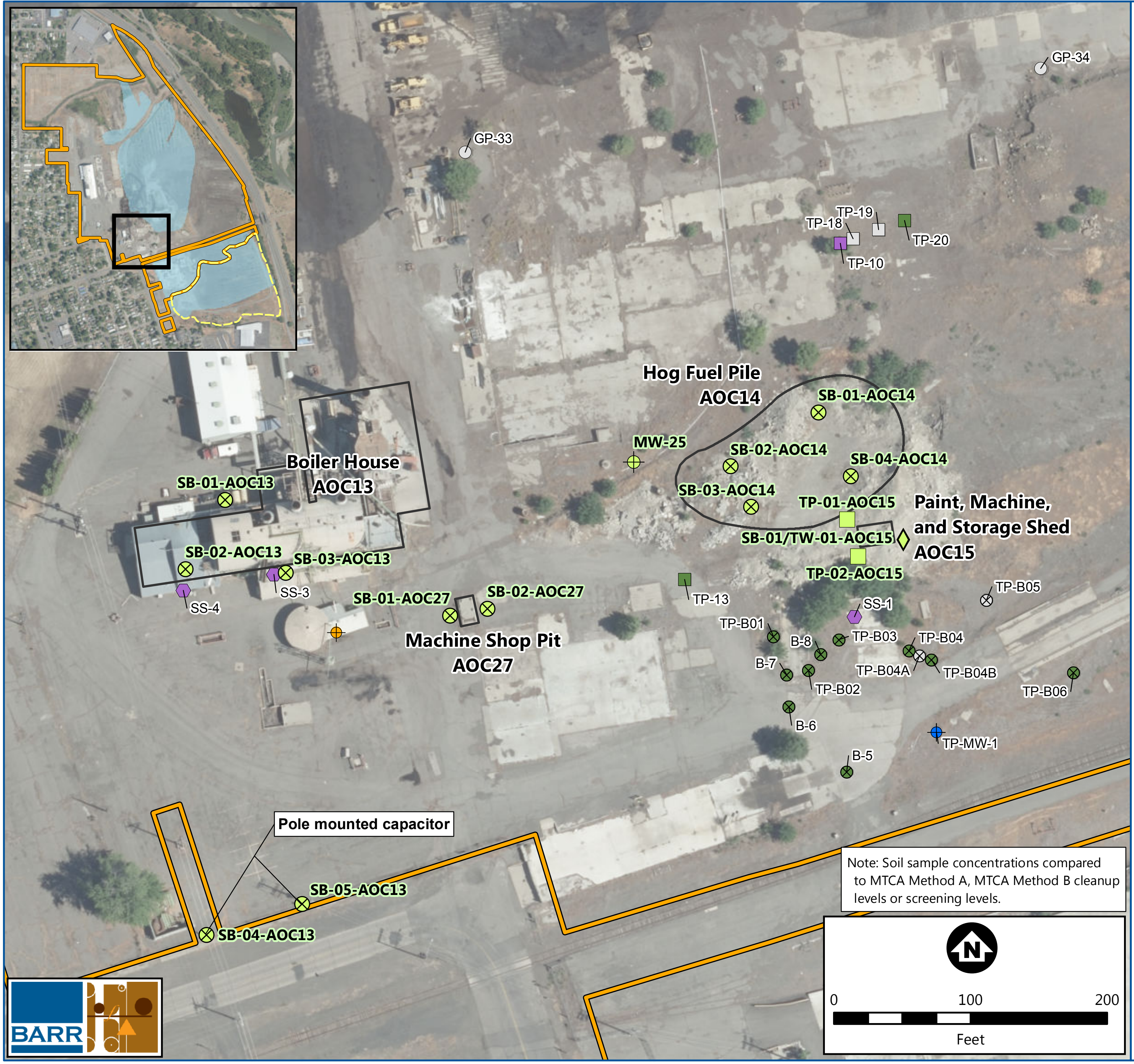
⊙	Soil Sample
○	Soil Gas Point (Not Monitored in RI)
▣	Soil Gas Point (To Be Monitored in RI)
□	Test Pit
🟪	Location Above MTCA Cleanup Levels
🟩	Location Below MTCA Cleanup Levels
⬜	No Sample Collected

Background Aerial Imagery Source: City of Yakima (June 2017)

SAWMILL AREA
Proposed RI Investigation Locations
Revised Final RI Work Plan-
January 2019
Yakima Mill Site
Yakima, WA

FIGURE 18

Barr Footer: ArcGIS 10.6, 2018-12-26 11:29 File: I:\Projects\47\39\1001\Maps\Reports\20170106_RI_Work_Plan\Figure 19 - Boiler House, Hog Fuel Pile, Paint, Machine and Storage Shed, and Machine Shop Pit.mxd User: kac2

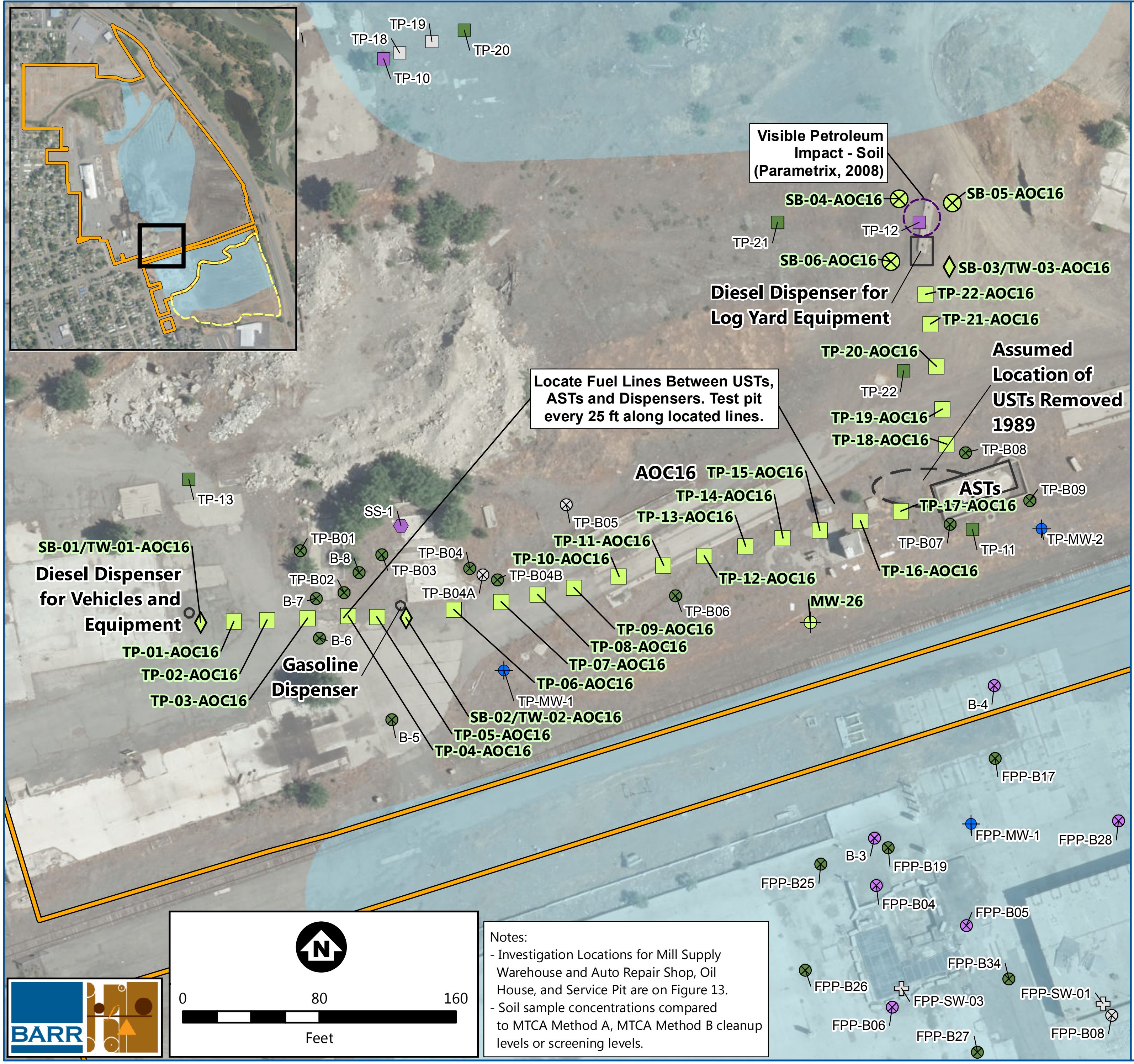


Note: Soil sample concentrations compared to MTCA Method A, MTCA Method B cleanup levels or screening levels.

Background Aerial Imagery Source:
City of Yakima (June 2017)

BOILER HOUSE, HOG FUEL PILE, PAINT, MACHINE AND STORAGE SHED, AND MACHINE SHOP PIT
Proposed RI Investigation Locations
Revised Final RI Work Plan-
January 2019
Yakima Mill Site
Yakima, WA

FIGURE 19



Notes:
- Investigation Locations for Mill Supply Warehouse and Auto Repair Shop, Oil House, and Service Pit are on Figure 13.
- Soil sample concentrations compared to MTCA Method A, MTCA Method B cleanup levels or screening levels.

▭ Yakima Mill Site Boundary

▭ Approximate Extent of Municipal Solid Waste

Historical Log Pond Extent

▭ Historical Site Feature

Proposed Investigation Location

⊗ Soil Boring

◆ Soil Boring and Temporary Well

⊕ Monitoring Well

■ Test Pit

Previous Investigation Location

⊗ Soil Boring

⬡ Surface Soil Sample

☐ Test Pit

✚ Surface Water Sample

🟪 Location Above MTCA Cleanup Levels

🟩 Location Below MTCA Cleanup Levels

⬜ No Sample Collected

Existing Well

⊕ Monitoring Well (To be Sampled in RI)

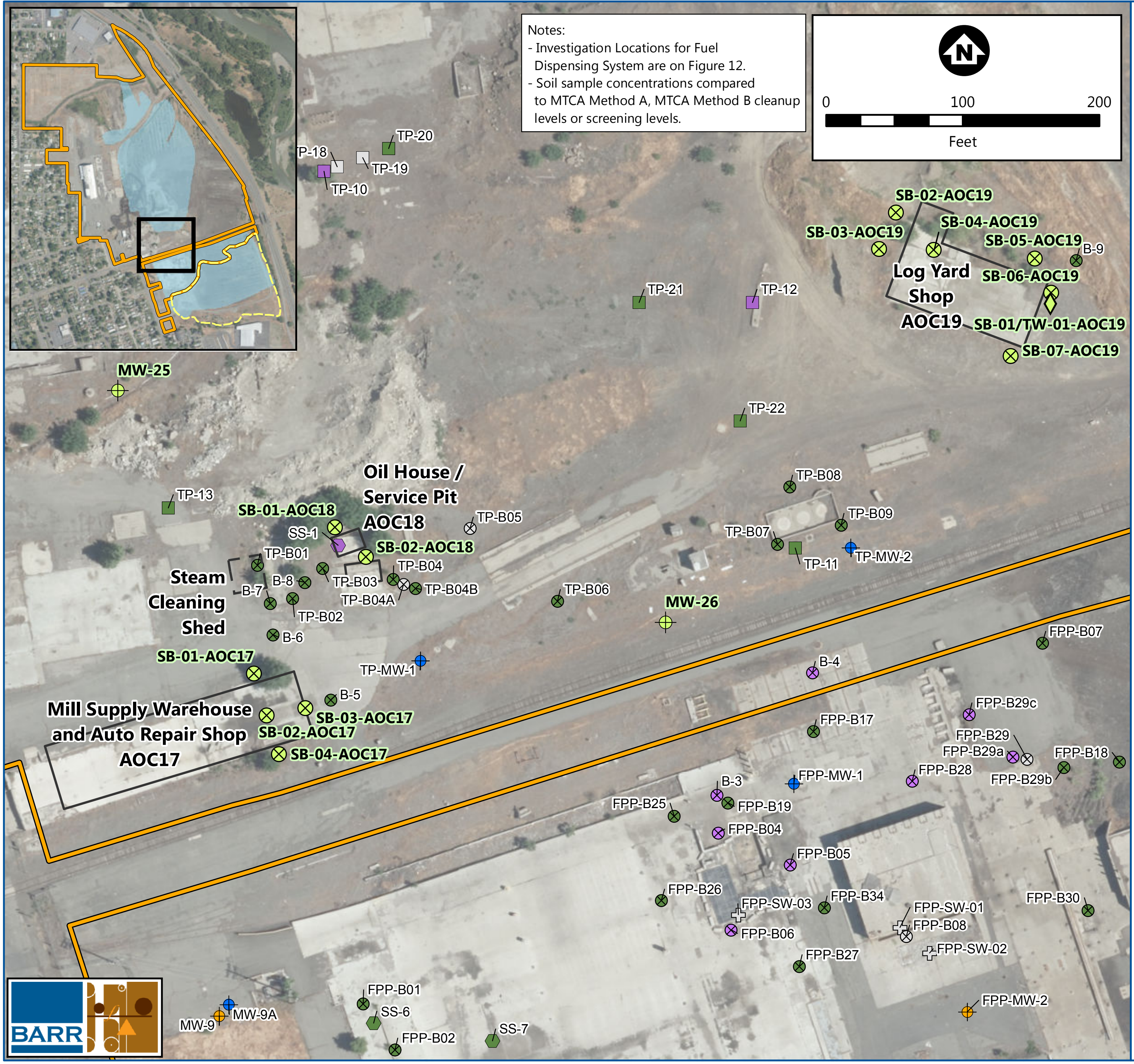
Background Aerial Imagery Source: City of Yakima (June 2017)

FUEL DISTRIBUTION SYSTEM
Proposed RI Investigation Locations

Revised Final RI Work Plan-
January 2019
Yakima Mill Site
Yakima, WA

FIGURE 20

Barr Footer: ArcGIS 10.6, 2018-12-26 11:35 File: I:\Projects\47\39\1001\Maps\Reports\20170106_RI_Work_Plan\Figure 21 - Mill Supply Oil House Log Yard Shop Area.mxd User: kac2



Notes:
- Investigation Locations for Fuel Dispensing System are on Figure 12.
- Soil sample concentrations compared to MTCA Method A, MTCA Method B cleanup levels or screening levels.

▭ Yakima Mill Site Boundary

▭ Approximate Extent of Municipal Solid Waste

Historical Log Pond Extent

▭ Historical Site Feature

Proposed Investigation Location
- ⊗ Soil Boring
- ◇ Soil Boring and Temporary Well
- ⊕ Monitoring Well

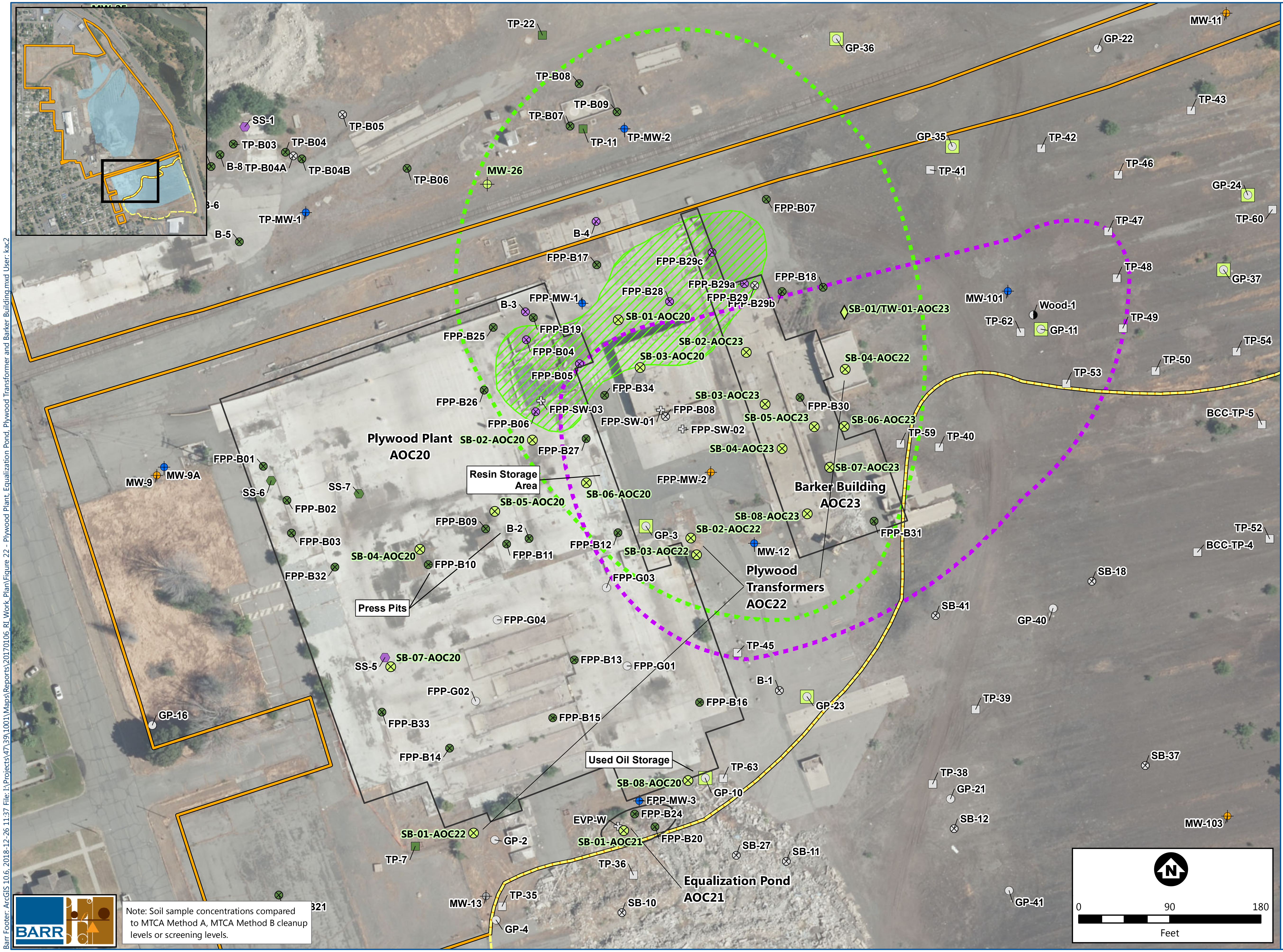
Previous Investigation Location
- ⊗ Soil Boring
- ○ Soil Gas
- ⬡ Surface Soil Sample
- ☐ Test Pit
- ✚ Surface Water Sample
- 🟪 Location Above MTCA Cleanup Levels
- 🟩 Location Below MTCA Cleanup Levels
- ⬜ No Sample Collected

Existing Well
- ⊕ Monitoring Well (To be Sampled in RI)
- ⊕ Well (Active - Not Sampled in RI)

Background Aerial Imagery Source:
City of Yakima (June 2017)

MILL SUPPLY WAREHOUSE /
OIL HOUSE / LOG YARD SHOP AREA
Proposed RI Investigation
Locations
Revised Final RI Work Plan-
January 2019
Yakima Mill Site
Yakima, WA

FIGURE 21



Note: Soil sample concentrations compared to MTCA Method A, MTCA Method B cleanup levels or screening levels.

- ▭ Yakima Mill Site Boundary
- ▭ Approximate Extent of Municipal Solid Waste
- ▭ Historical Log Pond Extent
- ▭ Historical Site Feature

Proposed Investigation Location

- ⊗ Soil Boring
- ◊ Soil Boring and Temporary Well
- ⊕ Monitoring Well

Previous Investigation Location

- ⊗ Soil Boring
- ○ Soil Gas Point (Not Monitored in RI)
- ▣ Soil Gas Point (To Be Monitored in RI)
- ○ Surface Soil Sample
- ☐ Test Pit
- ✣ Surface Water Sample
- ◑ Wood Waste Sample
- 🟪 Location Above MTCA Cleanup Levels
- 🟩 Location Below MTCA Cleanup Levels
- ⬜ No Sample Collected

Existing Well

- ⊕ Monitoring Well (To be Sampled in RI)
- ⊕ Well (Not Sampled in RI)
- ⊕ Monitoring Well (Abandoned)
- ▨ Est. TPH-Oil Concentration Above 2,000 mg/kg (MTCA CUL)
- Diesel Range Concentration Isocontour (500 ug/L) [Max Extent - September 2014]
- Heavy Oil Range Concentration Isocontour (500 ug/L) [Max Extent - March 2015]

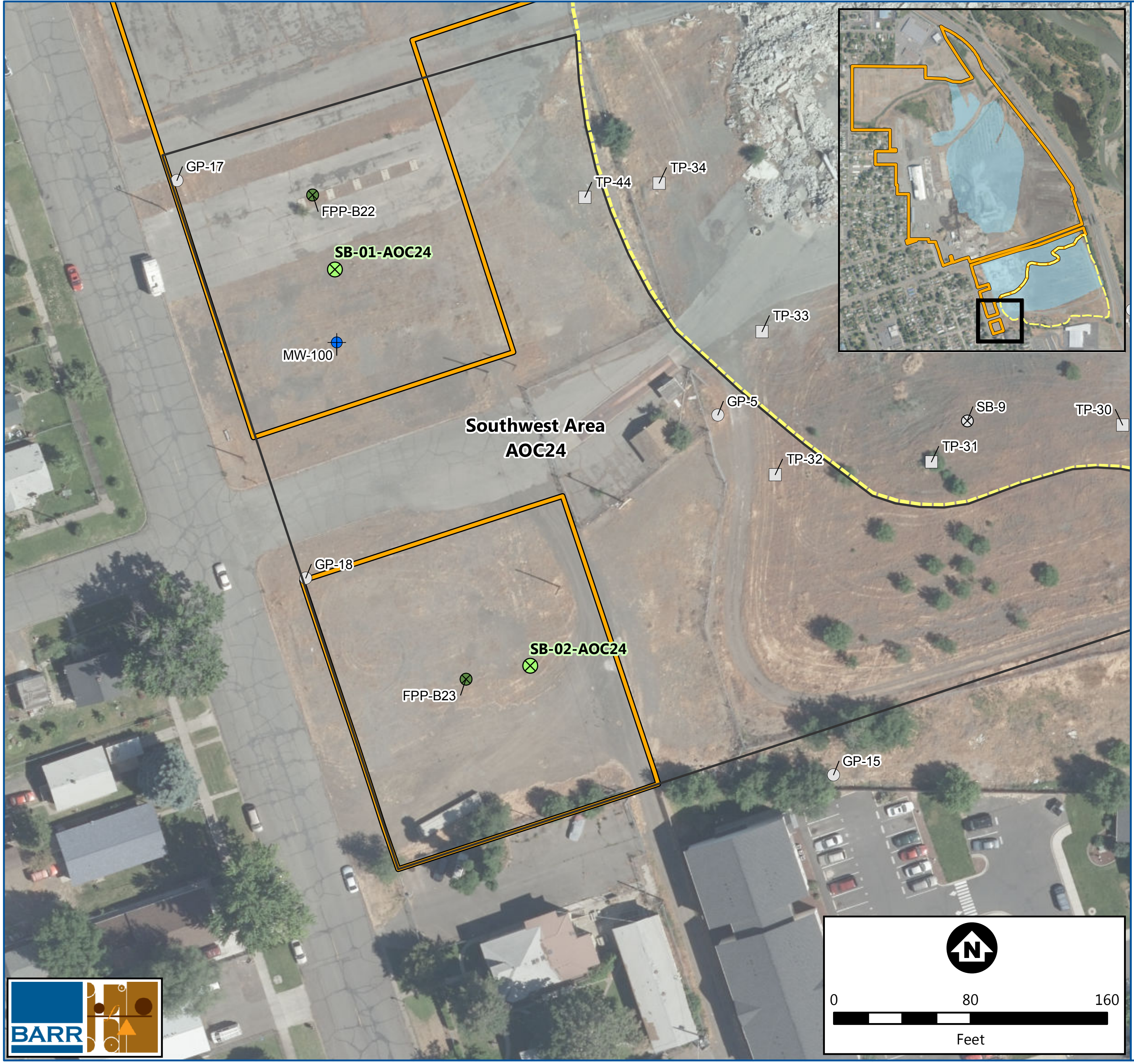
Background Aerial Imagery Source: City of Yakima (June 2017)

PLYWOOD PLANT, EQUALIZATION POND, PLYWOOD TRANSFORMERS AND BARKER BUILDING
Proposed RI Investigation Locations
Revised Final RI Work Plan-
January 2019
Yakima Mill Site
Yakima, WA

FIGURE 22

Barr Footer: ArcGIS 10.6, 2018-12-26 11:37 File: I:\Projects\47\39\1001\Maps\Reports\2017\0106_RI_Work_Plan\Figure 22 - Plywood Plant, Equalization Pond, Plywood Transformer and Barker Building.mxd User: kac2

Barr Footer: ArcGIS 10.6, 2018-12-26 11:39 File: I:\Projects\47\39\1001\Maps\Reports\20170106_RI_Work_Plan\Figure 23 - Southwest Area.mxd User: kac2



▭ Yakima Mill Site Boundary

▭ Approximate Extent of Municipal Solid Waste

Historical Log Pond Extent

▭ Historical Site Feature

Proposed Investigation Location

⊗ Soil Boring

🟪 Location Above MTCA Cleanup Levels

🟩 Location Below MTCA Cleanup Levels

⬜ No Sample Collected

Existing Well

⌖ Monitoring Well (Active - To be Sampled in RI)

Note: Soil sample concentrations compared to MTCA Method A, MTCA Method B cleanup levels or screening levels.

Background Aerial Imagery Source:
City of Yakima (June 2017)

SOUTHWEST AREA
Proposed RI Investigation
Locations
Revised Final RI Work Plan-
January 2019
Yakima Mill Site
Yakima, WA

FIGURE 23

▭ Yakima Mill Site Boundary

▭ Approximate Extent of Municipal Solid Waste

▭ Historical Site Feature

Existing Well

⊕ Monitoring Well (To be Sampled in RI)

⊕ Well (Not Sampled in RI)

⊕ Monitoring Well (Abandoned)

Proposed Investigation Location

▲ River Gauge (To be Field Verified)

◆ Temporary Well

⊕ Monitoring Well

～ Groundwater Elevation - June 2015 (Landau, 2015)

▭ Proposed Roadway Right-of-Way

Background Aerial Imagery Source:
City of Yakima (June 2017)

N

0 500 1,000
Feet

GROUNDWATER AND RIVER STAGE MONITORING NETWORK

Revised Final RI Work Plan-
January 2019
Yakima Mill Site
Yakima, WA

FIGURE 24

Barr Footer: ArcGIS 10.6, 2018-12-26 11:46 File: I:\Projects\47\39\1001\Maps\Reports\20170106_RI_Work_Plan\Figure 25 - Methane Monitoring Network.mxd User: kac2

- ▭ Yakima Mill Site Boundary
- ▭ Approximate Extent of Municipal Solid Waste
- ▭ Historical Site Feature

Previous Investigation Location

- ▣ Soil Gas Point (To Be Monitored in RI)
- ● Soil Gas Point (Not Monitored in RI)

Proposed Investigation Location

- ● Soil Gas Well
- ▭ Proposed Roadway Right-of-Way

Background Aerial Imagery Source:
City of Yakima (June 2017)

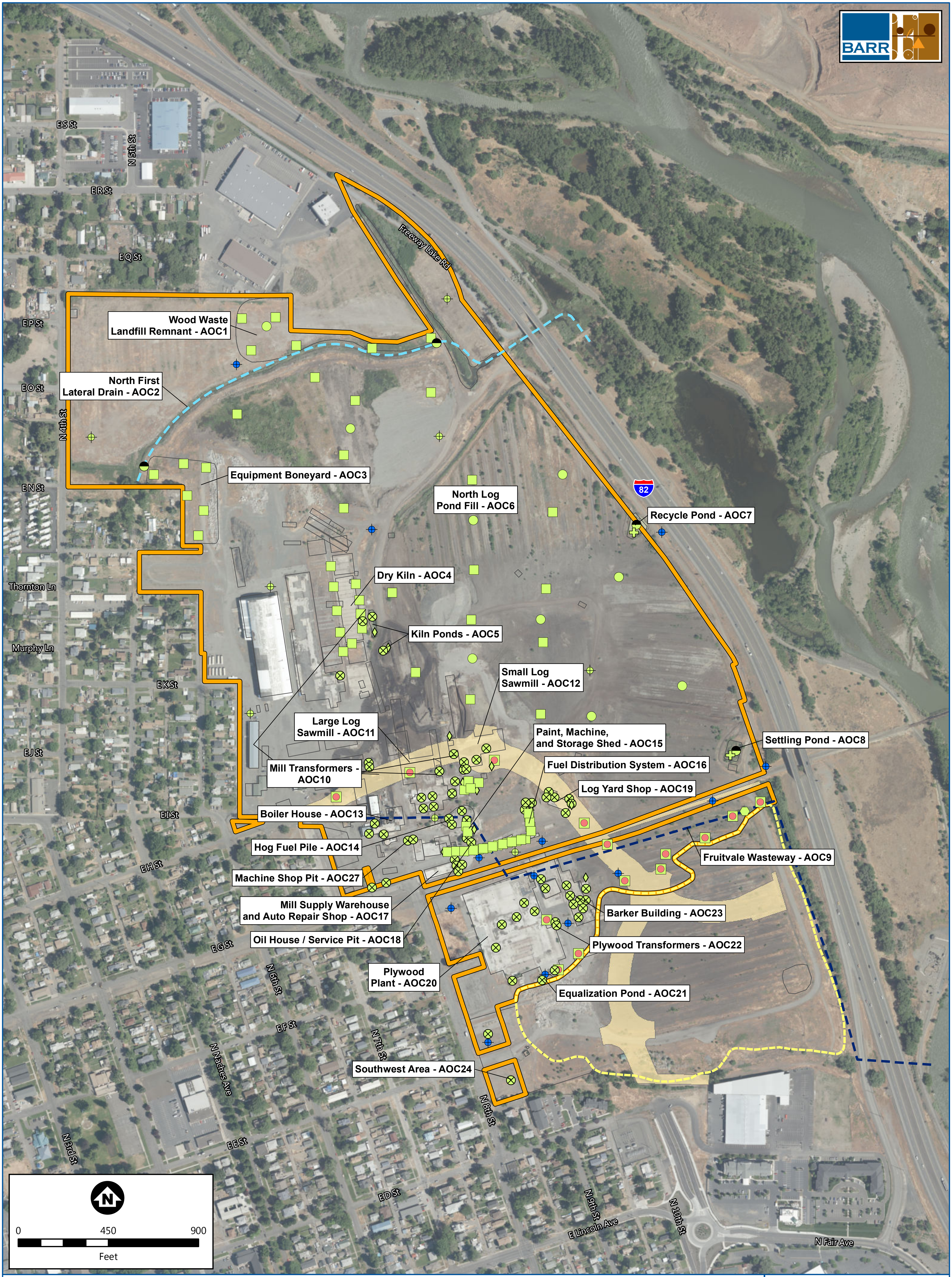
N

0 450 900
Feet

METHANE
MONITORING NETWORK
Revised Final RI Work Plan-
January 2019
Yakima Mill Site
Yakima, WA

FIGURE 25

Barr Footer: ArcGIS 10.6, 2018-12-26 11:48 File: I:\Projects\47\39\1001\Maps\Reports\20170106_RI_Work_Plan\Figure 26 - Proposed Investigation Summary.mxd User: kac2



▭ Yakima Mill Site Boundary

▭ Approximate Extent of Municipal Solid Waste (Landfill Site)

▭ Historical Site Feature

- - - Fruitvale Wasteway

- - - North First Lateral Drain

Previous Investigation Location

● Soil Gas Point (To Be Monitored in RI)

Existing Well

⊕ Monitoring Well (To be Sampled in RI)

Proposed Investigation Location

◓ Pond Bottom / Sediment Sample

● Soil Gas Well

⬢ Surface Soil Sample

⊗ Soil Boring

◊ Temporary Well

⊕ Monitoring Well

🟩 Test Pit

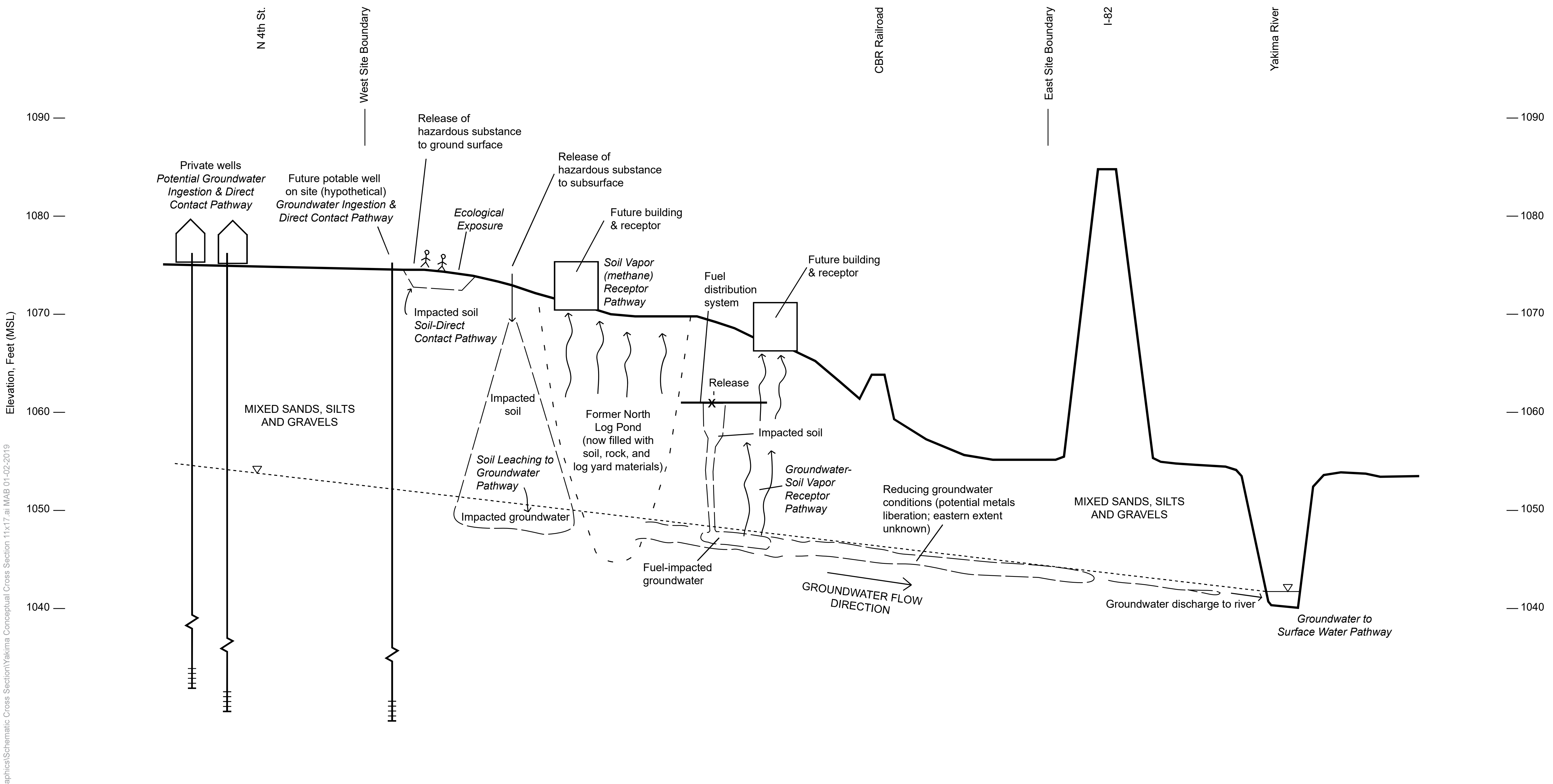
✚ Surface Water Sample

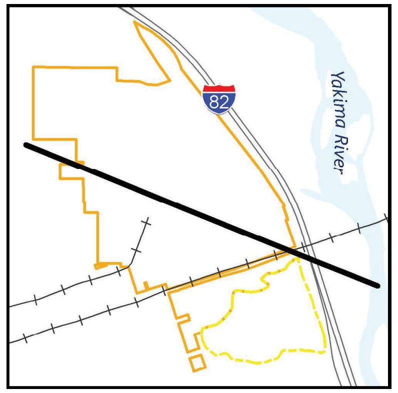
▭ Proposed Roadway Right-of-Way

Background Aerial Imagery Source: City of Yakima (June 2017)

PROPOSED INVESTIGATION SUMMARY
Revised Final RI Work Plan-January 2019
Yakima Mill Site
Yakima, WA

FIGURE 26





Cross Section Location

BARR

Figure 27

CONCEPTUAL SITE MODEL
Revised Final RI Work Plan – January 2019
Yakima Mill Site
Yakima, WA

BARR

▭ Yakima Mill Site Boundary

▭ Approximate Extent of Municipal Solid Waste (Landfill Site)

▭ Historical Site Feature

- - - Fruitvale Wasteway

- - - North First Lateral Drain

Proposed Investigation Location

⊗ Soil Boring

▨ Proposed Roadway Right-of-Way

Background Aerial Imagery Source:
City of Yakima (June 2017)

N

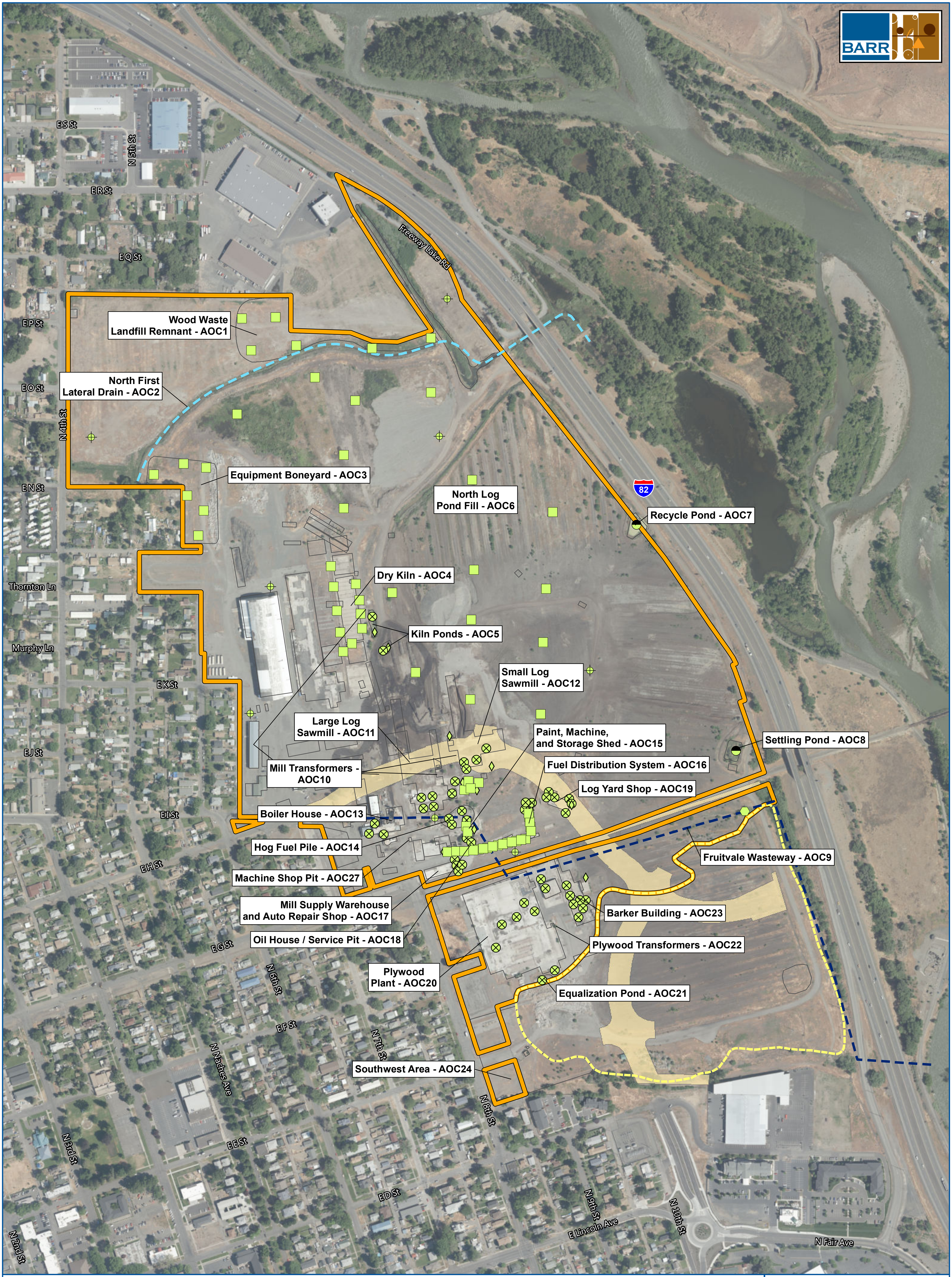
0 450 900

Feet

SHALLOW SOIL (0-2 FT BGS) INVESTIGATION SUMMARY
Revised Final RI Work Plan-
January 2019
Yakima Mill Site
Yakima, WA

FIGURE 28

Barr Footer: ArcGIS 10.6, 2018-12-26 11:43 File: I:\Projects\47\39\1001\Maps\Reports\20170106_RI_Work_Plan\SAP\Figure 29 - Deeper Soil (+2 ft bgs) Investigation Summary.mxd User: kac2



▭ Yakima Mill Site Boundary

▭ Approximate Extent of Municipal Solid Waste (Landfill Site)

▭ Historical Site Feature

- - Fruitvale Wasteway

- - North First Lateral Drain

Proposed Investigation Location

◓ Pond Bottom Sample

⬡ Surface Soil Sample

⊗ Soil Boring

◊ Temporary Well

⊕ Monitoring Well

🟩 Test Pit

▭ Proposed Roadway Right-of-Way

Background Aerial Imagery Source:
City of Yakima (June 2017)

N

0 450 900

Feet

DEEPER SOIL (>2 FT BGS)
INVESTIGATION
SUMMARY
Revised Final RI Work Plan-
January 2019
Yakima Mill Site
Yakima, WA

FIGURE 29

▭	Yakima Mill Site Boundary
▭	Approximate Extent of Municipal Solid Waste (Landfill Site)
▭	Historical Site Feature
- - -	Fruitvale Wasteway
- - -	North First Lateral Drain
▨	Proposed Roadway Right-of-Way

Proposed Investigation Location

✚	Surface Water Sample

Background Aerial Imagery Source: City of Yakima (June 2017)

SURFACE WATER INVESTIGATION SUMMARY
Revised Final RI Work Plan-
January 2019
Yakima Mill Site
Yakima, WA

FIGURE 30

▭ Yakima Mill Site Boundary

▭ Approximate Extent of Municipal Solid Waste (Landfill Site)

▭ Historical Site Feature

- - - Fruitvale Wasteway

- - - North First Lateral Drain

Proposed Investigation Location

● Pond Bottom / Ditch Bottom Sample

▨ Proposed Roadway Right-of-Way

Background Aerial Imagery Source:
City of Yakima (June 2017)

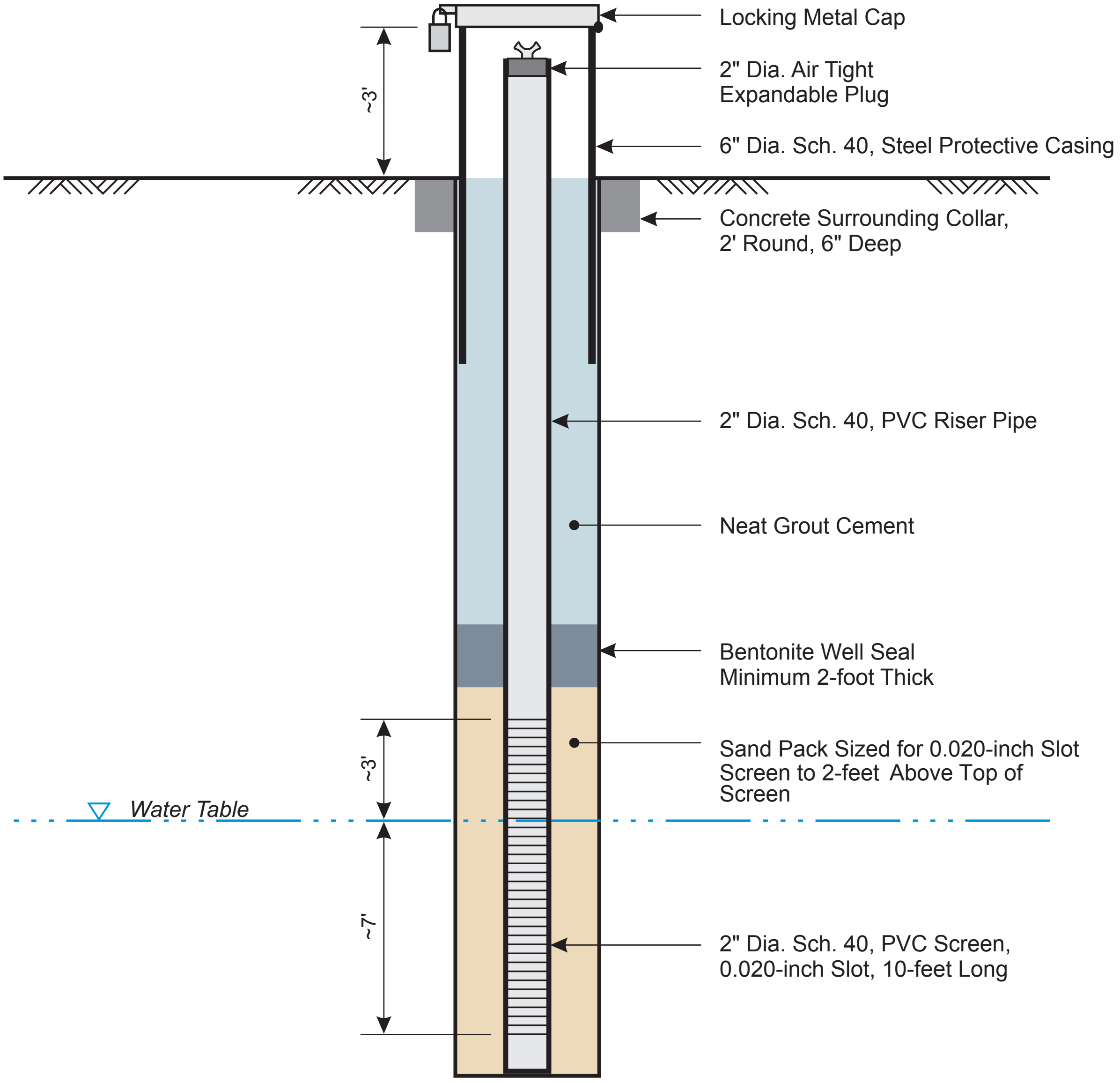
N

0 450 900
Feet

POND BOTTOM AND DITCH BOTTOM SAMPLING SUMMARY

Revised Final RI Work Plan-
January 2019
Yakima Mill Site
Yakima, WA

FIGURE 31



Not to Scale

P:\Mpls\47 WA\39\47391001\Workfiles\Graphics\Monitoring Well Schematic.CDR RLG 12-20-17

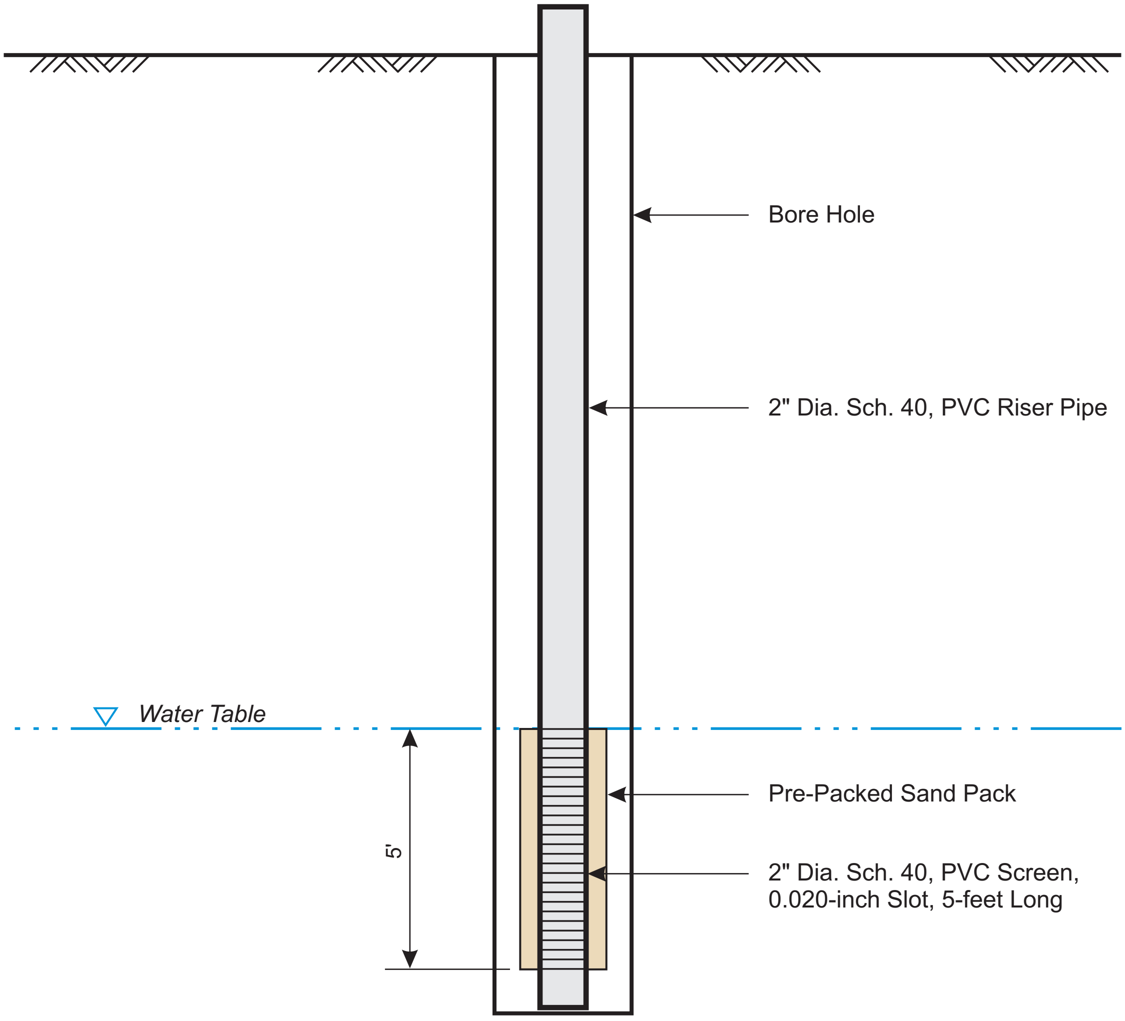
Figure 32

MONITORING WELL SCHEMATIC

Revised Final RI Work Plan - January 2019

Yakima Mill Site

Yakima, WA

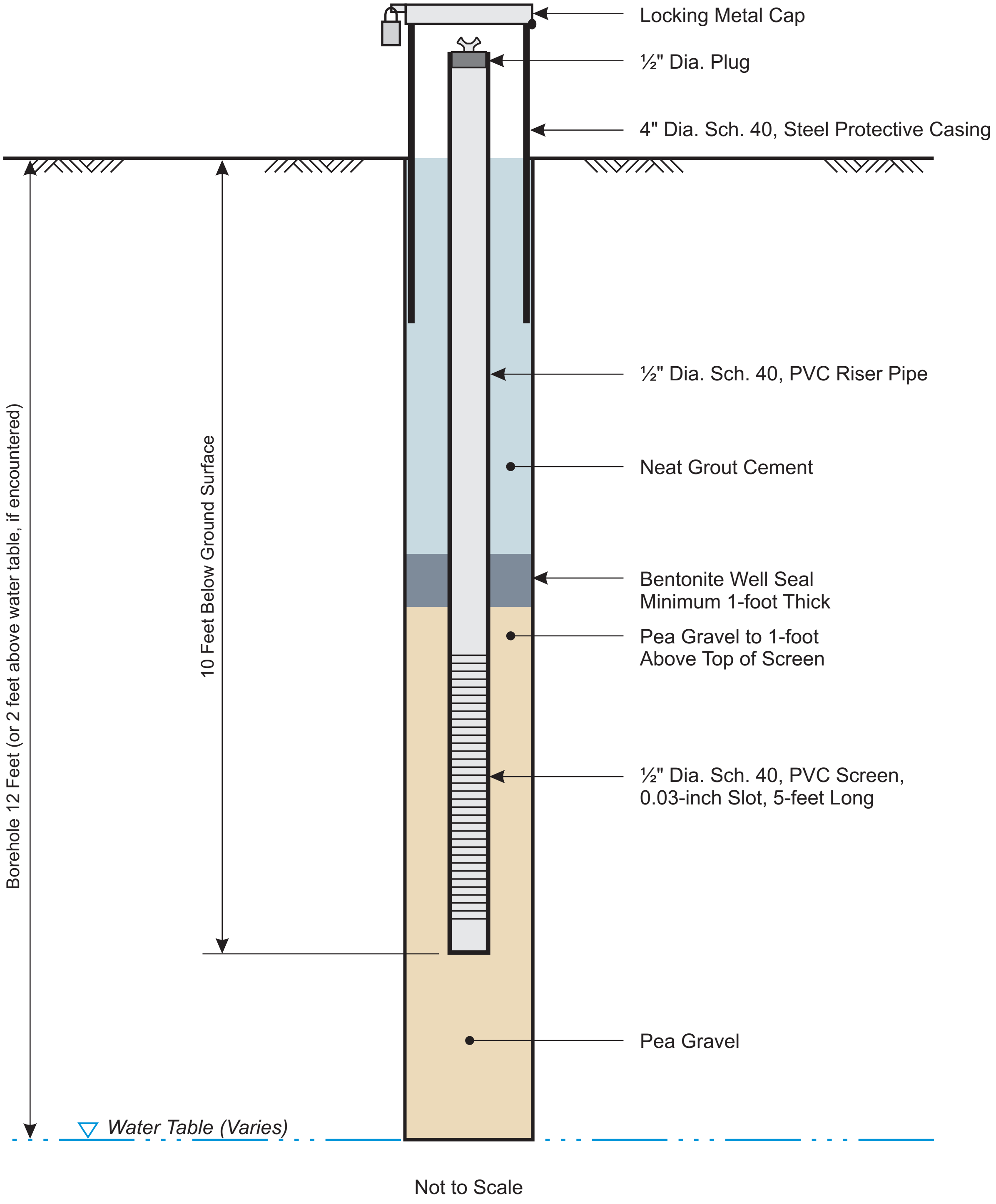


Not to Scale

Figure 33

TEMPORARY WELL SCHEMATIC

Revised Final RI Work Plan - January 2019
Yakima Mill Site
Yakima, WA



P:\Mpls\47 WA\39\47391001\Workfiles\Graphics\Soil Gas Well Schematic.CDR RLG 12-20-17

Figure 34

SOIL GAS WELL SCHEMATIC

Revised Final RI Work Plan - January 2019
Yakima Mill Site
Yakima, WA

Appendices

Appendix A

Standard Operating Procedures
Yakima Mill Site

BARR

Standard Operating Procedure – Yakima Mill Site

Collection of Groundwater Samples using Low-Flow Purging and Sampling

Revision 0

September 13, 2018

Approved By:

Alec Danielson — Alec Danielson — 9/13/18
Print Technical Reviewer Signature — Date

Dana Pasi — Dana Pasi — 9/13/18
Print QA Manager Signature — Date

Review of the SOP has been performed and the SOP still reflects current practice.

Initials: ________________ Date: ________________

Initials: ________________ Date: ________________

Initials: ________________ Date: ________________

Initials: ________________ Date: ________________

Minneapolis, MN ● Hibbing, MN ● Duluth, MN ● Ann Arbor, MI ● Jefferson City, MO ● Bismarck, ND ● Calgary, AB, Canada ●Grand Rapids, MI ●Salt Lake City, UT

Collection of Groundwater Samples using Low-Flow Purging and Sampling

1.0 Scope and Applicability

The purpose of this Standard Operating Procedure (SOP) is to describe the methods used for low-flow purging and sampling of monitoring wells. Low-flow sampling maximizes the potential for representative groundwater samples. A representative groundwater sample should accurately reflect the physical and chemical properties of the groundwater in the portion of the formation open to the well. This SOP also provides details regarding the measurement of groundwater stabilization criteria, and identification of common container, preservative, and holding times for typical groundwater sample analyses.

The recommended procedures in this SOP should be followed unless conditions make it impractical or inappropriate to do so. Modifications should be noted in the applicable documentation and communicated to appropriate personnel. Significant changes may result in a revision or newly created SOP.

2.0 Limitations

- Minimum of one week will pass between monitoring well development and monitoring well sampling.
- It is recommended that low-flow sampling be conducted when the air temperature is above 32 °F (0 °C). If the procedure is used below 32 °F, special precautions will need to be taken to prevent the groundwater from freezing in the equipment. Ice formation in the flow-through-cell will cause the monitoring probes to act erratically. A transparent flow-through-cell should be used to observe if ice is forming in the cell.
- Direct sun light and hot ambient air temperatures may cause the groundwater in the tubing and flow-through-cell to heat up. This may cause the groundwater to degas which will result in loss of volatile organic compounds (VOCs) and dissolved gases. When sampling under these conditions, the sampler will need to shade the equipment from the sunlight (e.g., umbrella, tent, etc.). The tubing exiting the monitoring well should be kept as short as possible to avoid the sun light or ambient air from heating up the groundwater.
- Collection of groundwater samples from residential/water supply systems are not discussed within this SOP.
- Dedicated sampling equipment and/or decontamination of sampling equipment is required to prevent cross-contamination.

3.0 Responsibilities

Equipment Technicians are responsible to maintain equipment in working order and aid in troubleshooting equipment issues.

The role of the Project Health and Safety Team Leader is to oversee all aspects of on-site safety activities.

The Project Manager, in conjunction with the client, develops the site specific scope of work (e.g., Work Plan, SAP, etc.).

Experienced Field Technician(s) are responsible for the measurement of well pumping rates, field screening procedures, field equipment and calibration, proper sample identification, collection of samples, quality control procedures, and documentation. They should be familiar with the procedures described in this document and use professional judgment when sampling, especially when conditions are not routine, in order to collect a representative sample.

Project staff are responsible for ordering sample containers prior to the sampling event.

4.0 Safety

Barr staff is responsible for conducting all aspects of the job safely. When applicable, refer to the appropriate Project Health and Safety Plan (PHASP) to understand the hazards associated with suspected contamination, symptoms of exposure, methods to minimize exposure, personal protection equipment (PPE), and personal air monitoring required when using this SOP. Minimum protection of two pair of chemical resistant gloves (e.g., nitrile) and safety glasses with side shields should be worn to prevent sample contact with the skin and eyes. When sampling waters contaminated with corrosive materials, emergency eye flushing facilities should be available.

5.0 Equipment, Reagents, and Supplies

- Water quality meter (e.g., YSI, or equivalent)
- Turbidimeter
- Water level indicator
- Graduated measuring container
- Clock or stopwatch
- Inline filters (if applicable)
- Sample containers (method specific)
- Sample labels
- Coolers
- Pump (submersible, bladder, or peristaltic), power source, and appropriate drive tubing
- Compressed air source (bladder pump only)
- Ring stand, or equivalent, to secure tubing
- Sample tubing*
- Chemical resistant gloves (e.g., nitrile)
- Calculator
- Plastic bags
- Waterproof ink pen or pencil
- Ice

* Tubing constructed of Teflon or Teflon-lined polyethylene tubing are preferred when sampling includes VOCs, SVOCs, pesticides, PCBs, and inorganics but other materials may be used if information is available showing that there is no leaching of contaminants or interferences for the analyses being performed. PVC, polypropylene or polyethylene tubing may be used when collecting samples for metals and other inorganics.

6.0 Procedure

This section addresses the procedure(s) for calibrating field equipment, measuring pumping rates, well purging, measuring well stabilization, and the sampling, handling, and delivery involving groundwater sampling. Best practices include setting up the purging, stabilization, and sampling equipment in an upwind direction from any potential source of contamination.

6.1 Calibration

The water quality meter and turbidimeter will be calibrated as per the applicable Barr SOP. The meters will undergo calibration checks, at a minimum, before and after sampling. The calibration check will be documented on a calibration form (as appropriate) and/or in the field notebook. Significant issues found during the calibration check will be handled as per the applicable Barr SOP, noted in the field notebook, and the Equipment Technicians will be notified.

6.2 Purging/Well Stabilization/Sampling

Prior to sampling, water levels are measured (see applicable Barr SOP) and purging of the monitoring well is performed to remove stagnant water from within the well and to stabilize the well to allow for representative groundwater sample collection. The term 'purge volume' refers to the amount of water removed from a well before groundwater sample collection occurs.

Low-flow purging will be completed using an electric submersible pump constructed of stainless steel or Teflon. The intake port for the pump being used will be placed at a depth such that the intake is at or slightly above the middle of the screened interval. A peristaltic pump will be used if the well recharges too slowly for the submersible pump to maintain drawdown in the targeted range. Slow recharge is not anticipated for the Site.

Pumping rates during low-flow purging are typically kept below 500 mL/min; however, this is dependent on the site-specific hydrogeology and will be adjusted to minimize drawdown during purging. Drawdown is the lowering of the water level in a monitoring well due to water being evacuated (purged) faster than the groundwater recharge rate. An electronic water level indicator will be used to determine that a minimal amount of drawdown is occurring within the well, ideally, no more than 4 inches. Flow rate will be measured using a graduated measuring container and a watch/clock. During the first purge/sampling event, a purge rate will be established for each monitoring well. Samplers should attempt to match the same purge rate during subsequent events, if possible. Pump powering equipment that generates air emissions will be kept downwind of the well that is being sampled.

If the well was purged dry, the samples should be collected within 24 hours of when the well was purged dry or when sufficient recharge allows (e.g., enough volume for analyses).

6.2.1 Submersible Pump Purging

A submersible pump is used when the water level is greater than the suction lift associated with a peristaltic pump. It can purge water from depths down to 200 feet depending on pump model and manufacturer. A variable speed controller is required for operation of the pump. There are a variety of speed controllers available, typically designed for a specific pump.

- Put on gloves for skin protection and to prevent sample contamination.
- Attach appropriate diameter tubing to pump intake, lower pump, and secure at desired depth (typically, middle of the well screen interval).
- Cut off tubing, allowing additional tubing length for discharge.
- Set the controller speed or voltage to zero.
- Plug the pump into the controller.
- Attach the controller to the power supply.
- Turn on the controller and dial the speed control to the desired flow rate, and measure the flow rate with the graduated measuring container. The controller can slow the purge rate down to the optimum rate.

Note: If the submersible pump is not running, turn off the pump and then disconnect from the power supply. Check connections and try again.

- Attach the flow-through-cell for the water quality meter after initial turbidity in the purge water has cleared visually.
- Sampling may begin once the well has stabilized (see Section 6.2.2, Well Stabilization of this SOP).

6.2.2 Well Stabilization

Well stabilization will be conducted to help verify that the groundwater sample is representative of aquifer conditions. A well is considered 'stabilized' after the groundwater (or well) stabilization parameter measurements are within acceptable limits for three consecutive readings. The stabilization parameters should be monitored at a frequency of five minute intervals. The pump's flow rate must be able to 'turn over' at least one flow-through cell volume between measurements (e.g., flow rate = 50 mL/min, flow-through cell = 250 mL, monitor every five minutes; every 10 minutes with a 500 mL flow-through cell). The following well stabilization parameters will be monitored: pH, specific conductance (temperature corrected electrical conductivity), oxidation-reduction potential (ORP), temperature, turbidity, and dissolved oxygen (DO). Turbidity and DO usually require the longest time for stabilization.

Most wells should stabilize within two hours. Prior to going on-site, review previous low-flow groundwater sampling logs from the site (if available). Initially, the field technician should verify that the field equipment is functioning properly and that operator error is not an issue. If the checks produce no new insight, one of three optional courses of action may be taken: 1) continue purging until stabilization is achieved, 2) discontinue purging, do not collect any samples, and record in the field log data sheets or field notebook and in the Field Sampling Report that stabilization could not be achieved (documentation must describe attempts to achieve stabilization), or 3) discontinue purging, collect samples and clearly document in the field log data sheets or field notebook and in the Field Sampling Report that stabilization was not achieved.

The procedure to stabilize a well includes recording well stabilization parameter measurements collected with the water quality meter during the well purging process and recording the purged well volumes. Groundwater aliquots used for stabilization parameter measurements (aside from turbidity) are measured by utilizing in-line, flow-through cell equipment. Turbidity will be measured with a standalone turbidimeter by collecting samples from a three way valve installed upstream of the flow-through-cell.

Documentation of the well stabilization process will include recording pertinent information such as the pumping rate, volume pumped, and well stabilization measurements on the field log data sheets or field notebook.

The well may be sampled after three consecutive measurements are within the criteria presented in Section 7.2, Measurement Criteria of this SOP.

6.2.3 Sampling

After the well has been purged and stabilized, disconnect the tubing exiting the pump from the flow-through cell. The same pump that is used for purging will be used for low-flow sampling. The project team will determine the order for sampling the wells but general guidelines are below:

- Where water quality data are available, the least contaminated wells would be sampled first, proceeding to increasingly contaminated wells.
- Where the distribution of contaminants is not known, wells considered to be upgradient from likely sources of contamination would be sampled first and downgradient wells closest to the suspected contamination would be last.
- Make certain to keep records of the order in which wells were sampled.

To prevent the possible loss of some volatile organic compounds (VOCs), samples for volatile parameters should be collected first with as little agitation and disturbance as possible, then proceed in order towards the least volatile parameter as listed in Barr's 'Water Sampling Guidelines' form. The 40 mL vials used to collect the VOC samples should be checked for air bubbles. Air bubbles may be caused by insufficient meniscus when sealing the vial, degassing after sample collection or during sample shipment, or reaction between the sample and preservative (HCl). If air bubbles > 6 mm (pea-sized) are observed during sampling, discard the vial and recollect the sample using a new vial. If air bubbles are believed to be due to the sample reacting with the preservative, the sample should be collected in an unpreserved vial if possible.

Groundwater samples will be analyzed for total and dissolved metals. Inline filtration methods will be used to collect filtered samples for dissolved metals analysis.

Put on new sampling gloves at each sampling site to reduce the risk of sample cross-contamination and exposure to skin. Never reuse old gloves.

Prepare sampling containers by filling out the label, using an indelible permanent pen, with the following information at a minimum:

- Sample ID
- Date and time of sample collection
- Preservative
- Sample analysis (if required by the lab)

When filling the containers, do not insert the tubing into the containers and do not overfill preserved containers. When all samples are containerized, place the filled sample containers in a sampling cooler with ice, turn off any equipment, disassemble the sampling apparatus, carefully remove non-dedicated equipment to minimize disturbance to the well, dispose of all one-time use (disposable) equipment, and decontaminate reusable equipment per Barr's SOP 'Decontamination of Sampling Equipment'.

6.2.4 Preservation

Container volume, type, and preservative are important considerations in sample collection. Container volume must be adequate to meet laboratory requirements for quality control, split samples, or repeat analyses. The container type varies with the analysis required. Typically, the analytical laboratory will preserve the container before shipment. Preservation and shelf life vary; contact the laboratory to determine if an on-hand container is still useful. Barr's 'Water Sampling Guidelines' form lists the parameter, container type, container volume, and preservative for many of the most common parameters collected. If samples are to be filtered, see Barr's SOP 'Filtering of Water Samples'.

6.2.5 Handling

The samples will be bubble wrapped or bagged after collection, stored in a sample cooler, and packed on double bagged wet ice. Samples will be kept cold (≤ 6 °C, but not frozen), until receipt at the laboratory (where applicable).

Note: Samples may need to be stored indoors in winter to prevent freezing.

6.2.6 Shipment/Delivery

Once the cooler is packed to prevent breaking of bottles, the proper chain-of-custody (COC) documentation is signed and placed inside a plastic bag then added to the cooler.

All samples will be kept secured to prevent tampering. If sample coolers are left in a vehicle or field office for temporary storage, the area will be locked and secured.

Custody seals may be present, but at a minimum, the coolers must be taped shut to prevent the lid from opening during shipment.

The coolers must be delivered to the laboratory via hand or overnight delivery courier, if possible, in accordance with all Federal, State and Local transportation regulations.

6.3 Data Reduction/Calculations

No data reduction or calculations are associated with this procedure.

6.4 Disposal

Waste generated by this process will be containerized for characterization and disposal of in accordance with Federal, State and Local regulations.

7.0 Quality Control and Quality Assurance (QA/QC)

The QC activities described below allow the self-verification of the quality and consistency of the work.

7.1 QA/QC Samples

QA/QC samples are defined in Barr's SOP 'Collection of Quality Control Samples'. QA/QC samples will be collected at a frequency of 1 every 20 samples.

7.2 Well Stabilization Criteria

Well stabilization criteria are:

- pH ± 0.1 standard units
- Specific conductance ± 3%
- ORP ± 10 mV
- Dissolved oxygen ± 10% (> 0.5 mg/L)

  Note: Three consecutive readings ≤ 0.5 mg/L is considered stabilized even if the change between readings is more than ± 10%
- Turbidity ± 10% (> 5 Nephelometric Turbidity Units (NTU))

  Note: Three consecutive readings ≤ 5 NTU is considered stabilized even if the change between readings is more than ± 10%.

- Temperature ± 0.5°C

8.0 Records

The field technician will document the flow rate, drawdown, time purged, volume purged, water level, total well depth, stabilization test measurements, and any unusual conditions that occurred (e.g., excessive drawdown, noticeable discoloration, presence of sediment, odor in the water, etc.) on the field log data sheet and/or field notebook. They will also document the type and number of bottles on the chain-of-custody record, as appropriate. The analysis for each container and the laboratory used will be documented on the chain-of-custody record. Refer to Barr's SOP 'Documentation on a Chain-of-Custody (COC)' for further information.

Examples of common field documentation are available in Barr's "Compendium of Field Documentation". Field documentation specific to this SOP are listed below:

- Sample Label
- Chain-of-custody (COC)
- Custody Seal (if applicable)
- Water Level Data Sheet
- Field Log Data Sheet
- Field Log Cover Sheet
- Field Sampling Report
- Water Sampling Guidelines (includes sampling order, container, preservation, and holding time)

The field documents and COCs are provided to a Barr Data Management Administrator for storage on the internal Barr network.

Other Barr SOP subjects referenced within this SOP: water level measurement, water quality meter, turbidimeter, filtering of water samples, collection of QC samples, decontamination of sampling equipment, and documentation on a COC.

9.0 References

Environmental Protection Agency, Region 1. 1996, revised 2010. *Low Stress (low-flow) Purging and Sampling Procedure for the Collection of Groundwater Samples from Monitoring Wells.*

Environmental Protection Agency, EPA/540/S-95/504. 1996. Groundwater Issue. *Low-Flow (Minimal Drawdown) Ground-water Sampling Procedures.*

Environmental Protection Agency. *Title 40 of the Code of Federal Regulations, Part 136.3.*

BARR

Standard Operating Procedure – Yakima Mill Site

Collection of Pond Bottom and Ditch Bottom Samples

Revision 0

September 13, 2018

Approved By:

Alec Danielson	Alec Danielson	9/13/18
Print	Technical Reviewer Signature	Date
Dana Pasi	Dana Pasi	9/13/18
Print	QA Manager Signature	Date

Review of the SOP has been performed and the SOP still reflects current practice.

Initials:		Date:	
Initials:		Date:	
Initials:		Date:	
Initials:		Date:	

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Collection of Pond Bottom and Ditch Bottom Samples

1.0 Scope and Applicability

The purpose of this Standard Operating Procedure (SOP) is to describe the collection of a representative sample of soil and settled solids from pond bottoms and ditch bottoms using a variety of hand-held equipment methods which may be used from shore, in waders, or in a boat on water. This procedure applies to the collection of pond bottom and ditch bottom samples for volatiles (VOC), semivolatiles (SVOC), metals, and inorganics analyses. It also identifies the container, preservative, and weight required for each analysis type.

The recommended procedures in this SOP should be followed unless conditions make it impractical or inappropriate to do so. Modifications should be noted in the applicable documentation and communicated to appropriate personnel. Significant changes may result in a revision or newly created SOP.

2.0 Limitations

- Samples with high moisture content often can slip through certain sampling media, thereby negatively affecting the representativeness of the sampled population/aliquot. Care should be taken when selecting sampling media, and using proper sample handling techniques when managing the materials prior to containerizing them for sample submittal/analysis.
- Sample device material can impact analytical results (e.g., aluminum device when collecting sample for aluminum analysis), try to collect sample using a different material or from a portion that was not in direct contact with the device.
- Clear communication with the laboratory will ensure the correct layer(s) (e.g. water versus solids or both) are analyzed when sample stratification occurs with high moisture solids.
- Inadequate homogenization of the samples, where applicable, can result in non-representative samples and results.
- Decontamination of sampling equipment is required to prevent cross-contamination.

3.0 Responsibilities

Equipment Technicians are responsible to maintain equipment in working order and aid in troubleshooting equipment issues.

The role of the Project Health and Safety Team Leader is to oversee all aspects of on-site safety activities.

The Project Manager, in conjunction with the client, develops the site specific scope of work (e.g., Work Plan, SAP, etc.).

Experienced Field Technicians are responsible for the proper collection of samples, field screening procedures, sample identification, field equipment and calibration, quality control procedures, and documentation.

Project staff is responsible for ordering sample containers prior to the sampling event.

4.0 Safety

Barr staff is responsible for conducting all aspects of the job safely. When applicable, refer to the appropriate Project Health and Safety Plan (PHASP) to understand the hazards associated with suspected contamination, symptoms of exposure, methods to minimize exposure, personal protection equipment (PPE), and personal air monitoring required when using this SOP. Minimum protection of two pair of chemical resistant gloves (e.g., nitrile) and safety glasses with side shields should be worn to prevent sample contact with the skin and eyes. When samples may be contaminated with corrosive materials, emergency eye flushing facilities should be available.

Some of the sample containers may require the use of preservatives. Consult the applicable Safety Data Sheet to review hazards and appropriate PPE to minimize exposure.

5.0 Equipment, Reagents, and Supplies

- Sampling devices/tools
- Stainless steel mixing bowl and spoon
- Global positioning unit (GPS)
- Measuring tape
- Balance
- Decontamination supplies (see Decon SOP)
- Sample containers (method specific)
- Chain-of-custody (COC)
- Coolers
- Chemical resistant gloves (e.g., nitrile)
- Paper towels/laboratory tissues
- Depth sounder for water depth
- Plastic bags
- 5 gallon bucket
- Sample label
- Custody seal, if applicable
- Waterproof ink pen or pencil
- Ice

6.0 Procedure

This section describes the procedure(s) for the sampling, handling, and delivery of samples.

General considerations to be taken into account when planning and conducting sampling operations are the required sample weight, sample holding times, sample handling, and special precautions for trace contaminant sampling.

To prevent sample cross contamination, the sampling equipment is carefully cleaned before initially sampling and after working at each sampling point per Barr's SOP 'Decontamination of Sampling Equipment'. A new, clean outer pair of disposable gloves will be worn for each sample location and sample containers are placed in separate plastic bags after collecting, preserving and tagging. Sample collection activities will proceed progressively from the least contaminated area to the most contaminated area (when known).

6.1 Calibration

No specific calibration procedures are required for the actual sampling equipment; however, the sampling equipment should be inspected prior to use and cleaned if needed.

6.2 Sample Collection

Depending on the project work to be done, cores may be collected for visual screening, physical analysis, or chemical analysis. General considerations to be taken into account when planning and conducting sampling operations are the type of sample collection technique to be used, type of tubes (e.g., plastic, polycarbonate, metal), parameters to be collected, required sample weight, sample holding times, and sample handling. Samples will be collected by core sampling, as feasible. If core sampling does not provide sufficient sample recovery, samples will be collected with a Ponar® dredge.

General cleanliness procedures will be followed at all times as outlined in the project documentation. To prevent sample cross-contamination, the sampling equipment is carefully cleaned before initially sampling and after working at each sampling point per Barr's SOP 'Decontamination of Sampling Equipment'.

6.2.1 Site Location and Measurements

Before sampling can begin, locate the sample site(s) using GPS. Survey top of settled solids elevation using GPS fitted with 8" disc on the bottom. Mark the locations on water using a small buoy, or by using ice stakes. Measure water depth using a measuring tape, or depth sounder, and record findings in the field documentation.

6.2.2 Soil Core Sampler (Recovery Core) (Wildco Device)

Core sampling will be completed in accordance with ASTM D4823-95(2014). Load the 16 mm liner and Eggshell™ (either plastic or steel) core catcher into place. Lower the stainless steel core sampler to the top of the sample interval. Maintain vertical angle and advance sampler to desired depth. The Eggshell™ core catcher will be forced open to allow filling of the core and water will be expelled via flow slots on the upper portion of the stainless core sampler.

Lift core out slowly, the Eggshell™ core catcher will now be closed, retaining sample core inside the liner. Once removed from the water, maintain vertical position and cap end. Remove liner from core sampler, remove sample core from liner, and place in a sample tray. Proceed to 'Visual Screening, Physical Analysis, or Chemical Analysis' described below.

Note: The core catcher may affect sample recovery in very soft solids.

6.2.3 Ponar® Dredge Sample Collection Device (Ponar® Dredge)

Ponar sampling will be completed in accordance with Section 10 of ASTM E1391-03(2014). Ensure that the mechanical parts of the Ponar® Dredge work as they should, including but not limited to; spring-loaded pin, dredge arms, and that the dredge buckets open and close smoothly and form a seal when closed. Also insure that the rope is in good condition and of adequate length.

Set up the Ponar® Dredge for sample collection by placing the spring-loaded pin in the release point on the dredge arms. This will hold the dredge buckets open as it is lowered into the water. Slowly and smoothly lower the Ponar® Dredge to just above the top of solids at the selected location, and then drop the Ponar® Dredge into the pond bottoms (to maximize penetration). Avoid sudden stops and starts during the descent through the water column to prevent the release of the spring-loaded pin and closing of the Ponar® Dredge during descent.

After the Ponar® Dredge is released at the sample interval make sure that there is enough slack in the line so that the spring-loaded pin will release the dredge arms from their locked open position. It may take a few short (but sharp) tugs on the rope to release the spring-loaded pin. Pull up slowly on the Ponar® Dredge rope ensuring that the dredge buckets have closed and then pull the Ponar® Dredge out of the water.

Once removed from the water, maintain vertical position and place Ponar® Dredge over collection vessel (stainless steel pan/bowl). Decant water slowly if necessary. Proceed to 'Visual Screening, Physical Analysis, or Chemical Analysis' described below.

6.2.4 Visual Screening, Physical Analysis, or Chemical Analysis

For the visual screening evaluation, measure and document stratigraphy, soil type, evidence of organics, etc. with core contained in tube then slice core down the middle, open halves, and verify physical description.

If collecting samples for physical or chemical analysis, label appropriate sample bottles and collect samples according to Barr's SOP 'Collection of Soil Samples'. The container size, type, preservative, and holding time are important considerations in sample collection. Sample and container size must be adequate to meet laboratory requirements for quality control, split samples, or repeat analyses. The container type varies with the analysis required. Typically, the analytical laboratory will preserve the container before shipment, where applicable. Preservation and shelf life vary; contact the laboratory to determine if an on-hand container is still useful.

NOTE: Samples collected for analysis of volatile organic compounds (VOCs) should not be homogenized or composited to minimize,to the extent possible, aeration of the sample. Aeration of the sample may result in loss of VOCs.

6.2.5 Handling

After collection, all samples should be handled as few times as possible. Samplers should use extreme care to ensure that samples are not contaminated. Immediately after samples are collected, they are bubble wrap or bagged and placed in a cooler containing bagged ice. Samples will be kept cold (≤ 6 °C, but not frozen) until receipt at the laboratory, where they are to be stored in a refrigerated area.

Keep samples secured to prevent tampering. If sample coolers are left in a vehicle or field office for temporary storage, the area will be locked and secured.

6.2.6 Shipment/Delivery

Once the cooler is packed to prevent breaking of containers, the proper COC documentation is relinquished by the sampler, placed into a plastic bag, and included in the cooler. Custody seals may be present, but at a minimum, the coolers must be taped shut to prevent the lid from opening during shipment.

The coolers must be delivered to the laboratory via hand or overnight delivery courier in accordance with all Federal, State and Local transportation regulations.

Note: Samples may have to be stored indoors in winter to prevent freezing.

6.3 Data Reduction/Calculations

No data reduction or calculations are associated with this procedure.

6.4 Disposal

Waste generated by this process will be containerized for characterization and disposal in accordance with Federal, State and Local regulations.

7.0 Quality Control and Quality Assurance (QA/QC)

The QC activities described below allow the self-verification of the quality and consistency of the work.

7.1 QA/QC Samples

QA/QC samples are defined in Barr's SOP 'Collection of Quality Control Samples'. QA/QC samples will be collected at a frequency of 1 every 20 samples.

- Equipment blanks
- Field blanks
- Trip blanks
- Field duplicate samples
- Matrix spike/matrix spike duplicate samples

7.2 Measurement Criteria

No specific criteria apply to the implementation of this SOP.

8.0 Records

The field technician will document the sampling event in a project dedicated field logbook or on field log data sheets. The analysis for each container, the number of bottles, and the laboratory used will be documented on the chain-of-custody record. Refer to Barr's SOP 'Documentation on a Chain-of-Custody (COC)' for further information.

Examples of common field documentation are available in Barr's "Compendium of Field Documentation". Field documentation specific to this SOP are listed below:

- Field Sampling Report
- Field Log Data Sheet
- COC
- Sample label

  Custody seal (if applicable)

Field documentation and COC are provided to a Barr Data Management Administrator for storage on the internal Barr network.

Other Barr SOP subjects referenced within this SOP: field screening soil samples, collection of soil samples, collection of QC samples, decontamination of sampling equipment, investigative derived waste, and documentation on a COC.

9.0 References

Mudroch and MacKnight, CRC Press. 1991. *Handbook of Techniques for Aquatic Sediment Sampling*.

University of Minnesota, year unknown. Wright, Cushing, and Livingstone, Contribution No. 9, Limnological Research Center. *Coring Devices for Lake Sediments*.

Standard Operating Procedure – Yakima Mill Site

Collection of Quality Control Samples

Revision 0

September 13, 2018

Approved By:

Dana Pasi

Dana Pasi — Print — QA Manager — Signature — 9/13/18 — Date

Review of the SOP has been performed and the SOP still reflects current practice.

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Minneapolis, MN ● Hibbing, MN ● Duluth, MN ● Ann Arbor, MI ● Jefferson City, MO ● Bismarck, ND ● Calgary, AB, Canada ● Grand Rapids, MI ● Salt Lake City, UT

Collection of Quality Control Samples

1.0 Scope and Applicability

The purpose of this Standard Operating Procedure (SOP) is to describe the procedures used in the collection and handling of field quality control (QC) samples: field blanks, equipment blanks, trip blanks, field (masked) duplicate samples, matrix spikes and matrix spike duplicate samples.

The recommended procedures in this SOP should be followed unless conditions make it impractical or inappropriate to do so. Modifications should be noted in the applicable documentation and communicated to appropriate personnel. Significant changes may result in a revision or newly created SOP.

2.0 Limitations

- Laboratory specific QC samples (e.g., method blanks, laboratory control samples) are not discussed within this SOP.

3.0 Responsibilities

Experienced Field Technicians are responsible for the accurate collection of QC samples and the laboratory is responsible for the accurate set-up and analysis of QC samples. Project staff are responsible for ordering sample containers prior to the sampling event.

The role of the Project Health and Safety Team Leader is to oversee all aspects of on-site safety activities.

The Project Manager, in conjunction with the client, develops the site specific scope of work (e.g., Work Plan, Sampling Analysis Plan (SAP), etc.).

4.0 Safety

Barr staff is responsible for conducting all aspects of the job safely. When applicable, refer to the appropriate Project Health and Safety Plan (PHASP) to understand the hazards associated with suspected contamination, symptoms of exposure, methods to minimize exposure, personal protection equipment (PPE), and personal air monitoring required when using this SOP. Minimum protection of two pair of chemical resistant gloves (e.g., nitrile) and safety glasses with side shields should be worn to prevent sample contact with the skin and eyes. When sampling soils contaminated with corrosive materials, emergency eye flushing facilities should be available.

Some of the sample containers may require the use of preservatives. Consult the applicable Safety Data Sheet to review hazards and appropriate PPE to minimize exposure.

5.0 Equipment, Reagents, and Supplies

- Laboratory-certified containers appropriate for the required analysis
- Chemical resistant gloves (e.g., nitrile)
- Sample labels
- Matrix specific sampling devices and equipment
- Sample containers/media
- Analyte-free water

6.0 Procedure

This section provides the definitions and sampling procedure(s) for QC samples.

6.1 Calibration

Calibration is not applicable to this SOP.

6.2 Sampling

General considerations to be taken into account when planning and conducting sampling operations are the required sample amount, sample holding times, sample handling, and special precautions for trace contaminant sampling. Matrix specific sampling SOPs should be followed for the collection and preservation of samples. The QC samples will be handled in the same manner as the sample group for which they are intended (i.e. stored and transported with the sample group).

6.2.1 Field Blank

Field blank samples are prepared on-site and are a sample of analyte-free water exposed to environmental conditions at the sampling site by transfer from one vessel to another. It measures field and laboratory sources of contamination. Field blanks will be collected for each parameter type of interest.

6.2.2 Equipment Blank (Rinsate Blank)

Equipment blank (or rinsate blank) samples are prepared on-site by pouring analyte-free water through decontaminated sample collection equipment (e.g., pump, transfer container, etc.) and collecting the "rinsate" in the appropriate sample container. If collecting a blank for dissolved metals or dissolved organic carbon, the rinsate will be filtered before adding to the sample container. In addition to the field sources of contamination that may be introduced in the transferring of samples to one vessel to another, an equipment blank also tests the potential cross contamination from incomplete decontamination. Equipment blanks will be collected for each parameter of interest.

6.2.3 Trip Blank

Trip blank samples are used when sampling volatile organic compounds (VOC) only. Analyte-free water is used for water samples and methanol (or other applicable sample preservative) is used for soil samples. They are prepared or provided by the laboratory along with the VOC sampling containers prior to a sampling event. Trip blank sample containers are not to be opened in the field. The trip blank samples accompany the VOC samples during collection, storage, and transport to the analytical laboratory. There must be one set of trip blank samples per sample cooler containing VOC samples from the Site. The trip blanks should be listed on the chain-of-custody (COC) along with the samples and the analysis required. The purpose of the trip blank sample is to determine the extent of potential contamination introduced during sample transport and handling.

6.2.4 Field (Masked) Duplicate

Field (masked) duplicate samples are two aliquots of a sample collected at the same time using the same procedures, equipment, and types of containers as the required samples. The samples are collected by rotating sampling containers from the original/source sample to the field duplicate sample (using the same exact methods for both). The field duplicate sample is identified with an alias (e.g., M-1 or FD) on the sample container label and on the COC to avoid alerting laboratories to the source of the sample duplicated. The time collected should be omitted on this sample also. Analyses of field duplicate samples are the same as the required samples and give a measure of the precision associated with sample collection, preservation, and storage, as well as laboratory procedures. Field duplicate samples are submitted to the laboratory for the same analyses as the original/source sample.

6.2.5 Matrix Spike (MS) and Matrix Spike Duplicate (MSD)

Matrix Spikes (MS) and Matrix Spike Duplicate (MSD) samples are two aliquots of a sample to which known quantities of analytes are added (spiked) in the laboratory. The MS and MSD are prepared and analyzed exactly like their native/source sample aliquot. For some analyses, it is required that three separate sample aliquots are collected in the field for each analysis. One aliquot is analyzed to determine the concentrations in the native/source sample, a second sample aliquot serves as the MS and the third sample aliquot serves as the MSD. The purpose of the MS and MSD is to quantify the bias and precision caused by the sample matrix.

6.3 Data Reduction/Calculations

6.3.1 Field Duplicate

Field duplicate sample results are evaluated by calculating the Relative Percent Difference (RPD) value. The RPD formula is as follows:

$$RPD = \frac{|S - D|}{(S + D)/2} \, x \, 100$$

Where: RPD = relative percent difference
S = native sample result
D = duplicate sample result

Note: The RPD equation may also be used to calculate the precision between the MS and MSD

6.3.2 MS/MSD

MS/MSD recoveries are calculated using the following equation:

$$\%R = \frac{SSR - SR}{SA} \, x \, 100$$

Where: %R = % recovery
SSR = spiked sample result
SR = native/source sample result
SA = spike added to native/source sample

6.4 Disposal

Waste generated by this process will be containerized for characterization and disposal in accordance with Federal, State and Local regulations.

7.0 Quality Control and Quality Assurance (QA/QC)

The QC activities described below allow the self-verification of the quality and consistency of the work.

7.1 QA/QC Samples

The frequency of QC samples will be one field blank/equipment blank/field duplicate/MS/MSD per twenty samples.

7.2 Measurement Criteria

Criteria are defined in the QAPP.

8.0 Records

The field technician will document the type and number of QC samples collected during each sampling event on a COC and in a project dedicated field logbook or on field log data sheets.

Examples of common field documentation are available in Barr's "Compendium of Field Documentation". Field documentation specific to this SOP are listed below:

- Field Log Data Sheet
- COC
- Sample label
- Custody seal (if applicable)

Field documentation and COC are provided to a Barr Data Management Administrator for storage on the internal Barr network.

Other Barr SOP subjects referenced within this SOP: sample collection, investigative derived waste, decontamination of sampling equipment, and documentation on a COC.

9.0 References

EPA QA/G-5. 2002. Guidance for Quality Assurance Project Plans.

BARR

Standard Operating Procedure – Yakima Mill Site
Collection of Soil Samples

Revision 0

September 13, 2018

Approved By:

Alec Danil

Alec Danielson | | 9/13/18
Print Technical Reviewer Signature Date

Dana Pasi

Dana Pasi | | 9/13/18
Print QA Manager Signature Date

Review of the SOP has been performed and the SOP still reflects current practice.

Initials:		Date:	
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Collection of Soil Samples

1.0 Scope and Applicability

The purpose of this Standard Operating Procedure (SOP) is to describe the collection of a representative soil sample using a variety of methods and equipment depending on the depth and type of sample required. This procedure applies to the collection of soil samples for volatiles (VOC), semivolatiles (SVOC), metals, and inorganics analyses. It also identifies the container, preservative, and weight required for each analysis type.

The recommended procedures in this SOP should be followed unless conditions make it impractical or inappropriate to do so. Modifications should be noted in the applicable documentation and communicated to appropriate personnel. Significant changes may result in a revision or newly created SOP.

2.0 Limitations

- Inadequate homogenization of the samples, where applicable, can result in non-representative samples and results.
- Decontamination of sampling equipment is required to prevent cross-contamination.
- Contact the local utilities hotline prior to digging to have utilities identified at sampling locations.

3.0 Responsibilities

Equipment Technicians are responsible to maintain equipment in working order and aid in troubleshooting equipment issues.

The role of the Project Health and Safety Team Leader is to oversee all aspects of on-site safety activities.

The Project Manager, in conjunction with the client, develops the site specific scope of work (e.g., Work Plan, SAP, etc.).

Experienced Field Technicians are responsible for the proper sample identification, collection of samples, field screening procedures, field equipment and calibration, quality control procedures, and documentation.

Project staff are responsible for ordering sample containers prior to the sampling event.

4.0 Safety

Barr staff is responsible for conducting all aspects of the job safely. When applicable, refer to the appropriate Project Health and Safety Plan (PHASP) to understand the hazards associated with suspected contamination, symptoms of exposure, methods to minimize exposure, personal protection equipment (PPE), and personal air monitoring required when using this SOP. Minimum protection of two pair of chemical resistant gloves (e.g., nitrile) and safety glasses with side shields should be worn to prevent sample contact with the skin and eyes. When sampling soils contaminated with corrosive materials, emergency eye flushing facilities should be available.

Some of the sample containers may require the use of preservatives. Consult the applicable Safety Data Sheet to review hazards and appropriate PPE to minimize exposure.

5.0 Equipment, Reagents, and Supplies

- Sampling devices/tools
- Stainless steel mixing bowl and spoon
- Sample containers (method specific)
- Balance
- Coolers
- Plastic bags
- Non-phosphorus containing detergent (e.g., Liquinox^{TM})
- Chemical resistant gloves (e.g., nitrile)
- Paper towels/laboratory tissues
- Chain-of-custody (COC)
- Sample label
- Custody seal, if applicable
- Waterproof ink pen or pencil
- Ice

6.0 Procedure

This section describes the procedure(s) for the sampling, handling, and delivery of soil samples.

6.1 Calibration

No specific calibration procedures are required for the actual sampling equipment.

6.2 Sampling

General considerations to be taken into account when planning and conducting sampling operations are the required sample weight, sample holding times, sample handling, and special precautions for trace contaminant sampling.

To prevent sample cross-contamination, the soil sampling equipment is carefully cleaned before initially sampling and after working at each sampling point per Barr's SOP 'Decontamination of Sampling Equipment'. A new, clean outer pair of disposable gloves will be worn for each sample location and sample containers are placed in separate plastic bags after collecting, preserving, and tagging. Sample collection activities will proceed progressively from the least contaminated area to the most contaminated area (when known).

Depending on the project work to be done, soil samples will be collected for analysis by either a rotasonic drill rig (equipped with a core barrel sampler), hand excavation (hand auger, trowel, or shovel), or from the excavator bucket for test pits.

- If a drilling apparatus is used, retrieve the core barrel sampler from the desired sampling interval and open. Open the liner to sample the soil.
- If hand excavating, dig with a trowel or shovel to the desired sampling interval and expose a fresh soil surface to sample. Collect a large sample on a shovel and bring it to the surface or collect the sample directly from the fresh soil surface. The hand excavation technique may be done from the bucket of a backhoe also.
- If test pits are used for sampling, collect samples from the excavator bucket collected from the target depth.

In most investigations, the soil samples are field screened for moisture, odor, oil sheen, discoloration and the presence of organic soil vapors and classified in accordance with ASTM D-2488, Standard Practice for

Description and Identification of Soils (Visual-Manual Procedure). Refer to Barr's SOP 'Screening Soil Samples'.

The form 'Soil Sampling Guidelines' lists the analyses (in order of collection) and describes the weight of sample, preservation, container, and holding time for the most common sampling media (information can vary depending on the laboratory used). The container size, type, preservative, and holding time are important considerations in sample collection. Sample and container size must be adequate to meet laboratory requirements for quality control, split samples, or repeat analyses. The container type varies with the analysis required. Typically, the analytical laboratory will preserve the container before shipment, where applicable. Preservation and shelf life vary; contact the laboratory to determine if an on-hand container is still useful.

6.2.1 Volatile Organic Compounds (VOC)

If VOC or similar analyses (e.g., GRO, TPH as Gasoline) will be performed on the samples, these samples should be collected as soon as possible after the soil is removed from the ground from a representative area of the most undisturbed soil possible. It is important to note that there are different containers and sampling media available for collecting a soil sample for VOC analysis. Typically, the VOC sample is collected at a 1:1 weight ratio with a preservative. A coring device, such as a Terra Core® or En Core® sampler, is the first choice for sampling.

Note: Analytical samples should not be collected from polyethylene bags sometimes used for field screening purposes.

6.2.1.1 Terra Core® Sampler

The Terra Core® Sampler is a single use device that is typically supplied with a 40 mL VOA vial containing preservative (e.g., methanol) and an unpreserved container for % moisture determination. To use the Terra Core®, make certain the plunger is aligned with, and seated in, the handle. Push the Terra Core® into freshly exposed soil until the sample chamber is filled. Depending on the Terra Core® sampler size, a filled chamber will deliver approximately 5 or 10 g of soil. If a 1:1 ratio of soil to preservative is needed, verify the correct size sampler is being used.

Wipe the outside of the sampler, check that the soil plug is flush with the mouth of the sampler, and remove any excess soil. Rotate the plunger 90° until it is aligned with the slots in the body. Extrude the sample into the appropriate container by pushing the plunger down. To provide a good sealing surface, wipe the container lip and screw threads to remove soil and immediately screw on the lid. If preservative is present in the container, swirl to immerse the sample. Record the sample ID on the container and package for shipment to the laboratory.

6.2.1.2 En Core® Sampler

The disposable En Core® sampler is a single use device that is pushed into the soil using a reusable En Core® T-handle. Two, 5 g samplers are typically supplied with an unpreserved container for % moisture determination. Hold the En Core® coring body and push plunger down until the small O-ring rests against the tabs so the plunger moves freely.

Depress the locking lever on the T-handle. Place coring body plunger end first into the open end of the T-Handle, aligning the slots on the coring body with the locking pins in the T-Handle. Twist coring body clockwise to lock pins in slots. Make certain that the sampler is locked in place.

Turn T-handle with T-up and coring body down. This will position the plunger bottom flush with bottom of coring body. Using T-handle, push sampler into soil until coring body is completely full. When full the small O-ring will be centered in the T-handle viewing hole. Remove excess soil from the coring body exterior.

Cap the coring body while it is still on the T-handle by pushing and twisting the cap over the bottom until grooves on locking arms seat over ridge on coring body. Remove the coring body from the T-handle and lock plunger by rotating extended plunger rod fully counterclockwise until wings rest firmly against tabs.

Attach the accompanying label and package for shipment to the laboratory.

6.2.1.3 Other

If no coring device is available, an estimate of the amount of soil needed to provide the desired weight can be determined. Place an extra laboratory container, disposable weigh boat, paper towel, or laboratory tissue on a balance pan. Using a stainless steel spoon, add the desired weight (10 g or 25 g) of a representative soil sample on the balance. Once the amount has been established, discard the soil used in the estimation and collect the sample as per form 'Soil Sampling Guidelines'.

If allowed by applicable regulations for VOC sample collection, the VOC aliquot may be weighed directly into the sample container by placing the pre-weighed sample container on the balance, taring the balance, then adding the appropriate amount of soil to the container to reach the desired aliquot weight. This should be done quickly to reduce the possible loss of VOCs.

6.2.2 Diesel Range Organics (DRO) / SVOC / General Chemistry / Metals

Fill the remaining containers in the order listed on the form 'Soil Sampling Guidelines'. Unless aliquot weights are listed, pack the soil into the sample jars leaving no headspace.

Wipe the container lip and screw threads to remove soil and provide a good sealing surface, and immediately screw on the lid.

6.2.3 Handling

After collection, all samples should be handled as few times as possible. Samplers should use extreme care to ensure that samples are not contaminated. Immediately after samples are collected, they are bubble wrap or bagged and placed in a cooler containing bagged ice. Samples will be kept cold (≤ 6 °C, but not frozen) until receipt at the laboratory, where they are to be stored in a refrigerated area.

Keep samples secure to prevent tampering. If sample coolers are left in a vehicle or field office for temporary storage, the area will be locked and secured.

6.2.4 Shipment/Delivery

Once the cooler is packed to prevent breaking of containers, the proper COC documentation is relinquished by the sampler, placed into a plastic bag, and included in the cooler. Custody seals may be used, and the coolers should be taped shut if not hand delivered.

The coolers must be delivered to the laboratory via hand or overnight delivery courier in accordance with all Federal, State and Local transportation regulations.

Note: Samples may have to be stored indoors in winter to prevent freezing.

6.3 Data Reduction/Calculations

No data reduction or calculations are associated with this procedure.

6.4 Disposal

Waste generated by this process will be containerized for characterization and disposal in accordance with Federal, State and Local regulations.

7.0 Quality Control and Quality Assurance (QA/QC)

The QC activities described below allow the self-verification of the quality and consistency of the work.

7.1 QA/QC Samples

QA/QC samples are defined in Barr's SOP 'Collection of Quality Control Samples'. QA/QC samples will be collected at a frequency of 1 every 20 samples.

7.2 Measurement Criteria

No specific criteria apply to the implementation of this SOP.

8.0 Records

The field technician will document the soil sampling event in a project dedicated field logbook or on field log data sheets. The analysis for each container, the number of bottles, and the laboratory used will be documented on the chain-of-custody record. Refer to Barr's SOP 'Documentation on a Chain-of-Custody (COC)' for further information.

Examples of common field documentation are available in Barr's "Compendium of Field Documentation". Field documentation specific to this SOP are listed below:

- Field Sampling Report
- Field Log Data Sheet
- COC
- Sample label
- Custody seal (if applicable)

Field documentation and COC are provided to a Barr Data Management Administrator for storage on the internal Barr network.

Other Barr SOP subjects referenced within this SOP: screening soil samples, balance calibration, collection of QC samples, decontamination of sampling equipment, investigative derived waste, domestic transport of samples, and documentation on a COC.

9.0 References

USEPA Environmental Response Team. 2000. *SOP for Soil Sampling*.

Standard Operating Procedure – Yakima Mill Site

Collection of Surface Water Samples

Revision 0

September 13, 2018

Approved By:

Alec Danielson	Alec Danielson	9/13/18
Print	Technical Reviewer Signature	Date
Dana Pasi	Dana Pasi	9/13/18
Print	QA Manager Signature	Date

Review of the SOP has been performed and the SOP still reflects current practice.

Initials: _______________ Date: _______________

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Minneapolis, MN ● Hibbing, MN ● Duluth, MN ● Ann Arbor, MI ● Jefferson City, MO ● Bismarck, ND ● Calgary, AB, Canada ●Grand Rapids, MI ● Salt Lake City, UT

Collection of Surface Water Samples

1.0 Scope and Applicability

The purpose of this Standard Operating Procedure (SOP) is to describe the methods used for sampling of surface water samples (e.g., ditches, streams, and ponds).

The recommended procedures in this SOP should be followed unless conditions make it impractical or inappropriate to do so. Modifications should be noted in the applicable documentation and communicated to appropriate personnel. Significant changes may result in a revision or newly created SOP.

2.0 Limitations

- Dedicated sampling equipment and/or decontamination of sampling equipment is required to prevent cross-contamination.

3.0 Responsibilities

Equipment Technicians are responsible to maintain equipment in working order and aid in troubleshooting equipment issues.

The role of the Project Health and Safety Team Leader is to oversee all aspects of on-site safety activities.

The Project Manager, in conjunction with the client, develops the site specific scope of work (e.g., Work Plan, SAP, etc.).

Experienced Field Technician(s) are responsible for the measurement of field screening procedures, field equipment and calibration, proper sample identification, collection of samples, quality control procedures, and documentation.

Project staff are responsible for ordering sample containers prior to the sampling event.

4.0 Safety

Barr staff is responsible for conducting all aspects of the job safely. When applicable, refer to the appropriate Project Health and Safety Plan (PHASP) to understand the hazards associated with suspected contamination, symptoms of exposure, methods to minimize exposure, personal protection equipment (PPE), and personal air monitoring required when using this SOP. Minimum protection of two pair of chemical resistant gloves (e.g., nitrile) and safety glasses with side shields should be worn to prevent sample contact with the skin and eyes.

Some of the sample containers may require the use of preservatives. Consult the applicable Safety Data Sheet to review hazards and appropriate PPE to minimize exposure.

5.0 Equipment, Reagents, and Supplies

- Water quality meter (e.g., YSI Model 556, or equivalent)
- Turbidimeter (optional)
- Sample containers (method specific)
- Chemical resistant gloves (e.g., nitrile)
- Plastic bags
- Waterproof ink pen or pencil

- Sample labels
- Coolers
- Custody seal, if applicable
- Ice

6.0 Procedure

This section describes the procedure(s) for calibrating field equipment, and the purging, sampling, handling, and delivery involving surface water samples.

6.1 Calibration

The water quality meter and turbidimeter will be calibrated as per the applicable Barr SOP. The meters will undergo calibration checks, at a minimum, before and after sampling. The calibration check will be documented on a calibration form (as appropriate) and/or in the field notebook. Any significant issues found during the calibration check will be noted in the field notebook.

6.2 Sampling

Surface water samples will be collected by decanting the water from a new, unpreserved transfer container.

Samples will be collected from the most volatile towards the least volatile parameter as listed in Barr's 'Water Sampling Guidelines' form and from the least contaminated area to the most contaminated area (when known). To prevent the possible loss of some VOCs, samples to be analyzed for volatile parameters should be collected first with as little agitation and disturbance as possible. The 40 mL vials used to collect the VOC samples should be checked for air bubbles. Air bubbles may be caused by insufficient meniscus when sealing the vial, degassing after sample collection or during sample shipment, or reaction between the sample and preservative (HCl). If air bubbles >6 mm (pea-sized) are observed during sampling, discard the vial and recollect the sample using a new vial. If air bubbles are believed to be due to the sample reacting with the preservative, the sample should be collected in an unpreserved vial if possible.

Put on new sampling gloves at each sampling site to reduce the risk of sample cross-contamination and exposure to skin. Never reuse old gloves.

Prepare sampling containers by filling out the label, using an indelible permanent pen, with the following information at a minimum:

- Sample ID
- Date and time of sample collection
- Preservative
- Sample analysis (if required by the lab)

When filling the containers, do not insert any portion of the transfer container to the lip of the sample containers and do not overfill preserved containers. When all samples are containerized, place the filled sample containers in a sampling cooler with ice, turn off any equipment, disassemble the sampling apparatus, dispose of all one-time use (disposable) equipment, and decontaminate reusable equipment per Barr's SOP 'Decontamination of Sampling Equipment'.

6.2.1 Preservation

Container volume, type, and preservative are important considerations in sample collection. Container volume must be adequate to meet laboratory requirements for quality control, split samples, or repeat analyses. The container type varies with the analysis required. Typically, the analytical laboratory will preserve the container before shipment. Preservation and shelf life vary; contact the laboratory to determine if an on-hand container is still useful. Barr's 'Water Sampling Guidelines' form lists the parameter, container type, container volume, and preservative for many of the most common parameters collected.

6.2.2 Handling

The samples will be bubble wrapped or bagged after collection, stored in a sample cooler, and packed on double bagged wet ice. Samples will be kept cold (≤ 6 °C, but not frozen), until receipt at the laboratory (where applicable).

Note: Samples may need to be stored indoors in winter to prevent freezing.

6.2.3 Shipment/Delivery

Once the cooler is packed to prevent breaking of bottles, the proper chain-of-custody (COC) documentation is signed and placed inside a plastic bag then added to the cooler.

All samples will be kept secured to prevent tampering. If sample coolers are left in a vehicle or field office for temporary storage, the area will be locked and secured.

Custody seals may be present, but at a minimum, the coolers must be taped shut to prevent the lid from opening during shipment.

The coolers must be delivered to the laboratory via hand or overnight delivery courier, if possible, in accordance with all Federal, State and Local transportation regulations.

6.3 Data Reduction/Calculations

No data reduction or calculations are associated with this procedure.

6.4 Disposal

Waste generated by this process will be containerized for characterization and disposal in accordance with Federal, State and Local regulations.

7.0 Quality Control and Quality Assurance (QA/QC)

The QC activities described below allow the self-verification of the quality and consistency of the work.

7.1 QA/QC Samples

QA/QC samples are defined in Barr's SOP 'Collection of Quality Control Samples'. QA/QC samples will be collected at a rate of 1 every 20 samples.

8.0 Records

The field technician will document any field test measurements on the field log data sheet and/or field notebook. They will also document the type and number of bottles on the chain-of-custody record, as appropriate. The analysis for each container and the laboratory used will be documented on the chain-of-custody record. Refer to Barr's SOP 'Documentation on a Chain-of-Custody (COC)' for further information.

Examples of common field documentation are available in Barr's "Compendium of Field Documentation". Field documentation specific to this SOP are listed below:

- Field Log Data Sheet
- Field Log Cover Sheet
- Field Sampling Report

The field documents and COCs are provided to a Barr Data Management Administrator for storage on the internal Barr network.

Other Barr SOP subjects referenced within this SOP: water quality meter, turbidimeter, collection of QC samples, decontamination of sampling equipment, and documentation on a COC.

9.0 References

Environmental Protection Agency, Region 4. 2013. *Surface Water Sampling Operating Procedure*.

Environmental Protection Agency. *Title 40 of the Code of Federal Regulations, Part 136.3.*

BARR

Standard Operating Procedure – Yakima Mill Site

Decontamination of Sampling Equipment

Revision 0

September 13, 2018

Approved By:

Alec Danielson — Alec Danielson — 9/13/18
Print — Technical Reviewer — Signature — Date

Dana Pasi — Dana Pasi — 9/13/18
Print — QA Manager — Signature — Date

Review of the SOP has been performed and the SOP still reflects current practice.

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Decontamination of Sampling Equipment

1.0 Scope and Applicability

The purpose of this Standard Operating Procedure (SOP) is to define the process used for decontaminating environmental sampling-related equipment including pumps, meters, and materials coming into contact with actual sampling equipment or with sampling personnel. This procedure is applicable to all personnel who are collecting samples and/or decontaminating sampling and field equipment.

The recommended procedures in this SOP should be followed unless conditions make it impractical or inappropriate to do so. Modifications should be noted in the applicable documentation and communicated to appropriate personnel. Significant changes may result in a revision or newly created SOP.

2.0 Limitations

- Equipment used once and discarded such as bailers, protective gear, and filtration devices are not part of this SOP.

3.0 Responsibilities

The equipment technician is responsible for ensuring field equipment has been thoroughly decontaminated and prepared for use out in the field. The field technician(s) are responsible for decontamination in the field at each individual sampling point and for ensuring adherence to any investigative derived waste (IDW) project-specific requirements set forth in the SAP.

The role of the Project Health and Safety Team Leader is to oversee all aspects of on-site safety activities.

4.0 Safety

Barr staff is responsible for implementing all aspects of the job safely. Where available, refer to the appropriate Project Health and Safety Plan (PHASP) to determine the proper personal protection equipment (PPE) required when using this SOP. Barr staff is responsible for conducting all aspects of the job safely. When applicable, refer to the appropriate Project Health and Safety Plan (PHASP) to understand the hazards associated with suspected contamination, symptoms of exposure, methods to minimize exposure, personal protection equipment (PPE), and personal air monitoring required when using this SOP. Minimum protection of two pair of chemical resistant gloves (e.g., nitrile) and safety glasses with side shields should be worn to prevent sample contact with the skin and eyes. When sampling soils contaminated with corrosive materials, emergency eye flushing facilities should be available.

Some of the sample containers may require the use of preservatives. Consult the applicable Safety Data Sheet to review hazards and appropriate PPE to minimize exposure.

5.0 Equipment, Reagents, and Supplies

- Non-phosphorus detergent (e.g., Liquinox^{TM})
- Scrub brush made of inert materials
- Oven
- Bucket
- Tap water
- Analyte-free water (e.g., distilled or deionized (DI) water, or equivalent)
- Kimwipes®, or equivalent
- Chemical resistant gloves (e.g., nitrile)
- Spray bottle
- Organic solvent (e.g. methanol)

6.0 Procedure

This section describes the procedure(s) for the decontamination of equipment used to sample water, soil, or air.

6.1 Calibration

Calibration is not applicable to this SOP.

6.2 Operation

Decontamination of sampling equipment will be performed before sampling and after working at each sampling point, if applicable.

6.2.1 Water Sampling Equipment

Equipment that does not contact sample water or the inside of the well should be rinsed with analyte-free water and inspected for remaining particles or surface film. If these are noted, repeat cleaning and rinse procedures.

Equipment that contacts sample water or the inside of the well should be cleaned (inside and outside where possible) with a non-phosphorus detergent solution applied with a spray bottle and/or scrub brush (if needed). Rinse with analyte-free water and containerize with other IDW and inspect for remaining particles or surface film. If these are noted, repeat cleaning and rinse procedures. Shake off remaining water and allow to air dry.

The internal surfaces of pumps and tubing that cannot be adequately cleaned by the above methods alone will also be cleaned by first circulating a non-phosphorus detergent solution through them followed by circulating analyte-free water. Special care will be exercised to ensure that the "rinse" fluids will be circulated in sufficient quantities to completely flush out contaminants and detergents.

When transporting or storing equipment after cleaning, the equipment will be stored in a manner that minimizes the potential for contamination.

6.2.2 Soil/Sediment Sampling Equipment

A variety of samplers (acetate liners, sonic cores, backhoe, hand-auger, or shovel) may be used to retrieve soil from sampling locations. The soil sample will be transferred to laboratory-supplied containers for analysis. The equipment required to transfer the soil from the sampler to the laboratory-supplied sample containers includes: stainless-steel spoons, Terra Core® Sampler or En Core® sampler (for VOC analysis), or scoops and the appropriate personal protective equipment necessary for collection and handling of soil samples as described in the PHASP.

All soil sampling equipment, including stainless-steel spoons and scoops, will be carefully cleaned before and during sampling with a tap water and non-phosphorus detergent solution, using a brush if necessary to remove particulate matter and films. The equipment is then rinsed three times with analyte-free water. Inspect equipment and repeat procedure if any residual soil or visible contaminants are present. Dry sampler with a Kimwipes®. Organic solvents (e.g., methanol) may be used to aid with desorbing organic material but should be kept to a minimum and must be collected and containerized if used.

At the completion of the work day, the samplers should be decontaminated following the procedure above and stored in a manner that minimizes the potential for contamination.

6.2.3 Handling

All equipment will be handled in a manner that minimizes cross-contamination between points. After cleaning, the equipment will be visibly inspected to detect any residues or other substances that may exist after normal cleaning. If inspection reveals that decontamination was insufficient, the decontamination procedures will be repeated.

6.3 Data Reduction/Calculations

No data reduction or calculations are associated with this procedure.

6.4 Disposal

IDW generated by this process will be containerized for characterization and disposal in accordance with Federal, State and Local regulations.

7.0 Quality Control and Quality Assurance (QA/QC)

The QC activities described below allow the self-verification of the quality and consistency of the work.

7.1 QA/QC Samples

Decontamination procedures will be monitored through the use of an equipment blank which consists of analyte-free water processed through non-disposable or non-dedicated aqueous or solid sampling equipment after equipment decontamination and before field sample collection. The equipment blank is analyzed for the same parameters as the samples at a project specific frequency (e.g., one per twenty samples).

7.2 Measurement Criteria

Equipment blank results should be below the laboratory's reporting limit.

8.0 Records

The field technician(s) will document the field equipment decontamination procedures in a project dedicated field logbook or on field log data sheets.

Examples of common field documentation are available in Barr's "Compendium of Field Documentation". Field documentation specific to this SOP are listed below:

- Field Sampling Report
- Field Log Cover Sheet
- Field Log Data Sheet
- COC

Field documentation and COC are provided to a Barr Data Management Administrator for storage on the internal Barr network.

Other Barr SOP subjects referenced within this SOP: investigative derived waste and sample collection.

9.0 References

ASTM. 2015. Standard Practice for Decontamination of Field Equipment Used at Waste Sites.

BARR

Standard Operating Procedure – Yakima Mill Site

Documentation on a Chain-of-Custody Form

Revision 0

September 13, 2018

Approved By:

Alec Danielson	Alec Danielson	9/13/18
Print Technical Reviewer	Signature	Date
Dana Pasi	Dana Pasi	9/13/18
Print QA Manager	Signature	Date

Review of the SOP has been performed and the SOP still reflects current practice.

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Documentation on a Chain-of-Custody Form

1.0 Scope and Applicability

The purpose of this procedure is to describe how to properly document information on a Chain-of-Custody (COC) form. A COC is a legally binding document that identifies sample identification, analyses required, and shows traceable possession of samples from the time they are obtained until they are introduced as evidence in legal proceedings. A Field Technician completes the information on the COC at the time he/she collects samples and the COC accompanies the samples during transport to a storage facility or to the laboratory for analysis.

The recommended procedures in this SOP should be followed unless conditions make it impractical or inappropriate to do so. Modifications should be noted in the applicable documentation and communicated to appropriate personnel. Significant changes may result in a revision or newly created SOP.

2.0 Limitations

- The SOP does not apply to sample aliquots that are only collected for field screening purposes.
- The SOP does not apply to samples remaining on-site.

3.0 Responsibilities

Experienced Field Technicians are responsible for the proper sample identification and for accurate and complete documentation on the COC.

4.0 Procedure

The COC is the most important sampling document; it must be filled out accurately and completely every time a sample is collected. The instructions below are specific to Barr's COC used for solid and liquid samples. The COC for soil and water samples is used when collecting matrices such as groundwater, surface water, drinking water, waste water, storm water, sediment, oil, paint chips, bulk materials, etc. Information common to the COCs and specific to each COC are detailed below. Some of the information on a COC may be filled out ahead of time (e.g., report and invoice recipient details, project number, project name, project manager, purchase order number, etc.) while other information should be completed when sampling. Complete one COC or more as needed for each set of project samples. The COC should be completed prior to leaving the sampling location.

Laboratory supplied COCs may be used but may differ in the information to record. The use of a Barr COC is recommended as it allows for more efficient data processing within Barr's systems. If there are any questions, please contact the quality assurance (QA) Manager.

The laboratory receiving the samples will sign and record when received, the lab work order number, and whether any custody seals were used and if intact.

4.1 Common Chain-of-Custody Information

- Barr office location managing the work.
- Two digit identification for the state or province the samples originated from/sampled in.
- COC numbered pages (e.g., 1 of 1).
- Report and invoice recipient information.
- Purchase order number (if applicable).
- Barr project name and number.
- Sample location.
- Sample collection date and time
- Sample matrix abbreviation (see "Matrix Code" on COC).
- Analysis requested.
- Field Technician (sampler) name.
- Barr Project Manager and project QA Manager names.
- Laboratory name and location.
- Requested due date.
- Signature of Field Technician (i.e. sampler) under the first 'relinquished by'.
- Signature of sample transferee.
- Date and time of sample transfers.
- Method of transport (UPS, FedEx, local courier, sampler, etc.).
- Air Bill number (if applicable).

4.2 Completing a Chain-of Custody for Solid and Liquid Samples

- Sample start and stop depth (if applicable) and unit of measurement (meter, feet, inches, etc.).
- Information regarding whether to perform sample Matrix Spike (MS) and MS duplicate (MSD).
- Container preservative type (see "Preservative Code" on COC).
- Information regarding whether the sample was field filtered.
- Number of each container type and the total number of containers for the sample.
- Presence or absence of ice.

4.3 Distribution of the COC Pages

Page one (white copy) accompanies the sample shipment to the laboratory; page two (yellow copy) is the Field Technician's copy; and page three (pink copy) is submitted to a Barr Data Management Administrator for filing.

5.0 Quality Control and Quality Assurance (QA/QC)

The Field Technician should review the COC for accurate and complete documentation.

6.0 Records

Examples of common field documentation are available in Barr's "Compendium of Field Documentation". Field documentation specific to this SOP are listed below:

- Chain-of-Custody Form

A copy of the COC is provided to a Barr Data Management Administrator for storage on the internal Barr network files.

7.0 References

United States Environmental Protection Agency. 2002. *Guidance for Quality Assurance Project Plans*. EPA QA/G-5.

BARR

Standard Operating Procedure – Yakima Mill Site

Field Screening Soil Samples

Revision 0

September 13, 2018

Approved By:

Alec Danielson	Alec Danielson	9/13/18
Print	Technical Reviewer Signature	Date
Dana Pasi	Dana Pasi	9/13/18
Print	QA Manager Signature	Date

Review of the SOP has been performed and the SOP still reflects current practice.

Initials: ____________________ Date: ____________________

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Field Screening of Soil Samples

1.0 Scope and Applicability

The purpose of this Standard Operating Procedure (SOP) is to describe the procedure for properly screening soil or sediment samples in the field. This procedure applies to all field technicians responsible for field screening soil or sediment samples.

The recommended procedures in this SOP should be followed unless conditions make it impractical or inappropriate to do so. Modifications should be noted in the applicable documentation and communicated to appropriate personnel. Significant changes may result in a revision or newly created SOP.

2.0 Limitations

- Sunlight and low temperatures may interfere with headspace development.
- Water and soil particles may interfere with PID measurements.
- Decontamination of screening equipment is required to prevent cross-contamination.
- Contact the local utilities hotline prior to digging to have utilities identified at sampling locations.

3.0 Responsibilities

Equipment Technicians are responsible to maintain equipment in working order and aid in troubleshooting equipment issues.

The role of the Project Health and Safety Team Leader is to oversee all aspects of on-site safety activities.

The Project Manager, in conjunction with the client, develops the site specific scope of work (e.g., Work Plan, SAP, etc.).

Experienced Field Technicians are responsible for the proper sample identification, field screening procedures, field equipment and calibration, quality control procedures, and documentation.

4.0 Safety

Barr staff is responsible for conducting all aspects of the job safely. When applicable, refer to the appropriate Project Health and Safety Plan (PHASP) to understand the hazards associated with suspected contamination, symptoms of exposure, methods to minimize exposure, personal protection equipment (PPE), and personal air monitoring required when using this SOP. Minimum protection of two pair of chemical resistant gloves (e.g., nitrile) and safety glasses with side shields should be worn to prevent sample contact with the skin and eyes. When screening soils contaminated with corrosive materials, emergency eye flushing facilities should be available.

Consult the applicable Safety Data Sheet to review hazards and appropriate PPE to minimize exposure.

5.0 Equipment, Reagents, and Supplies

- Photoionization detector (PID)
- Waterproof ink pen or pencil
- Squirt bottle with tap water
- Chemical resistant gloves (e.g., nitrile)
- Stainless steel spoon
- Polyethylene bags

6.0 Procedure

6.1 Calibration

The PID shall be calibrated or checked against a known concentration of a calibration gas standard prior to collection of field measurements. Calibration of the PID shall follow the recommended procedures as described in the manufacturer's operation manual.

Regular calibration checks (bump tests) are expected to be performed by the field technician a minimum of once per day of use in the field. It is recommended that bump tests be conducted around mid-day and at the end of the day. More frequent bump testing may be completed if warranted by field conditions. The bump testing results should be recorded in the field log book or field log data sheets.

If problems occur during calibration, during bump tests, or if the unit will not stay calibrated, the field technician should document the issue in the field notes then contact the equipment technician or project manager for assistance.

6.2 Screening Techniques

The field screening techniques for soils are as follows: visual examination, odor, headspace organic vapor screening, and oil sheen test. The results of these four screening procedures will be used to screen soil samples for possible contamination. To prevent sample cross-contamination, the screening equipment is carefully cleaned before and after working with each sample per Barr's SOP 'Decontamination of Sampling Equipment'.

6.2.1 Visual Examination

A visual examination of the soil sample will include noting any discoloration of the soil or visible oiliness or tar.

6.2.2 Odor

The field technician will note odor only if noticed incidentally while handling the soil sample. Field technicians will not unduly expose themselves to sample odors. Odor will be described as trace, light, moderate, or strong, and appropriate description of the type of odor, if evident.

6.2.3 Headspace Organic Vapor Screening

The polyethylene bag headspace method will be used in the field to screen soils suspected to contain volatile organic compounds. The screening method is intended to be used in conjunction with other "real time" observations.

The following equipment is required to conduct headspace organic vapor screening: PID, polyethylene bag, log book or record sheet, and appropriate PPE. Soil samples collected from a drill core will be collected immediately after opening the barrel or liner. If the sample is collected from a backhoe bucket, it will be collected from a freshly exposed surface.

- Half-fill the bag with the sample to be analyzed using a stainless-steel spoon or a gloved hand and immediately seal it. Agitate the bag for 15 seconds and manually break up any soil clumps within the bag.
- Allow headspace development for approximately 10 minutes. The sample should be kept in a shaded area out of direct sunlight. Ambient temperatures during headspace development should be recorded. When ambient temperatures are below 50°F, headspace development should be conducted inside a heated vehicle or building. After completing the headspace development, agitate the bag for an additional 15 seconds.
- Quickly puncture the bag with the sampling probe of the PID at a point about one-half of the headspace depth. Exercise care to avoid uptake of water droplets or soil particles.
- Record the highest PID meter response as the headspace concentration. The maximum response will likely occur between 0 to 5 seconds.

6.2.4 Oil Sheen Test

The oil sheen est is a method used to immediately determine the approximate magnitude of oil saturation in a soil sample. The oil sheen test is consistent with the sheen test described in Washington State Department of Ecology - Pub. No. 10-09-057, Guidance for Remediation of Petroleum Contaminated Sites.

The equipment required to conduct the oil sheen test includes: a stainless-steel spoon or glass jar, a squirt bottle filled with tap water, a log book or field log data sheet, and the appropriate personal protective equipment necessary for collection and handling of soil samples as described in the Project Health and Safety Plan.

The procedure for conducting the oil sheen test consists of obtaining approximately 50 grams (about 30 cc) of representative soil with the spoon or glass jar and then directing a stream of water onto the soil in the spoon with the squirt bottle until the soil is saturated and water begins to collect around the soil. The amount of oil sheen present on the water is determined by observation and the results of the test are reported as a magnitude of oil sheen observed: none, trace, light, moderate, heavy or rainbow. The test results, sample location, and observations of the sample's appearance and odor are recorded in the log book or field log data sheet.

The specific soil types at the area of investigation should be accounted for when performing the oil sheen test. The best results are obtained in silts, sands, and/or gravels with low organic content. The results obtained from clay soils may appear deceptively low. Typical descriptions of each test result are provided in the table below.

Oil Sheen Test Result	**Description**
None	No sheen detected.
Trace	Possible or faint oil sheen observed (may not continue to generate sheen as additional water is added).
Light	Obvious sheen that may not cover entire water surface
Moderate	Definite oil sheen that covers entire surface, but “rainbow colors” not distinguishable.
Heavy	Definite oil film or product that does not display rainbow colors.
Rainbow	Definite oil sheen, film or product that displays rainbow colors.

6.3 Data Reduction/Calculations

No data reduction or calculations are associated with this procedure.

6.4 Disposal

Waste generated by this process will be containerized for characterization and disposal in accordance with Federal, State and Local regulations.

7.0 Quality Control and Quality Assurance (QA/QC)

Field background readings are measured for the headspace organic vapor screening. PID readings should be duplicated every 20 field samples.

8.0 Records

The field technician(s) will document the field screening activities and measurements in a project dedicated field logbook or on field log data sheets.

Examples of common field documentation are available in Barr's "Compendium of Field Documentation". Field documentation specific to this SOP are listed below:

- Soil Boring Log
- Test Pit Log

Field documentation are provided to a Barr Data Management Administrator for storage on the internal Barr network.

Other Barr SOP subjects referenced within this SOP: PID and FID equipment, decontamination of sampling equipment, and investigative derived waste.

9.0 References

PID operation manuals.

BARR

Standard Operating Procedure – Yakima Mill Site

Filtering of Water Samples

Revision 0

September 13, 2018

Approved By:

Alec Danielson	Alec Danile	9/13/18
Print	Technical Reviewer Signature	Date
Dana Pasi	Dana Pasi	9/13/18
Print	QA Manager Signature	Date

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Filtering of Water Samples

1.0 Scope and Applicability

The purpose of this Standard Operating Procedure (SOP) is to describe the filtering process for water samples (e.g., groundwater and surface water) to remove silt, clay, and particles for laboratory analysis.

The recommended procedures in this SOP should be followed unless conditions make it impractical or inappropriate to do so. Modifications should be noted in the applicable documentation and communicated to appropriate personnel. Significant changes may result in a revision or newly created SOP.

2.0 Limitations

- Collection of water samples are not discussed within this SOP.

3.0 Responsibilities

Equipment Technicians are responsible to maintain equipment in working order and aid in troubleshooting equipment issues.

The role of the Project Health and Safety Team Leader is to oversee all aspects of on-site safety activities.

Experienced Field Technicians are responsible for the proper collection and filtering of samples, field equipment, sample identification, quality control procedures, and documentation.

Project staff are responsible for ordering sample containers prior to the sampling event.

4.0 Safety

Barr staff is responsible for conducting all aspects of the job safely. When applicable, refer to the appropriate Project Health and Safety Plan (PHASP) to understand the hazards associated with suspected contamination, symptoms of exposure, methods to minimize exposure, personal protection equipment (PPE), and personal air monitoring required when using this SOP. Minimum protection of two pair of chemical resistant gloves (e.g., nitrile) and safety glasses with side shields should be worn to prevent sample contact with the skin and eyes. When sampling water contaminated with corrosive materials, emergency eye flushing facilities should be available.

Some of the sample containers may require the use of preservatives. Consult the applicable Safety Data Sheet to review hazards and appropriate PPE to minimize exposure.

5.0 Equipment, Reagents, and Supplies

- Applicable water sampling equipment
- Filtering device (base and funnel)
- Peristaltic or vacuum pump and tubing
- Inline or disposable filters (e.g., 0.45 µm)

6.0 Procedure

This section describes the procedure(s) for the filtering of water samples for various laboratory analyses using a vacuum or peristaltic pump.

6.1 Calibration

Calibration is not applicable to this SOP.

6.2 Process

Representative samples are collected in an unpreserved container. Filter the sample using a 0.45 micron (µm) pore size within 15 minutes of sample collection. A new disposable filtering device is used for each sampling location.

6.2.1 Vacuum Pump

Connect the two sections of the 0.45 µm disposable filtering device (e.g., Corning Disposable Sterile Filter).

Attach the vacuum pump to the filtering device and turn on power to the pump. A hand powered vacuum pump may be used if a 110 volt power source is not available.

Pour the unpreserved water sample into the filter funnel and filter the amount of water sample needed for the analyses. After filtering is complete, pour the filtered sample into the appropriate sample container and dispose of the filtering device.

Note: Depending on the water sample matrix and volume required, additional filters may be needed.

6.2.2 In-line - Filter

Attach a 0.45 µm filter to the end of the purge tubing, ensuring direction of flow is correct, and place the appropriate sample container at the filter outlet.

Turn on purge/sample pump and purge a minimum of one filter volume through the filter before filling sample containers and discard the used filtering device.

Note: Depending on the water sample matrix and volume required, additional filters may be needed.

6.2.3 Preservation/Handling/Delivery

The filtered samples will be delivered to the laboratory via hand or overnight delivery courier in accordance with all Federal, State and Local transportation regulations.

6.3 Data Reduction/Calculations

No data reduction or calculations are associated with this procedure.

6.4 Disposal

Waste generated by this process will be containerized for characterization and disposal in accordance with Federal, State and Local regulations.

7.0 Quality Control and Quality Assurance (QA/QC)

The QC activities described below allow the self-verification of the quality and consistency of the work.

7.1 QA/QC Samples

QA/QC samples are defined in Barr's SOP 'Collection of Quality Control Samples'. QA/QC samples will be collected 1 every 20 samples.

7.2 Measurement Criteria

Measurement criteria are not applicable to this SOP.

8.0 Records

The field technician will document the water sampling event on the field log data sheet and/or field notebook. They will also document the number and type of filters used for each sample filtered. The analysis for each container and the laboratory used will be documented on the chain-of-custody record along with identifying which samples/analyses were field filtered. Refer to Barr's SOP 'Documentation on a Chain-of-Custody (COC)' for further information.

Examples of common field documentation are available in Barr's "Compendium of Field Documentation". Field documentation is listed in the SOPs referenced in this procedure.

The field documents and COCs are provided to a Barr Data Management Administrator for storage on the internal Barr network.

Other Barr SOP subjects referenced within this SOP: collection of samples, collection of QC samples, investigative derived waste, domestic transport of samples, and documentation on a COC.

9.0 References

Corning Disposable Sterile Filter Information Booklet.

BARR

Standard Operating Procedure – Yakima Mill Site

Measuring Static Water Level, Immiscible Layers (DNAPL and LNAPL), and Total Well Depth in Wells

Revision 0

September 13, 2018

Approved By:

Alec Danielson
Alec Danielson
9/13/18
Print Technical Reviewer Signature Date

Dana Pasi
Dana Pasi
9/13/18
Print QA Manager Signature Date

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Initials: ____________ Date: ____________

Measuring Static Water Level, Immiscible Layers (DNAPL and LNAPL), and Total Well Depth in Wells

1.0 Scope and Applicability

The purpose of this Standard Operating Procedure (SOP) is to describe the procedure for measuring static water level, light non-aqueous phase liquid (LNAPL) level, dense non-aqueous phase liquid (DNAPL) level, and total well depth in a groundwater well.

The recommended procedures in this SOP should be followed unless conditions make it impractical or inappropriate to do so. Modifications should be noted in the applicable documentation and communicated to appropriate personnel. Significant changes may result in a revision or newly created SOP.

2.0 Limitations

- Decontamination of reusable equipment is required to prevent cross-contamination.

3.0 Responsibilities

Equipment Technicians are responsible to maintain equipment in working order and aid in troubleshooting equipment issues.

The role of the Project Health and Safety Team Leader is to oversee all aspects of on-site safety activities.

The Project Manager, in conjunction with the client, develops the site specific scope of work (e.g., Work Plan, SAP, etc.).

Experienced Field Technicians are responsible for the proper measurement and documentation of water levels, immiscible (does not dissolve in water) layers (DNAPL and LNAPL), and total water depth.

4.0 Safety

Barr staff is responsible for conducting all aspects of the job safely. When applicable, refer to the appropriate Project Health and Safety Plan (PHASP) to understand the hazards associated with suspected contamination, symptoms of exposure, methods to minimize exposure, personal protection equipment (PPE), and personal air monitoring required when using this SOP. Minimum protection of two pair of chemical resistant gloves (e.g., nitrile) and safety glasses with side shields should be worn to prevent sample contact with the skin and eyes. When working with liquids contaminated with corrosive materials, emergency eye flushing facilities should be available.

Consult the applicable Safety Data Sheet to review hazards and appropriate PPE to minimize exposure.

5.0 Equipment, Reagents, and Supplies

- Electronic water level indicator
- Chemical resistant gloves (e.g., nitrile)
- Oil/water interface probe

6.0 Procedure

This section below describes the procedures and equipment used for measuring static water level, LNAPL or DNAPL) level (if present), non-aqueous phase product thickness (if present), and total well depth in a groundwater well.

6.1 Calibration

The electronic water level indicator and oil/water interface probe will be tested prior to use to ensure they are functioning properly. Instruments that are not properly functioning should be tagged for inspection by the Equipment Technician or sent to the manufacturer for repair. AA or 9V batteries are normally used for a power source; spare batteries should be kept on hand.

6.2 Measurements

The water level, total depth, and immiscible layers are measured prior to well purging or sampling. For new wells, measurements should not be taken until the water level in the well has stabilized, a minimum of 48 hours after well installation and development.

Decontaminate reusable equipment per Barr's SOP 'Decontamination of Sampling Equipment'.

6.2.1 Water Level

Groundwater levels will be measured at all permanent monitoring wells on the same day prior to purging and sampling with an electronic water level indicator probe that is lowered into the well. An oil/water interface probe may also be used if oil layers may be encountered (see section below). The electronic water level indicator consists of a spool of length-marked cable, a probe attached to the end, and an indicator. When the probe comes in contact with the water, the circuit is closed, and a meter light and/or tone signals the contact.

To ensure consistent results, groundwater level measurements are made in reference to an established point (e.g., top of riser pipe). Water level measurements are made from the high side of the riser pipe unless otherwise specified. If the top of the riser appears to be level, take the readings at the north side of the riser. The depth to water is indicated by the markings on the cable. Read the water level directly off of the tape. The groundwater level should be measured three times consecutively (without completely winding up the water level indicator probe) to help ensure accuracy. Record the water level to the nearest 0.01 foot on the appropriate field sheets.

6.2.2 Total Well Depth

Determine the total well depth by lowering the water level indicator probe (or equivalent) into the well. After feeling the bottom of the well, raise and lower the water level indicator probe three times to ensure the bottom is being felt. Record the total well depth to the nearest 0.01 foot on the appropriate field sheets.

6.2.3 Immiscible Layer Thickness – Oil/Water Interface Probe

An immiscible layer may consist of LNAPL or DNAPL. LNAPL has a specific gravity less than water and is typically found floating on the water surface in a well. DNAPL has a specific gravity greater than water and tends to accumulate at the bottom of a well. An oil/water interface probe is used to measure the layer and consists of a flat measuring tape with a probe attached to the end, an indicator, and a grounding mechanism. After grounding the instrument to a metal source (well casing), determine the LNAPL or DNAPL thickness by slowly lowering the probe into the well.

6.2.3.1 LNAPL

If LNAPL (floating product) is present, a steady tone will activate. If there is no LNAPL, an intermittent tone will activate indicating the air/water interface (i.e., water level) in the well. Raise and lower the probe gently to clear product from the conductivity sensor and to determine the exact upper level of the floating product. The air/product interface level should be measured three times consecutively (without completely winding up the product level interface probe) to help ensure accuracy. Read the level of the air/product interface from the measuring tape and record to the nearest 0.01 foot.

Continue lowering the probe through the product until the original signal changes to an intermittent tone. This signals contact of the probe with water. Raise and lower the probe gently to clear product from the conductivity sensor and to determine the exact lower level of the floating product. The product/water interface should be measured three times consecutively (without completely winding up the product level interface probe) to help ensure accuracy. Read the level of the product/water interface from the measuring tape and record to the nearest 0.01 foot.

6.2.3.2 DNAPL

If there isn’t any LNAPL present in the well, an intermittent tone will activate when the water level is reached. Continue lowering the probe until a steady tone is activated indicating the upper level of the DNAPL layer. Raise and lower the probe gently to clear product from the conductivity sensor and to determine the exact upper level of the DNAPL. The water/product interface level should be measured three times consecutively (without completely winding up the product level indicator probe) to help ensure accuracy. Read the level of the water/product interface from the measuring tape and record to the nearest 0.01 foot.

Continue lowering the probe through the product until coming into contact with the bottom of the well. Raise and lower the probe gently to ensure the bottom is being felt. The bottom of the well should be measured three times consecutively (without completely winding up the product level interface probe) to help ensure accuracy. Read the depth to the bottom of the well from the measuring tape and record to the nearest 0.01 foot.

6.3 Data Reduction/Calculations

The water column in the well is calculated by subtracting the measured water level from the total well depth.

The difference in the LNAPL upper level and the LNAPL lower level is the LNAPL thickness. The difference in the DNAPL upper level and the bottom of well is the DNAPL thickness.

6.4 Disposal

Waste generated by this process will be containerized for characterization and disposal in accordance with Federal, State and Local regulations.

7.0 Quality Control and Quality Assurance (QA/QC)

Not applicable.

8.0 Records

The field technician(s) will document the water level, total depth, or product level measurements on the water level data sheet and the field log data sheet for each well, if required.

Examples of common field documentation are available in Barr's "Compendium of Field Documentation". Field documentation specific to this SOP are listed below:

- Field Log Data Sheet
- Water Level Data Sheet

Field documentation are provided to a Barr Data Management Administrator for storage on the internal Barr network.

Other Barr SOP subjects referenced within this SOP: decontamination of sampling equipment and investigative derived waste.

9.0 References

Equipment operation manuals.

BARR

Standard Operating Procedure – Yakima Mill Site

Monitoring Well Development

Revision 0

September 13, 2018

Approved By:

Alec Danielson — Alec Danielson — 9/13/18
Print Technical Reviewer Signature — Date

Dana Pasi — Dana Pasi — 9/13/18
Print QA Manager Signature — Date

Review of the SOP has been performed and the SOP still reflects current practice.

Initials:		Date:	
Initials:		Date:	
Initials:		Date:	
Initials:		Date:	

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Monitoring Well Development

1.0 Scope and Applicability

The purpose of this procedure is to describe how to develop new monitoring wells or redevelop existing monitoring wells that have just been installed or existing monitoring wells that may have become partially filled with sediment during use as a monitoring well. These procedures are performed with the objective of obtaining representative groundwater information and water quality samples from aquifers.

The recommended procedures in this SOP should be followed unless conditions make it impractical or inappropriate to do so. Modifications should be noted in the applicable documentation and communicated to appropriate personnel. Significant changes may result in a revision or newly created SOP.

2.0 Limitations

- Well development should be completed by an appropriately licensed or registered well contractor unless allowed by rules governing wells and borings.

3.0 Responsibilities

The role of the Health and Safety Officer is to oversee all aspects of job safety.

Experienced Field Technicians are responsible for overseeing the well development, quality control procedures, and documentation.

The well drilling contractors are responsible for the development of monitoring wells at the time of installation and have the necessary tools, equipment, chemicals, applicable licenses or registrations that may be required to perform the development work.

4.0 Safety

Barr staff is responsible for conducting all aspects of the job safely. When applicable, refer to the appropriate Project Health and Safety Plan (PHASP) to understand the hazards associated with suspected contamination, symptoms of exposure, methods to minimize exposure, personal protection equipment (PPE), and personal air monitoring required when using this SOP. Minimum protection of two pair of chemical resistant gloves (e.g., nitrile) and safety glasses with side shields should be worn to prevent sample contact with the skin and eyes. When working with liquids contaminated with corrosive materials, emergency eye flushing facilities should be available.

5.0 Equipment, Reagents, and Supplies

- Pumps (e.g., submersible or peristaltic)
- Pump discharge hose/tubing
- Bailers
- Chemical resistant gloves (e.g., nitrile)
- Water level indicator or interface probe
- Surge block (optional)
- Water quality meter (YSI Model 556, or equivalent)
- Turbidimeter

6.0 Procedure

These procedures are used to remove the fine-grained materials from a well or well bore as a result of boring or well construction. Monitoring wells must be developed to provide water free of suspended solids and to yield representative samples. Well development should result in a well that yields visibly clear groundwater.

6.1 Calibration

The water quality meter and turbidimeter will be calibrated as per the applicable Barr SOP. The meters will undergo calibration checks, at a minimum, before and after sampling. The calibration check will be documented on a calibration form (as appropriate) and/or in the field notebook. Any significant issues found during the calibration check will be noted in the field notebook and the Equipment Technicians will be notified.

6.2 Development

Successful development methods include bailing, surging, pumping/over-pumping, and jetting with water. The basic principle behind each method is to create reversals of water flow into and out of the well screen (and/or bore hole) to break-down any potential mud cake or disturbed zones where fine-grained particles may be concentrated at the borehole-formation interface, and to draw the finer materials into the well or borehole for removal. This process also helps remove fine fraction formation materials in proximity to the borehole wall, leaving behind a “natural” pack of coarser-grained materials.

6.2.1 Bailing

In relatively clean, permeable formations where water flows freely into the borehole, bailing is an effective development technique. Let the bailer fall down the well until it strikes the surface of the groundwater which produces an outward surge. Rapidly withdraw the bailer to create a drawdown and/or after the bailer hits the groundwater lower it to the bottom of the well and agitate it with rapid short strokes. Continue bailing with repeated up and down “surging motions” until water bailed from the well is free from suspended particles.

Note: During this process, if the well goes dry, stop bailing and let the well recharge before continuing.

6.2.2 Surge Block

A surge block is a tool used to break up bridging of fine grained material by inducing agitation and inducing flow into and out of the well and aquifer formation. Bridging is the tendency for particles moving towards a well under unidirectional flow (pumping) to develop a blockage that restricts subsequent particles to move into a well. Surge block is used alternately with either a pump or bailer. Let the surge block fall down the well until it strikes the groundwater surface. This creates a vigorous outward surge; rapidly retrieve the surge block. Lower the surge block to the top of the well intake and begin a pumping action with a typical stroke of approximately 3 feet and gradually work downward through the screened interval. Remove the surge block at regular intervals to discard the loosened suspended particles by either bailing or pumping. Continue the cycle of surging/bailing/pumping until satisfactory development has been attained.

6.2.3 Pumping/Over-pumping

During pumping, the groundwater flow is induced to flow into the well and the fine particulate material moves into the well and is discharged by the pump. In the case of over-pumping, the pump is operated at a rate that substantially exceeds the ability of the formation to deliver water, which results in the water level in the well dropping throughout the pumping period. Once pumping has begun, start the surging action by lowering and raising the hose/pumping apparatus through the screened interval. Bailing or bailing and surging may be combined with pumping for efficient well development. Continue pumping until such time as satisfactory development has been attained based on field observation of visibly clear water produced.

If pumping/over-pumping is completed by air lifting, the air compressor must be of an oil-less type or fitted with an oil trap capable of removing compressor oil from the air stream to avoid contaminating the well or boring.

6.2.4 High Velocity Jetting

Development by high velocity jetting may be completed with either water or air. In practice, jetting with water is typically followed by or simultaneously occurring air-lift pumping/over pumping to remove the fine materials. The jetting procedure consists of operating a horizontal water jet(s) inside of the well screen so high velocity streams of water shoot through the screen openings into the sand pack/formation. The jetting tool is worked similar to a surge block. The jetting tool ideally will have four openings located 90 degrees apart and should be worked up and down the screened interval while being rotated. At a minimum, the amount of water introduced during jetting and, if feasible, an additional 10 well volumes of water should be purged from the well.

6.3 Data Reduction/Calculations

No data reduction or calculations are associated with this procedure.

6.4 Disposal

Waste generated by this process will be containerized for characterization and disposal in accordance with Federal, State and Local regulations.

7.0 Quality Control and Quality Assurance (QA/QC)

The objective of well development is to remove fine-grained materials from the well-pack for a good hydraulic connection that provides representative aquifer conditions. This objective will be evaluated through collection of QA/QC samples for turbidity. Well development is considered complete when samples have less than 5 nephelometric turbidity units (NTUs) or when 10 well volumes have been removed.

8.0 Records

The field technician(s) will document the method of development (e.g., high velocity jetting, flushing), any deviations from this SOP, volume of water purged, and any volume of water introduced to the well.

Examples of common field documentation are available in Barr's "Compendium of Field Documentation". Field documentation specific to this SOP are listed below:

- Field Log Data Sheet

The field documents are provided to a Barr Data Management Administrator for storage on the internal Barr network.

Other Barr SOP subjects referenced within this SOP: water quality meter, turbidimeter, well recovery rate testing, and low-flow purging/sampling.

9.0 References

American Society for Testing and Materials (ASTM), D5521/D5521M-13. 2013. *Standard Guide for Development of Groundwater Monitoring Wells in Granular Aquifers.*

Environmental Protection Agency, Offices of Waste Programs Enforcement and Solid Waste and Emergency Response. 1986. *RCRA Ground-Water Monitoring Technical Enforcement Document.*

Johnson Filtration Systems. 1986. *Groundwater and Wells.*

National Water Well Association. *Handbook of Suggested Practices for the Design and Installation of Groundwater Monitoring Wells.*

Standard Operating Procedure – Yakima Mill Site

Field Measurement of Soil Gases

Revision 0

September 13, 2018

Approved By:

Alec Danielson	Alec Danielson	9/13/18
Print	Technical Reviewer Signature	Date
Dana Pasi	Dana Pasi	9/13/18
Print	QA Manager Signature	Date

Review of the SOP has been performed and the SOP still reflects current practice.

Initials: __________ Date: __________

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Field Measurement of Soil Gases

1.0 Scope and Applicability

The purpose of this Standard Operating Procedure (SOP) is to detail the method of measuring landfill gases using the LANDTEC GEM™ 2000, GEM™500 or GA-90 landfill gas analyzer. Landfill gases measured by this equipment include: Methane (CH4), the percent of the Lower Explosive Limit (LEL) of Methane, Carbon Dioxide (CO2), and Oxygen (O2). Oxygen, carbon monoxide, LEL, and hydrogen sulfide will be measured using a 4-gas meter. The procedure applies to field measurements of gases from soil gas monitoring wells.

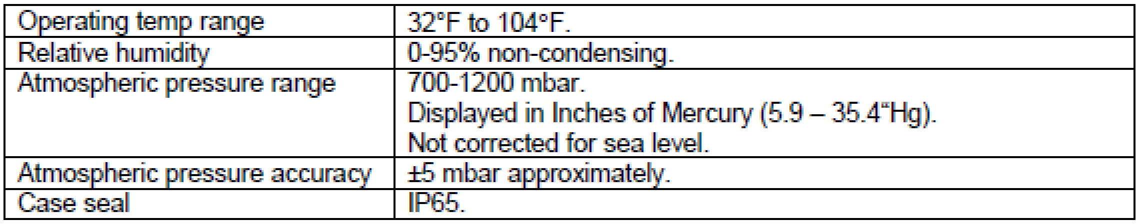
Measurements will be used for the following purposes:

1. To determine stabilization of soil gas/vapor concentrations to ensure a representative formation sample on the completion of the initial purging.

The recommended procedures in this SOP should be followed unless conditions make it impractical or inappropriate to do so. Modifications should be noted in the applicable documentation and communicated to appropriate personnel. Significant changes may result in a revision or newly created SOP.

2.0 Limitations

Field calibration of the GEM™ 2000, GEM™500 or GA-90 will improve the data collected in the range of the calibration gases used. Less accurate readings of concentrations outside the calibrated range may occur.



Operating temp range	32°F to 104°F.
Relative humidity	0-95% non-condensing.
Atmospheric pressure range	700-1200 mbar. Displayed in Inches of Mercury (5.9 – 35.4"Hg). Not corrected for sea level.
Atmospheric pressure accuracy	±5 mbar approximately.
Case seal	IP65.

3.0 Responsibilities

Equipment Technicians are responsible to maintain equipment in working order and aid in troubleshooting equipment issues.

The role of the Project Health and Safety Team Leader is to oversee all aspects of on-site safety activities.

Experienced Field Technicians are responsible for the proper sample identification, collection of samples, field screening procedures, field equipment and calibration, quality control procedures, and documentation. The Field Technician(s) are responsible for the field measurement of landfill gases from soil gas monitoring wells.

4.0 Safety

Barr staff is responsible for conducting all aspects of the job safely. When applicable, refer to the appropriate Project Health and Safety Plan (PHASP) to understand the hazards associated with suspected contamination, symptoms of exposure, methods to minimize exposure, personal protection equipment (PPE), and personal air monitoring required when using this SOP. Minimum protection of two pair of chemical resistant gloves (e.g., nitrile) and safety glasses with side shields should be worn to prevent sample contact with the skin and eyes. When samples may be contaminated with corrosive materials, emergency eye flushing facilities should be available.

Some of the sample containers may require the use of preservatives. Consult the applicable Safety Data Sheet to review hazards and appropriate PPE to minimize exposure.

5.0 Equipment, Reagents, and Supplies

- GEM™ 2000, GEM™500 and/or GA-90
- Zero Air
- Tubing
- Disposable small diameter polyethylene tubing
- Calibration Gas - span oxygen and zero methane
- Stainless steel PRT adaptor,
- Surgical grade silicon tubing
- Laboratory grade plastic 3-way valve

6.0 Procedure

Prepare the instrument for field calibration by removing it from the case. Instrument should be allowed to equilibrate to field atmospheric conditions with pump running. During the equilibration period, appropriate tubing and adaptors can be connected to the instrument in preparation of field calibration.

6.1 Calibration

The GEM™ 2000, GEM™500 and/or GA-90 will undergo calibration checks, at a minimum, before, mid-day, and after sampling. The calibration check will be documented in the field notes. Any significant issues found during the calibration check will be noted in the field notes and the Equipment Technician(s) will be notified.

It is important to field calibrate the GEM™ 2000, GEM™ 500 or GA-90 on-site after the instrument has stabilized at working temperature. For this reason, a GEM™ 2000, GEM™500 or GA-90 that was calibrated in the cool of the morning may not read as accurately during the hottest part of the day without recalibration.

6.1.1 Attaching the Hose Assembly to the Instrument

The GEM™ 2000, GEM™500 or GA-90 hose assembly comes fully assembled but it needs to be connected to the GEM™ 2000, GEM™2000, GEM™500 or GA-90. Connect the tubing with the external filter/water trap assembly to the static pressure/ sampling port (top left corner) on the GEM™ 2000, GEM™500 or GA-90. The shorter piece of tubing (from the water trap filter hosing) should be connected to the GEM™ 2000, GEM™500 or GA-90. This allows you to see any liquid entering the hose and shut the unit off before the liquid reaches the GEM™ 2000, GEM™500 or GA-90. Always connect the hose in the same direction. Connect the tubing to the impact pressure port on the GEM™ 2000, GEM™500 or GA-90. This port is located on the bottom left corner of the GEM™ 2000, GEM™500 or GA-90. Do not block the exhaust port.

6.1.2 Calibration Gas/Span Gases

Field calibration requires two calibration gas mixtures. One gas mixture is used to span oxygen and zero Methane. The other is used to span Methane, Carbon Dioxide and zero oxygen. The oxygen has two curves: 0-5% and 0-25%. The zero point is the same for both curves; however, the span is different. The user need only span the instrument using calibration gas below 5% for the 0-5% range or calibration gas below 25% for the 0-25% range. Regardless of the ranges used, the instrument must be zeroed. Various calibration gas mixtures are available from CES-LANDTEC.

6.1.3 Zero Methane

Calibration of the GEM™ 2000, GEM™500 or GA-90 starts by establishing the bottom point of the Methane gas curve. The Methane (CH4) is zeroed prior to taking readings at the start of each day. This function significantly improves the GEM™ 2000, GEM™500 or GA-90's CH4 accuracy over the entire range. It is essential that the gas analyzer be clear of CH4 when zeroed. Care must be taken if the GEM™ 2000, GEM™500 or GA-90 is to be zeroed using air near a landfill site because there are situations where Methane could be in the atmosphere.

6.1.4 Span Methane

A field calibration spans the Methane range prior to taking readings at the start of each day. The best results are obtained after the instrument has stabilized at its working temperature. This procedure alters the Methane calibration at all concentrations and stores the revised data in protected memory.

NOTE: Methane zero must be performed before setting the Methane Span.

6.1.5 Span Carbon Dioxide

Field calibration of CO2 will be performed prior to taking readings at the start of each day after the instrument has stabilized at its working temperature. This procedure alters the calibration at all concentrations and stores the revised data in protected memory.

6.1.6 Zero Oxygen

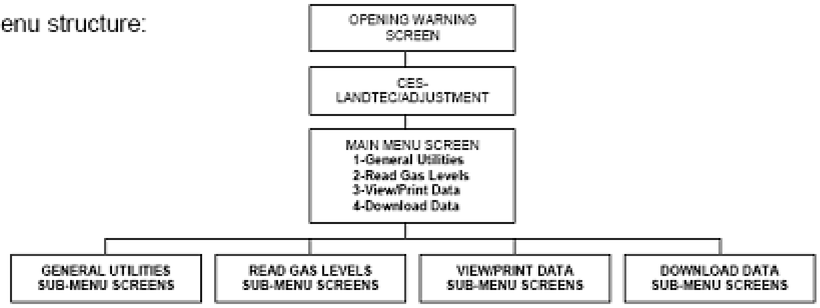
This function is essential where low concentrations of oxygen are expected (below 5%). This establishes the zero point of an oxygen curve that is stored in the GEM™ 2000, GEM™500 or GA-90 protected memory.

6.1.7 Span Oxygen

The oxygen calibration map contains two span curves, one for oxygen below 5% and one for oxygen above 5%. The proper curve is automatically selected. If a calibration gas with less than 5% oxygen is used, the lower span curve is set. If the calibration gas has more than 5% oxygen, the higher calibration curve is set. NOTE: The Oxygen zero must be set before setting the Oxygen Span.

GEM-500 Menu Tree

The overall menu structure:



6.2 Measuring Soil Gas

Several things will be done prior to beginning to collect data readings with the GEM™ 2000, GEM™500 or GA-90. The operator will perform the following in accordance with the LANDTEC GEM™ 2000, GEM™500 Operation Manual:

- Check the TIME/DATE.
- Charge the unit's factory provided nickel cadmium batteries.
- Perform a Field Calibration on the unit.
- Note/record ambient atmosphere readings of LFG's

6.2.1 Soil Gas Purging

A minimum of three (3) tubing or pipe volumes will be purged prior to beginning measurement..

6.2.2 Attach Instrument to Gas/Vapor Source

Upon completion of purging and with the instrument prepared and calibrated for use, attach the instrument to the soil gas monitoring well. Attachment to the soil gas monitoring well will be completed in a manner that completely seals the well from the ambient atmosphere.

6.2.3 Read Gas Levels

With the GEM™ 2000, GEM™500 or GA-90 field calibrated, running and properly attached to the soil gas monitoring well, wait for soil gas measurements to stabilize before recording the readings displayed on the GEM™ 2000, GEM™500 or GA-90 display screen. Upon completion of the field measurements, disconnect the GEM™ 2000, GEM™500 or GA-90 from the soil gas monitoring well and allow the instrument to continue running in order to purge any gases that may still be in the instrument's pump. The reading displayed on the GEM™ 2000, GEM™500 or GA-90 should be similar to the initial ambient atmosphere readings before moving to the next data collection point.

Physical Characteristics of the GEM 500 Instrument

GEM™500 Keyboard and Port Descriptions

1. **Red On/Off Key**—Turns unit on or off.
2. **Blue Number/Letter Toggle Key**—Enables well ID code to be entered by toggling between number and letter mode and toggles contrast on the gas read screens.
3. **Receptacle Port**—Used for battery recharging, RS232 serial communications, temperature probe or gas pod.
4. **Backspace/Exit Key**—Acts as backspace key when pressed and held for one second, to correct entry of wrong number/letter, returns to previous procedure or steps back one layer of menus (similar to pressing the ESCAPE key in many computer programs).

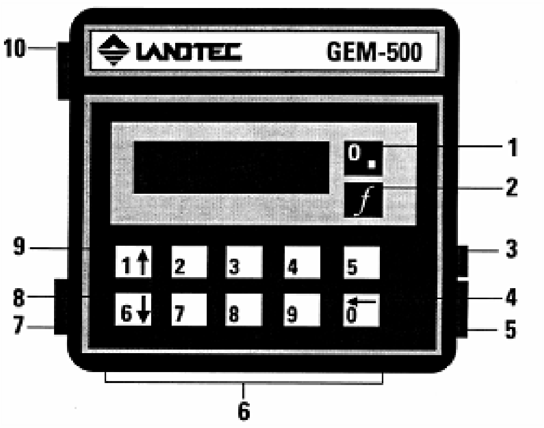


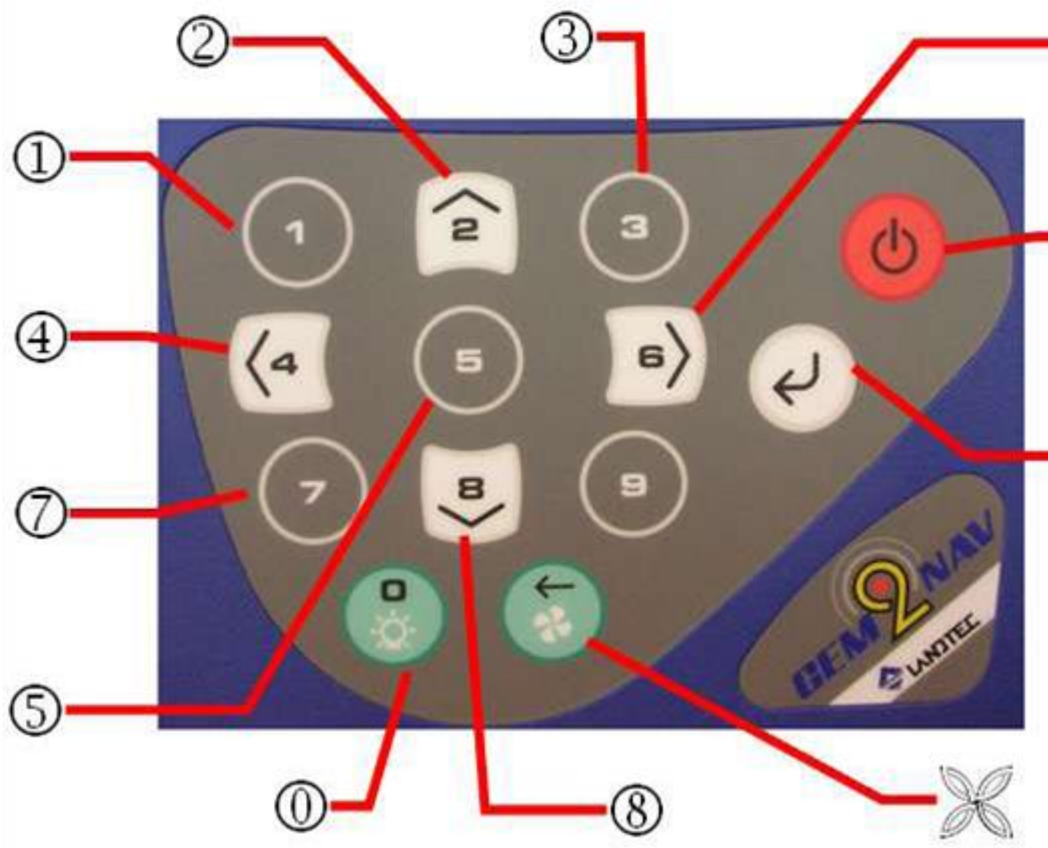
FIGURE 1.1

5. **Exhaust Port**—This port must be kept clear. If blocked while operating, over-pressurization may occur causing damage to internal components and case.
6. **Number Keys**—Enter numbers 0 through 9.
7. **Impact Pressure Port**—Measures impact pressure when connected to wellhead impact pressure port, pitot tube or orifice plate.
8. **Cursor-Down Key**—Enters number 6, scrolls down lines of information on display screens, and also scrolls down alphabetic character list.
9. **Cursor-Up Key**—Enters number 1, scrolls up lines of information on display screens, and also scrolls up alphabetic character list.
10. **Static Pressure/Sampling Port**—Measures static pressure and is inlet for gas sampling.

Physical Characteristics of the GEM 2000 Instrument

1 Exhaust Port
2 Temperature / Gas Pod / Communications Socket (Connector —A)
3 Power Socket (Connector —B)
4 Particulate Filter Housing (on back of instrument)
5 Sample Inlet, Static or System Pressure Port
6 Impact Pressure Port

Physical Characteristics of the GEM 2000 instruments



① ① key

② ② key, up arrow, ‗∧‘ cursor key, scroll up

③ ③ key

④ ④ key, left arrow, ‗<‘ cursor key, scroll left

⑤ ⑤ key

⑥ ⑥ key, right arrow, ‗>‘ cursor key, scroll right

⑦ ⑦ key

⑧ ⑧ key, down arrow, ‗∨‘ cursor key, scroll down

⑨ ⑨ key

⓪

⓪ key, (zero) key, Backlight operation, Keyboard Lock (press and hold for 2 second to activate keyboard lock, press again to deactivate the lock)

✤ Pump Operation, Pump On/Off, Backspace Key (press and hold for 1 second to backspace)

↵ Enter/Store key

⑩ Red Power Button, On-Off (Press and Hold for 2-3 seconds for normal On-Off function,

Press and Hold for 15 seconds to forcibly turn off the instrument)

6.3 Data Reduction/Calculations

No data reduction or calculations are associated with this procedure.

6.4 Disposal

Waste generated by this process will be disposed of in accordance with Federal, State and Local regulations and Barr's SOP 'Investigative Derived Waste'. No investigation derived waste is anticipated for soil gas monitoring.

7.0 Quality Control and Quality Assurance (QA/QC)

The QC activities described below allow the self-verification of the quality and consistency of the work.

7.1 QA/QC Samples

QA/QC samples are defined in Barr's SOP 'Collection of Quality Control Samples'. Field duplicate samples will be collected at a rate of 1 every 20 samples.

8.0 Records

Examples of common field documentation are available in Barr's "Compendium of Field Documentation". Field documentation specific to this SOP are listed below:

- Calibration form
- Field notes

Calibration forms and field notes are provided to a Barr Data Management Administrator for storage on the internal Barr network.

Other Barr SOP subjects referenced within this SOP:

- SOP for Decontamination of Sampling Equipment

9.0 References

CES – LANDTEC Soil Gas Sampling – PRT System by Geoprobe Systems. *LANDTEC GEM™ 2000, GEM™500 and GA-90 Operation Manual*

BARR

Standard Operating Procedure – Yakima Mill Site

Field Measurement of Turbidity in Water

Revision 0

September 13, 2018

Approved By:

Alec Danielson Alec Danielson 9/13/18

Print Technical Reviewer Signature Date

Dana Pasi Dana Pasi 9/13/18

Print QA Manager Signature Date

Review of the SOP has been performed and the SOP still reflects current practice.

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Field Measurement of Turbidity in Water

1.0 Scope and Applicability

The purpose of this Standard Operating Procedure (SOP) is to detail the method for measuring turbidity using the Hach Model 2100P Portable Turbidimeter. This SOP applies to Field Technicians measuring turbidity in water (e.g., groundwater, surface water, waste water).

The recommended procedures in this SOP should be followed unless conditions make it impractical or inappropriate to do so. Modifications should be noted in the applicable documentation and communicated to appropriate personnel. Significant changes may result in a revision or newly created SOP.

2.0 Limitations

The Hach Model 2100P Portable Turbidimeter measures turbidity from 0.01 to 10000 nephelometric turbidity units (NTU). This method does not apply to turbid water above 10000 NTUs of turbidity.

- When taking a reading, the instrument must be placed on a level surface. It should not be held in your hand.
- Make certain that cold (temperature) sample do not “fog” the sample cell which could affect the measurement.
- Do not leave the sample cell in the cell compartment which may compress the spring inside the cell holder.
- Instrument operating temperature range = 32 to 122 °F

3.0 Responsibilities

Equipment Technicians are responsible to maintain equipment in working order and aid in troubleshooting equipment issues.

The role of the Project Health and Safety Team Leader is to oversee all aspects of on-site safety activities.

Experienced Field Technicians are responsible for the proper sample identification, collection of samples, field screening procedures, calibration and operation of the Hach Model 2100P Portable Turbidimeter, quality control procedures, and documentation.

Project staff are responsible for ordering sample containers prior to the sampling event.

4.0 Safety

The calibration standards required by this method contain formaldehyde. Staff handling these chemicals should have undergone Formaldehyde Safety Training, as appropriate, prior to operating this piece of equipment. Additionally, a formaldehyde spill kit should be readily accessible near the work area. Consult the formazine calibration standards’ Safety Data Sheet to review hazards and appropriate PPE to minimize exposure.

Barr staff is responsible for conducting all aspects of the job safely. When applicable, refer to the appropriate Project Health and Safety Plan (PHASP) to understand the hazards associated with suspected contamination, symptoms of exposure, methods to minimize exposure, personal protection equipment

(PPE), and personal air monitoring required when using this SOP. Minimum protection of two pair of chemical resistant gloves (e.g., nitrile) and safety glasses with side shields should be worn to prevent sample contact with the skin and eyes. When samples may be contaminated with corrosive materials, emergency eye flushing facilities should be available.

Some of the sample containers may require the use of preservatives. Consult the applicable Safety Data Sheet to review hazards and appropriate PPE to minimize exposure.

5.0 Equipment, Reagents, and Supplies

- Hach Model 2100P Portable Turbidimeter
- StablCal primary calibration standards - <0.1 NTU, 20 NTU, 100 NTU, & 800 NTU Hach Item # 26594-05
- Gelex secondary calibration standards and 3 sample cells – Hach Item # 24641-05
- Four AA Alkaline Batteries
- Instrument manual with reference card
- Silicone oil with a dropper – Hach Item # 1269-06
- Oiling cloth – Hach Item # 47076-00
- Distilled or deionized water
- Phosphate-free detergent

6.0 Procedure

6.1 Calibration

A primary calibration standard, such as StablCal Stabilized Standards or formazin standards, should be used. Do not calibrate with Gelex Secondary Standards.

- Rinse a clean sample cell with dilution water several times. Fill the cell to the line (about 15ml) with dilution water or use StablCal <0.1 NTU standard and insert the sample cell in the cell compartment (with the diamond orientation mark facing toward the user).
- Close the lid and press I/O. Choose signal average mode option (on or off) before pressing CAL.
- Press CAL. The CAL and S0 icons will be displayed (the 0 will flash). The 4-digit display will show the value of the S0 standard for the previous calibration. If the blank was forced to 0.0, the display will be blank. Press → to get a numerical display.
- Press READ. Read the blank and use it to calculate a correction factor for the 20 NTU standard measurement. If the dilution water is > or = 0.5 NTU, E1 will appear when the calibration is calculated. The display will automatically increment to the next standard. Remove the cell from the cell compartment.
- The display will show the S1 (with the 1 flashing) and 20 NTU or the value of the S1 standard for the previous calibration. If the value is incorrect, edit the value by pressing the → key. After editing, fill a clean sample cell to the line with a well-mixed 20 NTU StablCal Standard or 20 NTU formazin standard. Insert and align the sample cell into the cell compartment and close the lid.
- Press READ. The instrument will measure the turbidity and store the value. The display will automatically increment to the next standard. Remove the sample cell from the compartment.

- The display will show the S2 and 100 NTU or the value of the of the S2 standard for the previous calibration. If the value is incorrect, edit the value by pressing the → key. After editing, fill a clean sample cell to the line with a well-mixed 100 NTU StablCal Standard or 100 NTU formazin standard. Insert and align the sample cell into the cell compartment and close the lid.
- Press READ. The instrument will measure the turbidity and store the value. The display will automatically increment to the next standard. Remove the sample cell from the compartment.
- The display will show the S3 and 800 NTU or the value of the of the S3 standard for the previous calibration. If the value is incorrect, edit the value by pressing the → key. After editing, fill a clean sample cell to the line with a well-mixed 100 NTU StablCal Standard or 800 NTU formazin standard. Insert and align the sample cell into the cell compartment and close the lid.
- Press READ. The instrument will measure the turbidity and store the value. The display will automatically increment to the next standard. Remove the sample cell from the compartment.
- Press CAL to accept the calibration. The instrument will return to measurement mode automatically.

6.2 Turbidity Measurement in Water Samples

- Fill a clean sample cell to the line with a well-mixed water sample taking care to hold the cell by the top. Wipe the sample cell with a lint free lab cloth to remove water spots and fingerprints.
- Apply a thin film of silicone oil to the outside of the sample cell and wipe with the lint-free cloth to ensure an even film over the entire surface of the sample cell.
- Insert and align the sample cell into the cell compartment (with the diamond orientation mark facing toward the user) and close the lid.
- Select manual or automatic range selection by pressing the RANGE key. The display will show AUTO RNG when the instrument is in automatic range selection.
- Select signal averaging mode by pressing the SIGNAL AVERAGE hey. The display will show SIG AVG when the instrument is using signal average.

  NOTE: Use signal average if the water sample causes a noisy signal (display changes constantly).
- Press READ. The instrument will measure the turbidity and store the value. Remove the sample cell from the compartment.
- Repeat.

Take a field replicate measurement every twenty (20) samples.

Analyze a calibration verification check standard at the end of the run sequence.

6.3 Corrective Action for Calibration/Field Equipment Failures

If E1 or E2 are displayed an error occurred during calibration. Check the standard preparation and review the calibration; repeat the calibration if necessary. If the error messages recur, calibrate using the factory-specified standards. Press DIAG to cancel the error message (E1 or E2). To continue without repeating the calibration, press I/O twice to restore the previous calibration. If CAL? is displayed, an error may have occurred during calibration. The previous calibration may not be restored and recalibration is necessary.

6.4 Preventative Maintenance Procedures

6.4.1 Cleaning

Keep the turbidimeter and accessories as clean as possible and store the instrument in the carrying case when not in use. Wash sample cells with non-abrasive laboratory detergent, rinse with distilled or deionized water and air dry. Avoid scratching the cells.

6.4.2 Battery Replacement

The battery icon flashes when battery replacement is needed. For battery replacement/installation, remove the battery compartment cover on the instrument bottom and install the batteries with the correct polarity shown on the battery holder. Reinstall the battery compartment cover.

6.4.3 Lamp Replacement

- Use a small screwdriver to remove and install the lamp leads in the terminal block.
- Orient the instrument so it is upside down and the top faces away from you. Remove the battery cover and at least one battery.
- Remove the lamp assembly by grasping the tab on the left side of the assembly. Firmly, but gently, slide the assembly towards the rear of the instrument.
- Rotate the tab towards the nearest outside edge. The assembly should release and slip out easily.
- Back the terminal block screws partially out (1 to 2 turns) and remove the old lamp leads.
- Gently bend the wires of the new lamp assembly into an “L” shape so they fit easily into the housing. Insert the leads into the terminal screws and tighten with clockwise turns. Gently tug the wires to make sure they are connected to the terminal block.
- Hold the new lamp assembly by the tab with the lamp facing the tope (keyboard) of the instrument. Slide the small catch on the other side of the assembly into the black plastic slot (towards the nearest edge of the instrument).
- Snap the U-shaped bottom of the tab into the slot on the left side of the black plastic that holds the lamp assembly.
- With your thumb firmly slide the assembly forward until it stops. Again, pushing firmly against the tab make sure the lamp is seated correctly.
- Replace the batteries and battery cover.
- Insert the 800 NTU formazin standard into the sample cell. Press and hold READ. Then press I/O. Release the READ key after the software version number disappears from the display.
- Adjust the scattered light amplifier output by inserting a small flat-bladed screwdriver into the trimpot hole (located on the bottom). Adjust the display to read 2.5 +/-0.3 volts (2.0 volts for models that display 2100 when turned on).

- Press I/O to exit gain adjust mode.
- Perform a formazin calibration.

6.5 Preventative Maintenance Schedule:

6.5.1 Battery Life

Typically 300 tests with signal average mode off; 180 tests with signal average mode on.

6.5.2 Light Source

Lamp life typically greater than 100,000 readings.

6.6 Data Reduction/Calculations

No data reduction or calculations are associated with this procedure.

6.7 Disposal

Waste generated by this process will be containerized for characterization and disposal of in accordance with Federal, State and Local regulations.

7.0 Quality Control and Quality Assurance (QA/QC)

The QC activities described below allow the self-verification of the quality and consistency of the work.

7.1 QA/QC Samples

QA/QC samples are defined in Barr's SOP 'Collection of Quality Control Samples'.

The following QA/QC samples are not included in the SOP referenced above but should be analyzed:

- Field replicate measurements

Replicate sample measurements should be taken a minimum of one every twenty (20) project samples or one each day, whichever is more frequent.

7.2 Measurement Criteria

- Field replicate measurements criterion: ±25 relative percent difference (RPD)

8.0 Records

Examples of common field documentation are available in Barr's "Compendium of Field Documentation". Field documentation specific to this SOP are listed below:

- Field Log Data Sheet
- Meter Calibration Summary Form

Field Sampling Report, Field Log Cover Sheet, Field Log Data Sheet, and Meter Calibration Summary Forms are provided to a Barr Data Management Administrator for storage on the internal Barr network.

9.0 References

Hach Company, 2004. *Portable Turbidimeter Model 2100P Instrument and Procedure Manual.*

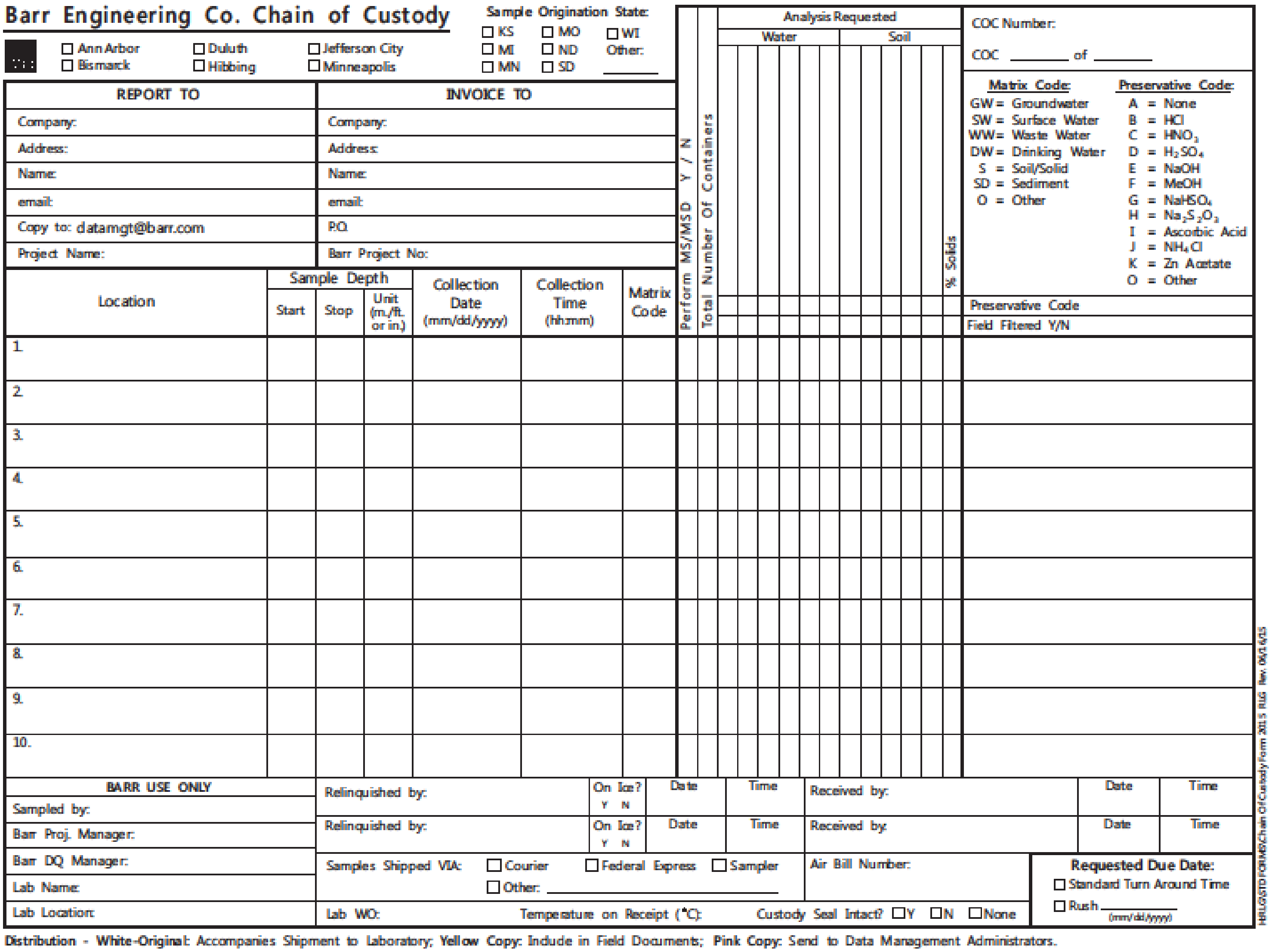
Compendium

Of

Field Documentation

Yakima Mill Site

Chain of Custody Form



Barr Engineering Co. Chain of Custody

☐ Ann Arbor ☐ Duluth ☐ Jefferson City
☐ Bismarck ☐ Hibbing ☐ Minneapolis

Sample Origination State:
☐ KS ☐ MO ☐ WI
☐ MI ☐ ND Other: ________
☐ MN ☐ SD

REPORT TO	INVOICE TO
Company:	Company:
Address:	Address:
Name:	Name:
email:	email:
Copy to: datamgt@barr.com	P.O.
Project Name:	Barr Project No:

COC Number:

COC ________ of ________

Matrix Code:	Preservative Code:
GW = Groundwater	A = None
SW = Surface Water	B = HCl
WW = Waste Water	C = HNO_3
DW = Drinking Water	D = H_2SO_4
S = Soil/Solid	E = NaOH
SD = Sediment	F = MeOH
O = Other	G = $NaHSO_4$
	H = $Na_2S_2O_3$
	I = Ascorbic Acid
	J = NH_4Cl
	K = Zn Acetate
	O = Other

Location	Sample Depth			Collection Date (mm/dd/yyyy)	Collection Time (hh:mm)	Matrix Code	Perform MS/MSD Y / N	Total Number Of Containers	Analysis Requested												
									Water						Soil						
	Start	Stop	Unit (m./ft. or in.)																	% Solids	
																					Preservative Code
																					Field Filtered Y/N
1.																					
2.																					
3.																					
4.																					
5.																					
6.																					
7.																					
8.																					
9.																					
10.																					

BARR USE ONLY
Sampled by:
Barr Proj. Manager:
Barr DQ Manager:
Lab Name:
Lab Location:

Relinquished by:	On Ice? Y N	Date	Time	Received by:	Date	Time
Relinquished by:	On Ice? Y N	Date	Time	Received by:	Date	Time

Samples Shipped VIA: ☐ Courier ☐ Federal Express ☐ Sampler ☐ Other: ________

Air Bill Number:

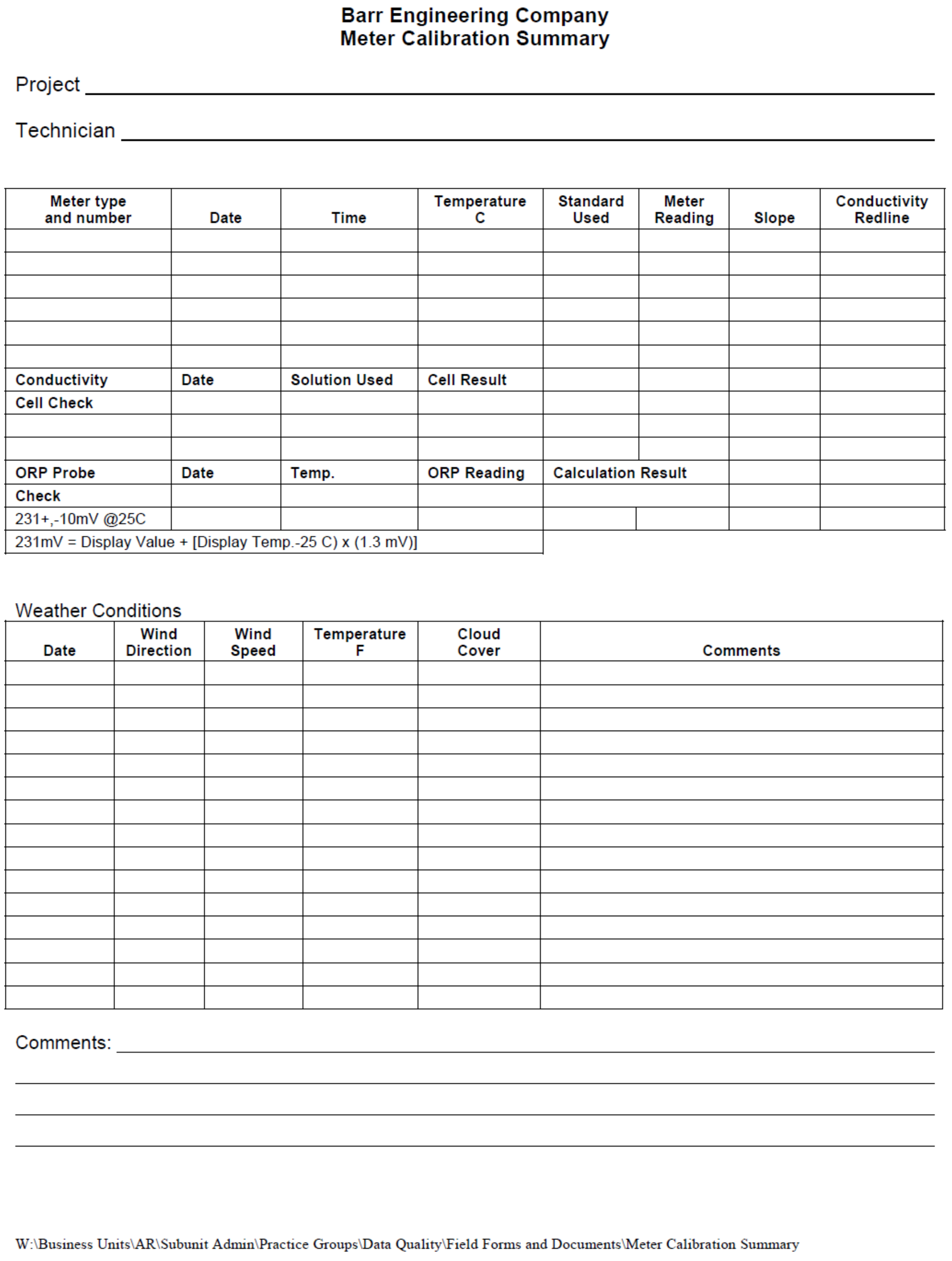
Lab WO: Temperature on Receipt (°C): Custody Seal Intact? ☐ Y ☐ N ☐ None

Requested Due Date:
☐ Standard Turn Around Time
☐ Rush ________ (mm/dd/yyyy)

HRLG\STD FORMS\Chain Of Custody Form 2015 RLG Rev. 06/16/15

Distribution - White-Original: Accompanies Shipment to Laboratory; **Yellow Copy:** Include in Field Documents; **Pink Copy:** Send to Data Management Administrators.

Meter Calibration Summary Form



Barr Engineering Company
Meter Calibration Summary

Project ______________________________

Technician ______________________________

Meter type and number	Date	Time	Temperature C	Standard Used	Meter Reading	Slope	Conductivity Redline
Conductivity	**Date**	**Solution Used**	**Cell Result**				
Cell Check							
ORP Probe	**Date**	**Temp.**	**ORP Reading**	**Calculation Result**			
Check							
231+,-10mV @25C							
231mV = Display Value + [Display Temp.-25 C) x (1.3 mV)]							

Weather Conditions

Date	Wind Direction	Wind Speed	Temperature F	Cloud Cover	Comments

Comments: ______________________________

W:\Business Units\AR\Subunit Admin\Practice Groups\Data Quality\Field Forms and Documents\Meter Calibration Summary

Water Level Data Sheet

WATER LEVEL DATA SHEET

Project: ______________________________

Project Number: ______________________________

Environmental Staff: ______________________________

Date: _______________

Monitoring Location	Measuring Point Elevation	Water Level Depth	Total Well Depth	Static Water Elevation	Comments

Field Log Data Sheet

Client:	**Monitoring Point:**
Location:	**Date:**
Project #:	**Sample time:**

GENERAL DATA		**STABILIZATION TEST**						
Barr lock:		Time/ Volume	Temp. ºC	Cond. @ 25	PH	ORP mV	D.O.	Turbidity NTU (not appearance)
Casing diameter:								
Total well depth:*		NA						
Static well level:*								
Water depth:*								
Well volume: (gal)								
Purge method:								
Sample method:								
Start time:		Odor:						
Stop time:		Purge Appearance:						
Duration: (minutes)		Sample Appearance:						
Rate, gpm:		Comments:						
Volume purged:								
Duplicate collected:								
Sample collection by:								

Others present:	Well condition:

MW: groundwater monitoring well WS: water supply well SW: surface water SE: sediment Other: sump

VOC Semi-volatile General Nutrient Cyanide DRO Sulfide

Oil, grease Bacteria Total Metal Filtered Metal Methane Filter

Others:

* Measurements are referenced from the top of riser pipe, unless otherwise indicated.

Appendix B

Soil Boring and Monitoring Well Log Form

LOG OF Boring

Client
Drill Contractor
Project Name
Drill Method
Project Location
Logged By
Riser Elevation
Surface Elevation --
Number
Start:
End
Northing:
Easting:
Total Depth

SHEET 1 OF 1

DEPTH FEET	SAMP. LENGTH & RECOVERY	SAMP. NUMBER	%GR/SA/ FINES	Headspace ppm	Discoloration- Odor- Sheen	Moisture	ASTM	LITHOLOGY	DESCRIPTION	DEPTH FEET
5										5
10										10
15										15
20										20

Barr Engineering
4300 MarketPointe Dr.
Minneapolis, MN 55435
Telephone: 952-832-2600
Fax: 952-832-2601

Remarks:

BGS = "below ground surface"
Additional data may have been collected in the field which is not included on this log.

ENVIRO LOG NEW (3/20/2012) 2311005_TILL PROJECT.GPJ BARR LIBR JAN06.GLB 8/3/12

Appendix C

Test Pit Log Form

Project Name:

Log of Test Pit No.

Client:

Number:

Elevation:

Total Depth:

Location:

Date Started:

Contractor:

Logged By:

Depth (feet)	PID Reading (ppm)	Odor	Discoloration	Sheen	DESCRIPTION

ELEVATION (feet MSL)

LENGTH (feet)

Map View

Remarks:

Figure

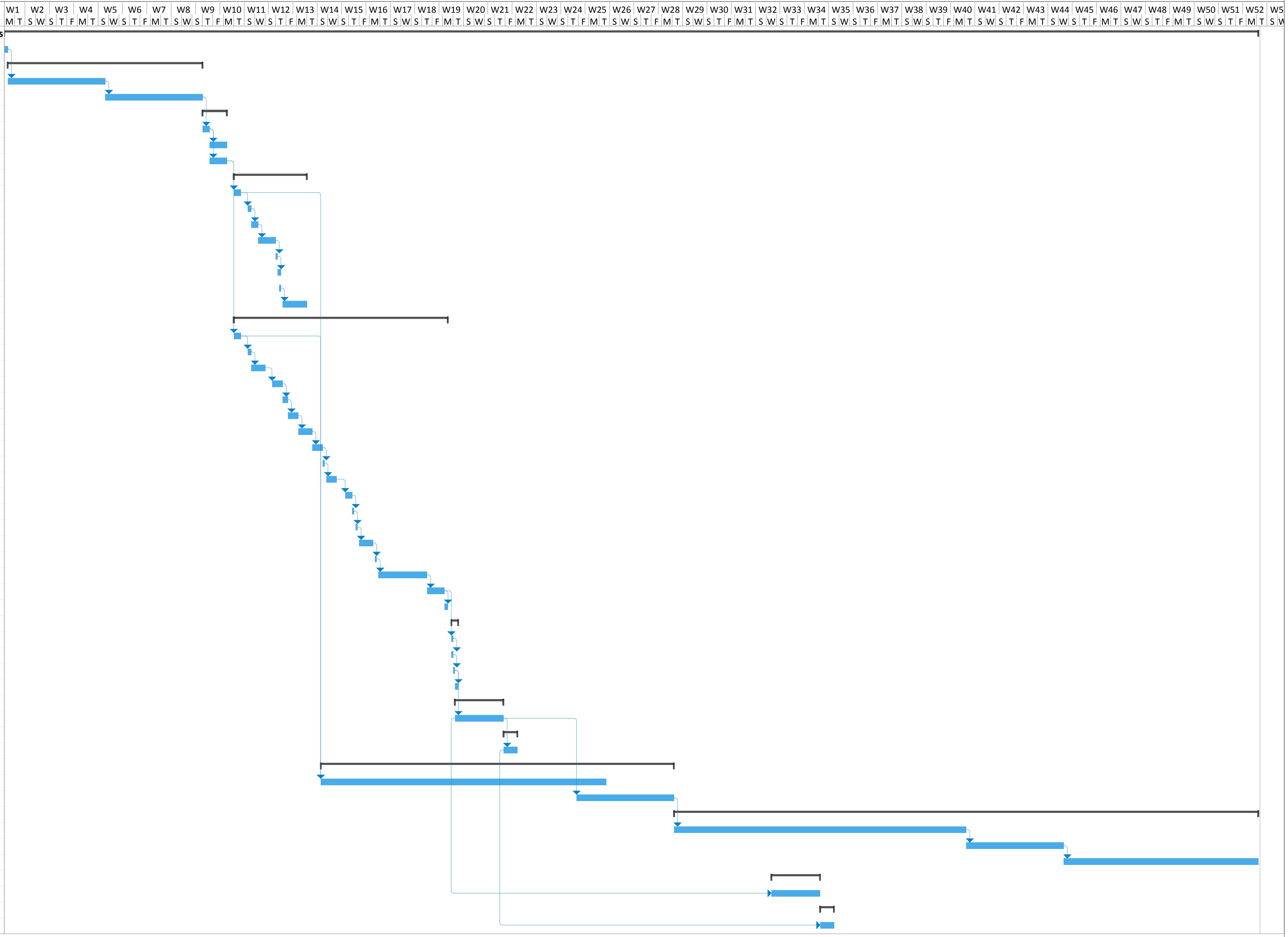
Barr Engineering Co.
4300 MarketPointe Dr.
Minneapolis, MN 55435
Telephone: 952-832-2600
Fax: 952-862-2601

Appendix D

Yakima Mill Site Stage 1 RI Schedule

Appendix D - Yakima Mill Site Stage 1 RI Schedule

ID	Task Name	Duration
1	**Yakima Mill Site Stage 1 RI Schedule**	**258.5 days**
2	Ecology approval of Final RIWP	1 day
3	**Pre Field Work Coordination**	**40 days**
4	Obtain Subcontractor Bids	1 mon
5	Select Subcontractors	1 mon
6	***Preparation***	**5 days**
7	Site Reconnaissance	2 days
8	Utility Locate	3 days
9	Geophysical Survey	3 days
10	***Test Pits***	**15 days**
11	AOC1 – 6 test pits	2 days
12	AOC3 - 6 shallow test pits	1 day
13	AOC4 – 10 shallow test pits	2 days
14	AOC6 – 16 test pits	3 days
15	AOC9 – 1 soil sample	0.5 days
16	AOC11 – 4 test pits near TP-10	1 day
17	AOC15 – 2 shallow test pits	0.5 days
18	AOC16 – approximately 25 test pits	5 days
19	***Soil Borings, Temp Wells, Monitoring Wells, Soil Gas Wells***	**43.5 days**
20	AOC5 – 2 borings; 2 borings w/temp wells	2 days
21	AOC10 – 7 shallow borings	1 day
22	AOC11 – 6 borings; 2 borings with temp wells; 1 mon well	4 days
23	AOC12 – 4 shallow borings; 2 borings w/temp wells; 1 boring	3 days
24	AOC13 – 2 shallow borings; 3 borings	1.5 days
25	AOC15 – 1 boring w/temp well	1 day
26	AOC16 – 3 borings w/temp wells; 1 mon well; 3 borings	4 days
27	AOC17 – 4 borings	1 day
28	AOC18 – 2 borings	0.5 days
29	AOC19 – 7 borings; 1 boring w/temp well	3 days
30	AOC20 – 7 borings	2 days
31	AOC21 – 1 boring	0.5 days
32	AOC22 – 4 shallow borings	0.5 days
33	AOC23 – 7 shallow borings; 1 boring w/temp well	2 days
34	AOC24 – 2 borings	0.5 days
35	AOC25 – install/develop 8 monitoring wells	10 days
36	AOC26 – install 9 soil gas wells	3 days
37	AOC27 - install 2 borings	1 day
38	***SW and Sediment Sampling***	**2 days**
39	AOC2 – collect 2 sediment samples	0.5 days
40	AOC7 – collect SW and pond bottom samples	0.5 days
41	AOC8 – collect SW and pond bottom samples	0.5 days
42	AOC25 - install 3 river gauges	1 day
43	***Groundwater Sampling – 1st event***	**10 days**
44	AOC25 – collect 21 groundwater samples	10 days
45	***Methane Monitoring – 1st event***	**2 days**
46	AOC26 – monitor 23 soil gas wells	2 days
47	***Data Review & Validation (further details in QAPP)***	**73.5 days**
48	Soil Data	3 mons
49	Water Data	1 mon
50	***Reporting***	**120 days**
51	Stage 2 Draft RI Scope of Work (if necessary)	3 mons
52	Ecology Review	1 mon
53	Final Stage 2 Scope of Work	2 mons
54	***Groundwater Sampling – 2nd event***	**10 days**
55	AOC25 – collect 21 groundwater samples	10 days
56	***Methane Monitoring – 2nd event***	**2 days**
57	AOC26 – monitor 23 soil gas wells	2 days



Project: Yakima Mill Site Stage 1 R
Date: Thu 1/3/19

Task
Split
Milestone ◆
Summary
Project Summary
External Tasks
External Milestone ◆
Inactive Task
Inactive Milestone ◆
Inactive Summary
Manual Task
Duration-only
Manual Summary Rollup
Manual Summary
Start-only [
Finish-only]
Deadline ↓
Progress
Manual Progress

Exhibit B

Quality Assurance Project Plan (QAPP)

(No changes from September 2018 Revised Final RI Work Plan submittal)

Revised Final Quality Assurance Project Plan

Exhibit B to Revised Final Remedial Investigation Work Plan

Yakima Mill Site

Prepared for
OfficeMax Incorporated
LeeLynn, Inc. & Wiley Mt., Inc
Yakima Resources, LLC
Dunollie Enterprises, LLC

September 2018

Prepared by
Barr Engineering Co.
Fulcrum Environmental Consulting Inc.

4300 MarketPointe Drive, Suite 200
Minneapolis, MN 55435
952.832.2600
www.barr.com

Revised Final Quality Assurance Project Plan
Exhibit B to Revised Final Remedial Investigation Work Plan

September 2018

Approved by:

Signature: Date: 9/17/2018
Allan Gebhard, Project Coordinator, Barr Engineering Co. Senior Vice President

Signature: Date: 9/12/2018
Ryan Mathews, Fulcrum Environmental Consulting Inc. Project Manager

Signature: John C Greer Date: 9/17/2018
John Greer, Barr Engineering Co. Licensed Geologist/Hydrogeologist

Signature: Date: 9/17/2018
Michael C. Ridgeway, Fremont Analytical Laboratory Director

Signature: Dana Pasi Date: 9/17/2018
Dana Pasi, Barr Engineering Co. Data Quality Assurance Manager

Quality Assurance Project Plan
Yakima Mill Site
Exhibit B to Revised Final Remedial Investigation Work Plan

September 2018

1.0 Table of Contents

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2.0 Abstract

This quality assurance project plan (QAPP) has been prepared as an exhibit to the Revised Final Remedial Investigation (RI) Work Plan (Work Plan) and is to be used in conjunction with the Sampling and Analysis Plan (SAP) and the Project Health and Safety Plan (PHASP) to investigate Areas of Concern (AOCs) at the Yakima Mill Site (Site) located in Yakima, Washington. This QAPP presents the organization, objectives, functional activities, and specific quality assurance (QA) and quality control (QC) activities associated with the implementation of the RI Work Plan. This QAPP describes specific protocols for sample handling, chain-of-custody procedures, laboratory analyses, and data management.

This QAPP is the primary document for laboratory procedures, data QA/QC and data validation. Reasonable effort has been made to make all descriptions of laboratory procedures, data QA/QC and data validation in the Work Plan and SAP consistent with language in the QAPP, but the QAPP language will supersede any inconsistent language in the Work Plan and SAP regarding laboratory procedures, data QA/QC or data validation.

Barr Engineering Co. (Barr) and Fulcrum Environmental Consulting, Inc. (Fulcrum) prepared this QAPP in accordance with Washington Department of Ecology (Ecology) guidance (Ecology, 2016) and USEPA Requirements for Quality Assurance Project Plans (USEPA, 2001).

3.0 Background

This QAPP is included as an exhibit to the Work Plan in support of the RI. The project background, including Site history, current Site conditions, and previous investigations are described in detail in the RI Work Plan. In general, the Site is a former sawmill and plywood plant located in Yakima, Washington. Previous operations date back to the early 1900s and over time have included sawmill operations and a plywood plant. Releases of hazardous substances, including petroleum products, have been documented in certain discrete locations (subsites) at the Site. The Site has been the subject of numerous investigations that have involved site assessments and environmental sampling and analyses. Those investigations have indicated an exceedance of MTCA cleanup levels (Method A or B) and/or visible evidence of a potential release (i.e. visual staining in soils) at some locations at the Site and results that were either non-detect or below MTCA cleanup levels. A comprehensive review of existing investigation data and historical land uses along with local knowledge of operations on the Site were used to identify potential areas of concern (AOCs) and data gaps at the Site.

4.0 Project description

A RI will be conducted to determine the nature and extent of releases of hazardous substances, including petroleum products, to the extent needed to select a cleanup action under Washington Administrative Code (WAC) 173-340-360. Proposed investigation activities are designed to assess potential impacts from each AOC and to characterize site-wide conditions. Follow-up work will be conducted in a Stage 2 of the RI, as necessary, to complete the delineation of the magnitude and extent of soil and groundwater determined to exceed the applicable MTCA (Method A, Method B, or Table 749-3 Ecological Indicator Soil Concentrations for Protection of Terrestrial Plants and Animals) and USEPA (Secondary Maximum Contaminant Levels (SMCL)) cleanup levels (i.e., Site screening levels). This QAPP includes additional details on the plan for data collection, analysis, QC, and interpretation.

5.0 Organization and schedule

5.1 Key individuals and their responsibilities

Table 1 Organization of project staff and responsibilities

Person/Agency or Firm	Title	Responsibilities
Allan Gebhard Barr Engineering Co Phone: 952-832-2725	Project Coordinator	Responsible for implementation of the project in accordance with the Agreed Order. Provides overall leadership and coordination of work on the project, primarily ensuring that technical, financial, and schedule objectives are achieved successfully. Approval of all external report deliverables prior to submittal to Ecology, and may represent the project team at various meetings. May delegate certain responsibilities to appropriately qualified individuals.
John Greer, LG, LHG Barr Engineering Co Phone: 952-832-2691	Licensed Geologist / Hydrogeologist	In responsible charge of the RI work; reviews work plans and any deviations of the work performed to ensure its quality and technical content. May delegate certain responsibilities to appropriately qualified individuals but remains in responsible charge of the work.
Alec Danielson, PE Barr Engineering Co Phone: 952-832-2837	Overall Project Manager	Coordinates and directs staff to meet project objectives and to keep project on schedule and on budget; reviews the work performed to ensure its quality, responsiveness, and timeliness. May delegate certain responsibilities to appropriately qualified individuals.
Ryan Mathews Fulcrum Environmental Phone: 509-574-0839	Fulcrum Project Manager	Responsible for coordinating with the Project Coordinator, Licensed Geologist and Project Manager for work completed by Fulcrum on the project and for providing local knowledge. Responsible for quality, responsiveness, and timeliness of Fulcrum work. May delegate certain responsibilities to appropriately qualified individuals.
Dana Pasi Barr Engineering Co Phone: 952-832-2756	Data Quality Assurance (QA) Manager	Responsible for preparing the QAPP and verifying the laboratory implements the requirements of the QAPP and address any QA issues. Provides technical assistance to project staff and performs necessary audits and data verification and validation. May delegate certain responsibilities to appropriately qualified individuals.
Kevin McGilp Barr Engineering Co Phone: 952-832-2856	Field Manager	Coordinates and directs field staff to see that the data collection and field activities are in conformance with the objectives of the Work Plan, SAP, and QAPP. Able to stop work on-site as required to address a site safety issue. May delegate certain responsibilities to appropriately qualified individuals but remains responsible for all fieldwork.
Kevin McGilp	Field Safety Manager	Responsible for seeing that all on-site personnel follow the PHASP. Responsible for any modifications to the PHASP due to discovered conditions. Able to stop work if needed to deal with a site safety issue. May delegate certain responsibilities to appropriately qualified individuals.
Mike Ridgeway Fremont Analytical, Inc. Phone: 206-352-3790	Laboratory Director	Responsible for adhering to the analysis requirements stated in the QAPP, SAP, and Work Plan and subsequent QAPP modifications. Contacts Barr Data QA Manager as necessary with problems that may affect data quality.

5.2 Special training and certifications

5.2.1 Field personnel

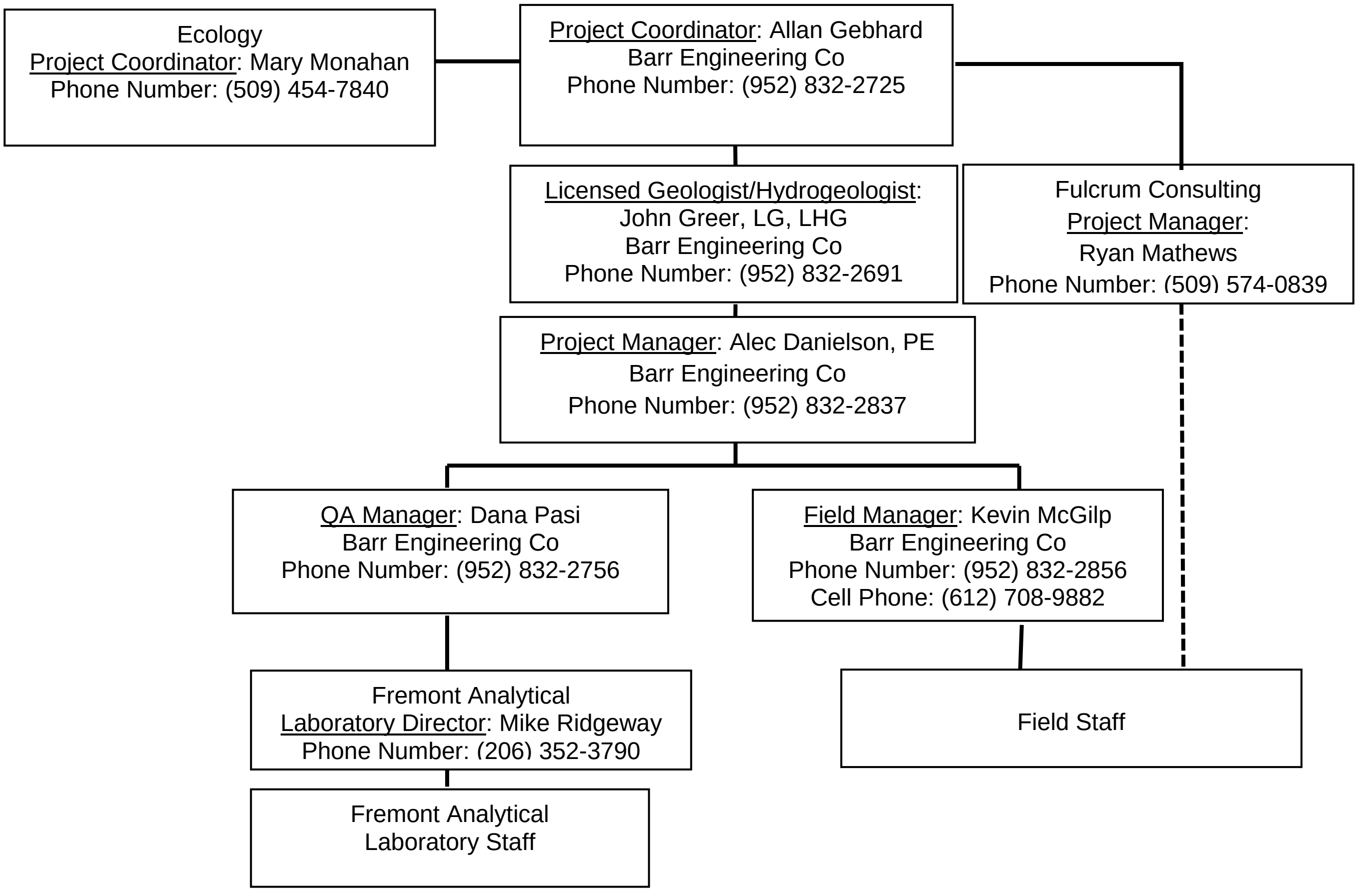
Field personnel will be under the supervision of the Field Manager. They will be trained as mandated by the Occupational Safety and Health Administration (OSHA) Act regulations (29 Code of Federal Regulations [CFR] 1910.120) and as specified under WAC 296-843-21005 and will be trained to follow the health and safety procedures as described in the PHASP (RI Work Plan Exhibit C). Barr and Fulcrum will provide training to field personnel in relation to proper field equipment operation, sampling and preservation techniques, sample handling and custody, and QC. Training records will be kept in the respective employer's personnel training files, respectively.

5.2.2 Laboratory

The laboratory utilized for this project is Fremont Analytical, Inc. (Fremont). Fremont is located in Seattle, Washington. Fremont will analyze all soil and water samples. Fremont has the appropriate certifications, included in Appendix B of this QAPP, necessary to perform the required sample analyses in the State of Washington. Fremont's personnel training will be conducted and monitored by the laboratory QA manager as described in their Quality Assurance Manual (QAM), which is retained at Fremont's place of business and is available upon request for review.

5.3 Organization chart

Figure 1 Organization of project staff



5.4 Proposed project schedule – Stage 1 RI

Provided below is the proposed schedule for completion of the laboratory data analysis, validation, and submittal. A detailed schedule for the field activities is provided in the SAP and a schedule for the overall project is provided in the Final RI Work Plan.

Activities	Anticipated Initiation from Ecology Approval of RI Work Plan, SAP, QAPP	Deliverable	Anticipated Deliverable Timeframe
Soil, sediment, surface water, and groundwater sampling; methane monitoring	Week 10	Field reports and sample results	38 weeks from initiation (Week 48)
Review chain of custody	Week 10	Not applicable	1 week from sample receipt
Sample analysis - Soil, sediment, surface water, and groundwater	Week 10	Laboratory reports	3 weeks from sample receipt
Verification and validation of data	After receipt of data reports	QC Summary Reports	2 weeks from sample laboratory report receipt
Submit data to Ecology's Environmental Information Management System (EIM)	38 weeks from initiation (Week 48)	EIM Submittal File	Prior to submittal of Stage 2 Supplemental RI Work Plan

6.0 Quality objectives

6.1 Data quality objectives

Data quality objectives (DQOs) are qualitative and quantitative statements that clarify project objectives, define the appropriate type of data, and specify tolerable levels of potential decision errors that will be used as the basis for establishing the quality and quantity of data needed to support project decisions.

The seven-step DQO process (USEPA, 2006) was used to develop the overall approach to each study element, and ultimately to design the various field and laboratory investigations. The seven steps include 1) statement the problem (define the problem), 2) identify the decision, 3) identify the inputs to the decision, 4) define the boundaries to the study, 5) develop a decision rule, 6) specify tolerable limits on decision errors, and 7) optimize the design for obtaining data. The DQOs for this project are described in Large Table 1 (attached). In general, the DQOs for the project are to develop and implement procedures for field sampling, chain-of-custody, laboratory analysis, and reporting that will provide the level of data required for determining the characteristics of the various environmental media.

6.2 Measurement quality objectives

Measurement quality objectives (MQOs) are statements that support the project DQOs and contain specific units of measurement that are directly compared to the data. The purpose of this section is to address the MQOs for the six data quality indicators (precision, bias, sensitivity, representativeness, comparability and completeness), along with the means by which they will be measured to monitor compliance with the project needs.

6.2.1 Targets for precision, bias, and sensitivity

The MQOs for project results, expressed in terms of acceptable precision, bias, and sensitivity, are described in this section and are summarized below in Table 2 for soil sample analytical data, Table 3 for water analytical data, and Table 4 for field measurements. The acceptance criteria for precision are shown as being equal to or less than the relative percent differences (RPDs) based on masked field duplicate samples, lab duplicate samples, and matrix spike duplicate samples. The acceptance criteria for bias are shown as a range of percent recovery limits for laboratory control samples and matrix spike samples. The acceptance criterion for sensitivity is when the PQL is lower than applicable cleanup level (CUL) using the appropriate laboratory method.

Table 2 **Measurement quality objectives – soil**

MQO →	Precision			Bias				Sensitivity		
Parameter and Method Soil	Duplicate Samples		MS Duplicates	Laboratory Control Samples		Matrix Spike Samples		Practical Quantitation Limit (PQL)(1)	MTCA CUL	
	Field	Lab							Lowest Criteria	Criteria Ref
	RPD (%)			Recovery Limits (%)(2)		Recovery Limits (%)(2)		Concentration (mg/kg)		
				Low	High	Low	High			
Gasoline by NWTPH-Gx										
Gasoline	40	30	30	65	135	65	135	5	30a, 100b	Method A, Unr
Diesel and Heavy Oil by NWTPH-Dx/Dx Ext. with and without Silica Gel Cleanup										
Diesel (Fuel Oil)	40	30	30	65	135	65	135	20	200	Soil Biota
Heavy Oil	40	30	--	--	--	--	--	50	2000	Method A, Unr
VOCs by EPA Method 8260										
1,2-Dibromoethane (EDB)	40	30	30	50.5	154	50.4	136	0.005	0.00500	Method A, Unr
1,2-Dichloroethane (EDC)	40	30	30	50.9	162	51.3	139	0.02	11.0	Method B, Can
2-Butanone (MEK)	40	30	30	51.4	144	31.4	135	0.25	48000	Method B, Non Can
Acetone	40	30	30	46.3	150	44.8	134	0.25	72000	Method B, Non Can
Benzene	40	30	30	64.3	133	63.5	133	0.02	0.0300	Method A, Unr
Carbon tetrachloride	40	30	30	63.4	137	53.3	144	0.025	14.3	Method B, Can
Chloroform	40	30	30	69	145	53.2	129	0.02	32.3	Method B, Can
Ethylbenzene	40	30	30	74	129	54.5	134	0.025	6.00	Method A, Unr
m,p-Xylene	40	30	30	70	124	53.1	132	0.05	9.00 (Xylenes Total)	Method A, Unr
Methyl tert-butyl ether (MTBE)	40	30	30	66.3	145	58.5	167	0.05	0.100	Method A, Unr
Methylene chloride	40	30	30	46.3	140	54.7	142	0.02	0.020	Method A, Unr

MQO →	Precision			Bias				Sensitivity		
Parameter and Method Soil	Duplicate Samples		MS Duplicates	Laboratory Control Samples		Matrix Spike Samples		Practical Quantitation Limit (PQL)$^{(1)}$	MTCA CUL	
	Field	Lab							Lowest Criteria	Criteria Ref
	RPD (%)			Recovery Limits (%)$^{(2)}$		Recovery Limits (%)$^{(2)}$		Concentration (mg/kg)		
				Low	High	Low	High			
o-Xylene	40	30	30	68.1	139	53.3	139	0.025	9.00 (Xylenes Total)	Method A, Unr
Tetrachloroethene	40	30	30	52.7	150	35.6	158	0.025	0.0500	Method A, Unr
Toluene	40	30	30	67.3	138	63.4	132	0.02	7.00	Method A, Unr
Trichloroethene	40	30	30	65.5	137	61.6	147	0.02	0.0300	Method A, Unr
Vinyl chloride	40	30	30	43.4	151	43.6	150	0.025	0.67	Method B, Can
Semi-Volatile Organic Compounds (SVOCs) by EPA Method 8270-Selected Ion Monitoring (SIM)										
Benz(a)anthracene	40	30	30	41.2	141	41.2	141	0.04	1.37	Method B, Can
Benzo(a)pyrene	40	30	30	30.2	171	30.2	171	0.04	0.100	Method A, Unr
Benzo(b)fluoranthene	40	30	30	41	155	41	155	0.04	1.37	Method B, Can
Bis(2-ethylhexyl)phthalate	40	30	30	37.8	144	37.8	144	0.05	71.4	Method B, Can
Butyl benzyl phthalate	40	30	30	30.4	138	30.4	138	0.05	526	Method B, Can
Chrysene	40	30	30	46.9	138	46.9	138	0.04	137	Method B, Can
Dibenz(a,h)anthracene	40	30	30	28	158	28	158	0.04	0.137	Method B, Can
Indeno(1,2,3-cd)pyrene	40	30	30	31.3	159	31.3	159	0.04	1.37	Method B, Can
Naphthalene	40	30	30	46.4	125	46.4	125	0.04	5.00	Method A, Unr
Pentachlorophenol	40	30	30	5	127	5	127	0.04	2.50	Method B, Can

MQO →	Precision			Bias				Sensitivity		
Parameter and Method Soil	Duplicate Samples		MS Duplicates	Laboratory Control Samples		Matrix Spike Samples		Practical Quantitation Limit (PQL)(1)	MTCA CUL	
	Field	Lab							Lowest Criteria	Criteria Ref
	RPD (%)			Recovery Limits (%)(2)		Recovery Limits (%)(2)		Concentration (mg/kg)		
				Low	High	Low	High			
Total Metals by EPA Method 6020										
Arsenic	40	20	20	80	120	75	125	0.1	0.667	Method B, Can
Cadmium	40	20	20	80	120	75	125	0.2	2.00	Method A, Unr
Chromium	40	20	20	80	120	75	125	0.1	42	Plants & Soil Biota
Copper	40	20	20	80	120	75	125	0.2	50	Soil Biota
Lead	40	20	20	80	120	75	125	0.2	50	Plants
Nickel	40	20	20	80	120	75	125	0.1	30	Plants
Silver	40	20	20	80	120	75	125	0.1	2	Plants
Zinc	40	20	20	80	120	75	125	0.5	86	Plants
Hexavalent Chromium by EPA Method 7196										
Chromium, Hexavalent	40	30	30	65	135	65	135	0.5	19.0	Method A, Unr
Polychlorinated Biphenyls (PCB) by EPA Method 8082										
Aroclor 1016	40	30	30	38.5	149	27.1	166	0.1	5.60	Method B, Non Can
Aroclor 1221	40	30	--	--	--	--	--	0.1	--	--
Aroclor 1232	40	30	--	--	--	--	--	0.1	--	--
Aroclor 1242	40	30	--	--	--	--	--	0.1	--	--
Aroclor 1248	40	30	--	--	--	--	--	0.1	--	--
Aroclor 1254	40	30	--	31.9	167	--	--	0.1	0.500	Method B, Can
Aroclor 1260	40	30	30	35.4	154	20.6	168	0.1	0.500	Method B, Can
Aroclor 1262	40	30	--	--	--	--	--	0.1	--	--
Aroclor 1268	40	30	--	--	--	--	--	0.1	--	--
Total PCBs	--		--	--	--	--	--	--	0.500	Method B, Can

MQO →	Precision			Bias				Sensitivity		
Parameter and Method Soil	**Duplicate Samples**		**MS Duplicates**	**Laboratory Control Samples**		**Matrix Spike Samples**		**Practical Quantitation Limit (PQL)[1]**	**MTCA CUL**	
	Field	**Lab**							**Lowest Criteria**	**Criteria Ref**
	RPD (%)			**Recovery Limits (%)[2]**		**Recovery Limits (%)[2]**		**Concentration (mg/kg)**		
				Low	**High**	**Low**	**High**			
Chlorinated Pesticides by EPA Method 8081										
4,4´-DDD	40	30	30	42	155	31.3	159	0.01	0.75	Wildlife
4,4´-DDE	40	30	30	43.9	155	34	166	0.01	0.75	Wildlife
4,4´-DDT	40	30	30	48.2	152	38.4	160	0.01	0.75	Wildlife
Aldrin	40	30	30	43.7	147	41.9	130	0.01	0.0588	Method B, Can
Alpha BHC	40	30	30	54.2	139	37.3	163	0.01	0.159	Method B, Can
alpha-Chlordane	40	30	30	42.2	155	33.3	156	0.01	1	Soil Biota
Beta BHC	40	30	30	56.5	142	30.1	161	0.01	0.556	Method B, Can
Delta BHC	40	30	30	47.4	157	31.5	153	0.01	6	Wildlife
Dieldrin	40	30	30	43.4	158	32.5	155	0.01	0.0625	Method B, Can
Endosulfan I	40	30	30	41.8	156	32.2	162	0.01	480	Method B, Non can
Endosulfan II	40	30	30	47	154	37.9	154	0.01	480	Method B, Non can
Endosulfan sulfate	40	30	30	53.8	148	25.2	144	0.01	480	Method B, Non can
Endrin	40	30	30	45.6	164	32.3	166	0.01	0.2	Wildlife
Endrin aldehyde	40	30	30	39.5	153	38.3	156	0.01	0.2	Wildlife
Endrin ketone	40	30	30	28.5	162	40.2	119	0.01	0.2	Wildlife
Gamma BHC (Lindane)	40	30	30	55.5	142	40.5	158	0.01	0.0100	Method A, Unr
gamma-Chlordane	40	30	30	41.2	155	35.4	153	0.01	1	Soil Biota
Heptachlor	40	30	30	50.9	153	37.9	156	0.01	0.222	Method B, Can
Heptachlor epoxide	40	30	30	43.3	154	41	161	0.01	0.110	Method B, Can

MQO →	Precision			Bias				Sensitivity		
Parameter and Method Soil	**Duplicate Samples**		**MS Duplicates**	**Laboratory Control Samples**		**Matrix Spike Samples**		**Practical Quantitation Limit (PQL)$^{(1)}$**	**MTCA CUL**	
	Field	**Lab**							**Lowest Criteria**	**Criteria Ref**
	RPD (%)			**Recovery Limits (%)$^{(2)}$**		**Recovery Limits (%)$^{(2)}$**		**Concentration (mg/kg)**		
				Low	**High**	**Low**	**High**			
Methoxychlor	40	30	30	34.6	159	43.4	178	0.01	400	Method B, Non can
Toxaphene	40	30	30	57.8	137	--	--	0.1	0.909	Method B, Can
Chlorinated Herbicides by EPA Method 8151A										
2,4,5-T	40	30	30	22.8	144	13.1	147	0.05	800	Method B, Non can
2,4,5-TP (Silvex)	40	30	30	21.2	138	28.6	134	0.02	640	Method B, Non can
2,4-D	40	30	30	22.4	130	12.4	134	0.03	800	Method B, Non can
2,4-DB	40	30	30	5	164	50.2	152	0.025	640	Method B, Non can
3,5-Dichlorobenzoic acid	40	30	30	18.7	139	10	164	0.04	--	--
4-Nitrophenol	40	30	30	5	163	44.8	125	0.03	--	--
Acifluorfen	40	30	30	5	163	15	140	0.08	1040	Method B, Non can
Bentazon	40	30	30	7.59	162	15	140	0.035	2400	Method B, Non can
Chloramben	40	30	30	5	147	5	162	0.02	1200	Method B, Non can
Dacthal (DCPA)	40	30	30	5	164	5	132	0.03	800	Method B, Non can
Dalapon	40	30	30	18.4	162	24.9	139	0.2	2400	Method B, Non can
Dicamba	40	30	30	24.7	141	31.9	118	0.035	2400	Method B, Non can
2,4-DP	40	30	30	26.4	130	27.2	129	0.025	--	--
Dinoseb	40	30	30	5	165	10	179	0.03	80.0	Method B, Non can
MCPA	40	30	30	47.4	128	13.7	147	2.8	40.0	Method B, Non can

MQO →	Precision			Bias				Sensitivity		
Parameter and Method Soil	Duplicate Samples		MS Duplicates	Laboratory Control Samples		Matrix Spike Samples		Practical Quantitation Limit (PQL)(1)	MTCA CUL	
	Field	Lab							Lowest Criteria	Criteria Ref
	RPD (%)			Recovery Limits (%)(2)		Recovery Limits (%)(2)		Concentration (mg/kg)		
				Low	High	Low	High			
MCPP	40	30	30	22.2	157	37.8	140	4.4	80.0	Method B, Non can
Picloram	40	30	30	5	175	5	140	0.05	5600	Method B, Non can

(1) PQL may vary based on annual MDL verification studies, initial mass, dilution factor, % solids, and possible matrix interferences. Results will be reported on a dry weight basis.

(2) Recovery limits may be method prescribed or defined by the laboratory. Recovery limits for methods 8260, 8270, 8081, 8151, and 8082 are based on ongoing statistical analysis and are subject to change.

a Gasoline with benzene present in groundwater

b Gasoline with no detectable benzene present in groundwater

-- No limit; no criteria identified

In Table 3 for water sample's data, the acceptance criteria for precision are shown as the difference in the RPDs based on masked field duplicate samples, lab duplicate samples, and matrix spike duplicate samples. The acceptance criteria for bias are shown as a range of percent recovery limits for laboratory control samples and matrix spike samples. The acceptance criterion for sensitivity is when the PQL is lower than the applicable MTCA criteria using the appropriate laboratory methods.

Table 3 Measurement quality objectives – water

MQO →	Precision			Bias				Sensitivity		
Parameter and Method Water	Duplicate Samples		MS Duplicates	Laboratory Control Samples		Matrix Spike Samples		Practical Quantitation Limit (PQL)(1)	MTCA or USEPA CUL	
	Field	Lab							Lowest Criteria	Criteria Ref
	RPD (%)			Recovery Limits (%)(2)		Recovery Limits (%)(2)		Concentration Units (ug/L)		
				Low	High	Low	High			
Gasoline by NWTPH-Gx										
Gasoline	30	30	30	65	135	65	135	50	800[a], 1000[b]	GW Method A
Diesel and Heavy Oil by NWTPH-Dx/Dx Ext. with and without Silica Gel Cleanup										
Diesel (Fuel Oil)	30	30	30	65	135	65	135	50	500	GW Method A
Heavy Oil	30	30	--	--	--	--	--	100	500	GW Method A

MQO →	Precision			Bias				Sensitivity		
Parameter and Method Water	Duplicate Samples		MS Duplicates	Laboratory Control Samples		Matrix Spike Samples		Practical Quantitation Limit (PQL)(1)	MTCA or USEPA CUL	
	Field	Lab							Lowest Criteria	Criteria Ref
	RPD (%)			Recovery Limits (%)(2)		Recovery Limits (%)(2)		Concentration Units (ug/L)		
				Low	High	Low	High			
VOCs by EPA Method 8260										
1,2-Dibromoethane (EDB)	30	30	30	63.2	128	37.8	168	0.0014^{+}	0.0100	GW Method A
1,2-Dichloroethane (EDC)	30	30	30	55.5	139	38.8	159	0.010^{+}	0.481	GW Method B, Can
2-Butanone (MEK)	30	30	30	35.9	186	61.8	132	5	4800	GW Method B, Non Can
Acetone	30	30	30	26.6	156	50.8	135	5	7200	GW Method B, Non Can
Benzene	30	30	30	71	128	51.2	156	0.0033^{+}	0.795	GW Method B, Can
Carbon tetrachloride	30	30	30	66.2	134	62.7	146	0.5	0.625	GW Method B, Can
Chloroform	30	30	30	66.3	131	48.1	140	1	1.41	GW Method B, Can
Ethylbenzene	30	30	30	72	130	64.5	136	1	700	GW Method A
m,p-Xylene	30	30	30	70.3	134	63.3	135	1	1000 (Xylenes total)	GW Method A
Methyl tert-butyl ether (MTBE)	30	30	30	58	138	60.9	132	1	20.0	GW Method A
Methylene chloride	30	30	30	67.1	131	61.6	135	1	5.00	GW Method A
o-Xylene	30	30	30	72.1	131	64.8	150	1	1000 (Xylenes total)	GW Method A
Tetrachloroethene	30	30	30	47.5	147	50.3	133	1	5.00	GW Method A

MQO →	**Precision**			**Bias**				**Sensitivity**		
Parameter and Method Water	**Duplicate Samples**		**MS Duplicates**	**Laboratory Control Samples**		**Matrix Spike Samples**		**Practical Quantitation Limit (PQL)(1)**	**MTCA or USEPA CUL**	
	Field	**Lab**							**Lowest Criteria**	**Criteria Ref**
	RPD (%)			**Recovery Limits (%)(2)**		**Recovery Limits (%)(2)**		**Concentration Units (ug/L)**		
				Low	**High**	**Low**	**High**			
Toluene	30	30	30	61.3	145	52	147	1	640	GW Method B, Non Can
Trichloroethene	30	30	30	65.2	136	60.4	134	0.5	0.540	GW Method B, Can
Vinyl chloride	30	30	30	56.3	134	40.8	154	0.0042^{+}	0.0290	GW Method B, Can
SVOCs by EPA Method 8270-SIM										
Benz(a)anthracene	30	30	30	42.8	125	30.8	126	0.1	0.120	GW Method B, Can
Benzo(a)pyrene	30	30	30	18.7	120	22.1	120	0.00718^{+}	0.0120	GW Method B, Can
Benzo(b)fluoranthene	30	30	30	25.9	132	26.8	130	0.1	0.120	GW Method B, Can
Bis(2-ethylhexyl)phthalate	30	30	30	9.17	156	39.9	143	0.5	6.25	GW Method B, Can
Butyl benzyl phthalate	30	30	30	12.7	144	50.5	139	0.6	46.1	GW Method B, Can
Chrysene	30	30	30	32.3	120	22	113	0.1	12.0	GW Method B, Can
Dibenz(a,h)anthracene	30	30	30	21.3	137	31.4	120	0.00205^{+}	0.0120	GW Method B, Can
Indeno(1,2,3-cd)pyrene	30	30	30	21.3	131	29.5	126	0.1	0.120	GW Method B, Can

MQO →	Precision			Bias				Sensitivity		
Parameter and Method Water	Duplicate Samples		MS Duplicates	Laboratory Control Samples		Matrix Spike Samples		Practical Quantitation Limit (PQL)(1)	MTCA or USEPA CUL	
	Field	Lab							Lowest Criteria	Criteria Ref
	RPD (%)			Recovery Limits (%)(2)		Recovery Limits (%)(2)		Concentration Units (ug/L)		
				Low	High	Low	High			
Naphthalene	30	30	30	30.4	113	26	108	0.1	160	GW Method A & B Non Can
Pentachlorophenol	30	30	30	10.7	121	25	145	0.1	0.219	GW Method B, Can
Metals, Total and Dissolved (Field filtered) by EPA Method 6020										
Arsenic	30	30	30	80	120	75	125	1	0.0583*	GW Method B, Can
									5.00	GW Method A
Cadmium	30	30	30	80	120	75	125	0.2	5.00	GW Method A
Chromium	30	30	30	80	120	75	125	1	50 (Cr III)	GW Method A
Copper	30	30	30	80	120	75	125	0.5	640	GW Method B, Non Can
Iron	30	20	20	80	120	75	125	100	300	USEPA SMCL
Lead	30	30	30	80	120	75	125	1	15.0	GW Method A
Manganese	30	20	20	80	120	75	125	2	50	USEPA SMCL
Nickel	30	30	30	80	120	75	125	2	--	--
Silver	30	30	30	80	120	75	125	2.5	80.0	GW Method B, Non Can
Zinc	30	30	30	80	120	75	125	3.5	4800	GW Method B, Non Can

MQO →	Precision			Bias				Sensitivity		
Parameter and Method Water	Duplicate Samples		MS Duplicates	Laboratory Control Samples		Matrix Spike Samples		Practical Quantitation Limit (PQL)(1)	MTCA or USEPA CUL	
	Field	Lab							Lowest Criteria	Criteria Ref
	RPD (%)			Recovery Limits (%)(2)		Recovery Limits (%)(2)		Concentration Units (ug/L)		
				Low	High	Low	High			
Anions by EPA 300										
Nitrate (as N)	30	20	20	90	110	80	120	100	25600	GW Method B, Non Can
Sulfate	30	20	20	90	110	80	120	300	250000	USEPA SMCL
TOC by SM 5310C										
TOC	30	30	30	80	120	70	130	500	--	--

(1) PQL may vary based on annual MDL verification studies, initial volume, or dilution factors and possible matrix interferences.
(2) Recovery limits may be method prescribed or defined by the laboratory. Recovery limits for methods 8260 and 8270 are based on ongoing statistical analysis and are subject to change.
a Gasoline with benzene present in groundwater
b Gasoline with no detectable benzene present in groundwater
+ PQL for these compounds are for SIM or low-level SIM for the VOCs and SVOCs respectively.
* Lowest criteria below background. Data will be compared to Method A cleanup level of 5.00 ug/L.
-- No limit; no criteria identified

In Table 4 for field measurements, the acceptance criteria for precision are shown as less than or equal to the RPDs based on field duplicate samples. The acceptance criterion for bias are shown as the accuracies of the instruments. The acceptance criteria for sensitivity is the capability range of the particular instrument used for an analysis. These measurement quality objectives meet project objectives, including the stabilization criteria as referenced in the SAP.

Table 4 Measurement quality objectives – field data

MQO →	Precision	Bias	Sensitivity		
Parameter	**Duplicate Samples**	**Instrument Accuracy**	**Range**	**Resolution**	**Units**
Field Measurements YSI					
Dissolved Oxygen (DO)	RPD ≤ 35% on duplicate water samples	0 - 20: ± 0.2 or ± 2% of reading, whichever is greater	0 - 50	0.01	mg/L O_2
Temperature		± 0.15	-5 to 45°C	0.1	°C
Conductivity		4m cable: ± 1 or ± 0.5% of reading, whichever is greater	0 to 200,000	1-100 (range dependent)	uS/cm
pH		± 0.2	0 to 14	0.01	su
Oxidation-Reduction Potential (ORP)		± 20	-999 to +999	0.1	mV
Turbidimeter Hach 2100					
Turbidity	RPD ≤ 35% on duplicate water samples	≤ 2% of reading	0 - 1000	0.01	NTU
Photoionization Detector (PID) MiniRAE 2000					
VOCs	--	0 - 2000: ≤ 2 or 10% of reading > 2,000: ≤ 20%	0 - 10,000	0.1-10 (range dependent)	ppm
Photoionization Detector (PID) MiniRAE 3000					
VOCs	--	10 - 2,000: 3% at calibration point	0 - 15,000	0.1-1 (range dependent)	ppm
LANDTEC GEM 2000					
Methane, oxygen, and carbon dioxide	--	0-5% volume: ± 5% 5-15% volume: ± 1% 15-Full scale volume: ± 3% (100%)	0-70% to specification, 0 - 100% reading	0.1	%
4-Gas Meter					
Hydrogen sulfide, carbon monoxide, LEL, and oxygen	--	Hydrogen sulfide – 1 ppm Carbon monoxide – 1 ppm LEL – 1% Oxygen – 0.1%	Hydrogen sulfide – 0 to 1 ppm Carbon monoxide – 0 - 500 ppm LEL – 0 - 100% Oxygen – 0-30.0%	0.1 ppm, 0.1% (gas and range dependent)	ppm, %

-- No limit; no criteria identified

6.2.1.1 Precision

Precision measures the reproducibility of a measurement under a given set of conditions. Precision of sampling will be assessed by comparing the analytical results between field duplicate samples. A field duplicate sample is a second aliquot of a sample generated in the field that, when collected, processed, and analyzed by the same organization, provides precision information for the entire measurement system including: sample collection, sample constituent heterogeneity, handling, shipping, storage, preparation, and analysis. Field duplicate samples will be submitted to the laboratory as blind (masked) samples. The RPD will be calculated using the equation below for each pair of duplicate analyses where both results are greater than five times the PQL, which is consistent with the USEPA Contract Laboratory Program National Functional Guidelines.

$$RPD = \frac{|S - D|}{(S + D)/2} \, x \, 100$$

Where:

S = First sample value (original value)
D = Second sample value (duplicate value)

Field duplicate samples will be collected and sent to the laboratory at the frequency shown in Table 5. RPDs ≤ 30% for water and ≤ 40% for soils and sediments will be considered acceptable precision when both the native and field duplicate sample concentrations are greater than five times the PQL. Higher RPDs are expected when results are at or near the PQLs (i.e. within five times the PQL) and are not necessarily indicative of poor precision. RPDs above these limits, and detected more than five times above the PQL, will result in corrective actions or qualification by the Barr Data QA manager. Examples of corrective action include, but are not limited to, reanalysis of samples or recollection of samples for reanalysis.

Precision in the laboratory is assessed through the calculation of RPDs for laboratory control samples/laboratory control sample duplicates (LCS/LCSD), matrix spike/matrix spike duplicate (MS/MSD) samples, and/or laboratory duplicate samples. Laboratory precision samples will be analyzed at the frequency shown in Table 5 for each parameter group. The specific parameters included in each group are included in Table 2 and Table 3. The laboratory’s precision criteria are included in the laboratory analysis reports and in Table 2 and Table 3. The laboratory’s SOPs are on file at the laboratory.

Table 5 Quality control samples, types, and frequency – soil and water

Parameter Group[1]	Field (Event)+		Laboratory (Batch)				
	Blank Samples	Replicate Samples	Method Blank Samples	LCSs	MS Samples	Analytical Duplicate Sample^	Surrogates*
Gasoline	1/20	1/20	1/20	1/20	1/20	1/10	Each sample
Diesel and Heavy Oil	1/20	1/20	1/20	1/20	1/20	1/10	Each sample
VOCs	1/20	1/20	1/20	1/20	1/20	1/20	Each sample
SVOCs	1/20	1/20	1/20	1/20	1/20	1/20	Each sample
Metals	1/20	1/20	1/20	1/20	1/20	1/20	--
Hexavalent Chromium (soil only)	1/20	1/20	1/20	1/20	1/20	1/20	--
PCBs	1/20	1/20	1/20	1/20	1/20	1/20	Each sample
Pesticides and Herbicides (soil only)	1/20	1/20	1/20	1/20	1/20	1/20	Each sample
General Parameters: Nitrate, Sulfate, TOC	1/20	1/20	1/20	1/20	1/10	1/10	--

(1) The parameter group is listed and applies to all parameters in that group. Refer to Table 2 and Table 3 for specific parameters.

\+ If less than the referenced number of samples is taken, then a minimum of 1 field QC sample will be collected for each event.

^ It may be a duplicate of a sample or a duplicate of a LCS or MS. The sample used may be a project or non-project sample. Frequency is based on method requirements

* Surrogates are added to each sample for organic analyses (blank samples, spiked samples, project samples, QC samples) prior to sample extraction.

-- No limit; no criteria

6.2.1.2 Bias

Bias is the difference between a population mean and the true value. Bias will be addressed by calibrating field and laboratory instruments and by analyzing LCSs, MS samples, and/or surrogates. Surrogates are added to each sample for organic analyses (blanks, spiked samples, project samples, QC samples) prior to sample extraction. Because surrogates are not expected to be present in the samples, they give analytical responses that can be distinguished from those of the analytes of interest. Surrogate recoveries also provide an estimate of accuracy for the entire analytical procedure. The recovery limits for bias are expressed in terms of acceptable percent recoveries of a known quantity and are listed in Table 2 and Table 3. The recovery limits are method-prescribed and are defined by the laboratory. The percent recovery (%R) for spiked samples will be calculated using the following equation (for LCS and other laboratory-prepared samples, B is zero):

$$\%R = \frac{A - B}{C} x\, 100$$

Where:

A = The analyte concentration determined from the analysis of the spiked sample
B = The background level determined by a separate analysis of the unspiked sample
C = The amount of the spike added

6.2.1.3 Sensitivity

Sensitivity expresses the instrument's, methodology's and laboratory's ability to meet or exceed the applicable criteria. Field sensitivity is represented in Table 4 for the field instruments. Laboratory sensitivity will be assessed by comparing the analytical PQLs to the applicable Site clean-up criteria. Where the PQL for the standard analysis is above the lowest clean-up level, the parameter will be analyzed by SIM or low-level SIM where applicable. The PQL for arsenic is greater than the lowest MTCA Method B cleanup level (0.0583 ug/L) but below the MTCA A clean-up level of 5 ug/L which is typically use by Ecology. Typical background concentrations of arsenic (MTCA/SMS Advisory Group, 2010) are greater than the PQL of 1 ug/L. The targets for acceptable sensitivity of all field and lab measurements are included in Table 2 through Table 4. Table 6 and Table 7 reflect all of the applicable criteria that may be used with the lowest value included for comparison against the PQL in Table 2 and Table 3 for soil and water, respectively.

Table 6 Site cleanup criteria – soil

Parameter and Method	Method A Unrestricted Land Use (mg/kg)	Method B Non cancer (mg/kg)	Method B Cancer (mg/kg)	Table 749-3 Plants (mg/kg)	Table 749-3 Soil Biota (mg/kg)	Table 749-3 Wildlife (mg/kg)
Gasoline by NWTPH-Gx						
Gasoline	30[a], 100[b]	--	--	--	100	5000
Diesel and Heavy Oil by NWTPH-Dx/Dx Ext.						
Diesel (Fuel Oil)	2000	--	--	--	200	6000
Heavy Oil	2000	--	--	--	--	--
VOCs						
1,2-Dibromoethane (EDB)	0.00500	720	0.500	--	--	--
1,2-Dichloroethane (EDC)	--	480	11.0	--	--	--
2-Butanone (MEK)	--	48000	--	--	--	--
Acetone	--	72000	--	--	--	--
Benzene	0.0300	320	18.2	--	--	--
Carbon tetrachloride	--	320	14.3	--	--	--
Chloroform	--	800	32.3	--	--	--
Ethylbenzene	6.00	8000	--	--	--	--
Methyl tert-butyl ether (MTBE)	0.100	--	556	--	--	--
Methylene chloride	0.020	480	500	--	--	--

Parameter and Method	Method A Unrestricted Land Use (mg/kg)	Method B Non cancer (mg/kg)	Method B Cancer (mg/kg)	Table 749-3 Plants (mg/kg)	Table 749-3 Soil Biota (mg/kg)	Table 749-3 Wildlife (mg/kg)
Tetrachloroethene	0.0500	480	476	--	--	--
Toluene	7.00	6400	--	200	--	--
Trichloroethene	0.0300	40.0	12.0	--	--	--
Vinyl chloride	--	240	0.670	--	--	--
Xylenes, total	9.00	16000	--	--	--	--
SVOCs						
Benz(a)anthracene	--	--	1.37	--	--	--
Benzo(a)pyrene	0.100	--	0.137	--	--	12
Benzo(b)fluoranthene	--	--	1.37	--	--	--
Bis(2-ethylhexyl)phthalate	--	1600	71.4	--	--	--
Butyl benzyl phthalate	--	16000	526	--	--	--
Chrysene	--	--	137	--	--	--
Dibenz(a,h)anthracene	--	--	0.137	--	--	--
Indeno(1,2,3-cd)pyrene	--	--	1.37	--	--	--
Naphthalene	5.00	1600	--	--	--	--
Pentachlorophenol	--	400	2.5	3	6	4.5
Total Metals						
Arsenic	20.0	24.0	0.667	10(As V)	60(As V)	7 (As III), 132(As V)
Cadmium	2.00	80.0	--	4	20	14
Chromium	2000 (Cr III)	120000 (Cr III)	--	42	42	67
Copper	--	3200	--	100	50	217
Lead	250	--	--	50	500	118
Nickel	--	--	--	30	200	980
Silver	--	400	--	2	--	--
Zinc	--	24000	--	86	200	360
Hexavalent Chromium						
Chromium, Hexavalent	19.0	240	--	--	--	--

Parameter and Method	Method A Unrestricted Land Use (mg/kg)	Method B Non cancer (mg/kg)	Method B Cancer (mg/kg)	Table 749-3 Plants (mg/kg)	Table 749-3 Soil Biota (mg/kg)	Table 749-3 Wildlife (mg/kg)
PCBs						
Aroclor 1016	--	5.60	14.3	--	--	--
Aroclor 1221	--	--	--	--	--	--
Aroclor 1232	--	--	--	--	--	--
Aroclor 1242	--	--	--	--	--	--
Aroclor 1248	--	--	--	--	--	--
Aroclor 1254	--	1.60	0.500	--	--	--
Aroclor 1260	--	--	0.500	--	--	--
Aroclor 1262	--	--	--	--	--	--
Aroclor 1268	--	--	--	--	--	--
Total PCBs	1.00	--	0.500	40	--	0.65
Chlorinated Pesticides						
4,4´-DDD	--	--	4.17	--	--	0.75
4,4´-DDE	--	--	2.94	--	--	0.75
4,4´-DDT	3.00	40.0	2.94	--	--	0.75
Aldrin	--	2.40	0.0588	--	--	0.1
Alpha BHC	--	640	0.159	--	--	6
alpha-Chlordane	--	40.0	2.86	--	1	2.7
Beta BHC	--	--	0.556	--	--	6
Delta BHC	--	--	--	--	--	6
Dieldrin	--	4.00	0.0625	--	--	0.07
Endosulfan I	--	480	--	--	--	--
Endosulfan II	--	480	--	--	--	--
Endosulfan sulfate	--	480	--	--	--	--
Endrin	--	24.0	--	--	--	0.2
Endrin aldehyde	--	24.0	--	--	--	0.2
Endrin ketone	--	24.0	--	--	--	0.2
Gamma BHC (Lindane)	0.0100	24.0	0.909	--	--	6
gamma-Chlordane	--	40.0	2.86	--	1	2.7
Heptachlor	--	40.0	0.222	--	--	0.4

Parameter and Method	Method A Unrestricted Land Use (mg/kg)	Method B Non cancer (mg/kg)	Method B Cancer (mg/kg)	Table 749-3 Plants (mg/kg)	Table 749-3 Soil Biota (mg/kg)	Table 749-3 Wildlife (mg/kg)
Heptachlor epoxide	--	1.04	0.110	--	--	0.4
Methoxychlor	--	400	--	--	--	--
Toxaphene	--	--	0.909	--	--	--
Chlorinated Herbicides						
2,4,5-T	--	800	--	--	--	--
2,4,5-TP (Silvex)	--	640	--	--	--	--
2,4-D	--	800	--	--	--	--
2,4-DB	--	640	--	--	--	--
3,5-Dichlorobenzoic acid	--	--	--	--	--	--
4-Nitrophenol	--	--	--	--	--	--
Acifluorfen	--	1040	--	--	--	--
Bentazon	--	2400	--	--	--	--
Chloramben	--	1200	--	--	--	--
Dacthal (DCPA)	--	800	--	--	--	--
Dalapon	--	2400	--	--	--	--
Dicamba	--	2400	--	--	--	--
2,4-DP	--	--	--	--	--	--
Dinoseb	--	80.0	--	--	--	--
MCPA	--	40.0	--	--	--	--
MCPP	--	80.0	--	--	--	--
Picloram	--	5600	--	--	--	--

a	Gasoline with benzene present in groundwater
b	Gasoline with no detectable benzene present in groundwater
--	No limit; no criteria identified

Table 7 Site cleanup criteria – groundwater

Parameter and Method	Method A (µg/L)	Method B Non cancer (µg/L)	Method B Cancer (µg/L)	USEPA SMCLs (ug/L)
Gasoline by NWTPH-Gx				
Gasoline	800[a], 1000[b]	--	--	--
Diesel and Heavy Oil by NWTPH-Dx/Dx Ext.				
Diesel (Fuel Oil)	500	--	--	--
Heavy Oil	500	--	--	--
VOCs				
1,2-Dibromoethane (EDB)	0.0100	72.0	0.0219	--
1,2-Dichloroethane (EDC)	5.00	48.0	0.481	--
2-Butanone (MEK)	--	4800	--	--
Acetone	--	7200	--	--
Benzene	5.00	32.0	0.795	--
Carbon tetrachloride	--	32.0	0.625	--
Chloroform	--	80	1.41	--
Ethylbenzene	700	800	--	--
Methyl tert-butyl ether	20.0	--	24.3	--
Methylene chloride	5.00	48.0	21.9	--
Tetrachloroethene	5.00	48.0	20.8	--
Toluene	1000	640	--	--
Trichloroethene	5.00	4.00	0.540	--
Vinyl chloride	0.200	24.0	0.0290	--
Xylenes, total	1000	1600	--	--
SVOCs				
Benz(a)anthracene	--	--	0.120	--
Benzo(a)pyrene	0.100	--	0.0120	--
Benzo(b)fluoranthene	--	--	0.1200	--
Bis(2-ethylhexyl)phthalate	--	320	6.25	--
Butyl benzyl phthalate	--	3200	46.1	--
Chrysene	--	--	12.0	--
Dibenz(a,h)anthracene	--	--	0.0120	--
Indeno(1,2,3-cd)pyrene	--	--	0.120	--
Naphthalene	160	160	--	--

Parameter and Method	Method A (µg/L)	Method B Non cancer (µg/L)	Method B Cancer (µg/L)	USEPA SMCLs (ug/L)
Pentachlorophenol	--	80.0	0.219	--
Metals				
Arsenic	5.00	4.80	0.0583*	--
Cadmium	5.00	8.00	--	--
Chromium, trivalent (III)	50.0	24000	--	--
Copper	--	640	--	1000
Iron	--	11200	--	300
Lead	15.0	--	--	--
Manganese	--	2240	--	50
Nickel	--	--	--	--
Silver	--	80.0	--	100
Zinc	--	4800	--	5000
Anions				
Nitrate (as N)	--	25600	--	--
Sulfate	--	--	--	250000
TOC				
TOC	--	--	--	--

a Gasoline with benzene present in groundwater
b Gasoline with no detectable benzene present in groundwater
* Lowest criteria below background. Data will be compared to the PQL.
-- No limit; no criteria identified

6.2.2 Targets for comparability, representativeness, and completeness

6.2.2.1 Comparability

Comparability is defined as the confidence with which one set of data can be compared with another. The extent to which existing and planned analytical data will be comparable depends on the similarity of: sampling methods, sample preparation procedures, analytical methods, and holding times. Comparability will be satisfied by ensuring that the Work Plan, SAP, and QAPP procedures will be consistently followed. This will be accomplished by the project team and measured with the use of QC samples as described in Section 10 as well as adherence to the laboratory and field SOPs.

6.2.2.2 Representativeness

Representativeness is defined as the degree to which data represents a characteristic of a population, variation at a sampling point, a process condition, or an environmental condition. Representativeness is a qualitative measure that is dependent upon the proper design of the sampling program and proper sampling and laboratory protocols. As described in the RI Work Plan, the sampling network is designed to provide samples representative of Site conditions. During development of the sampling program, consideration was given to past operations, existing analytical data, physical setting, and constraints inherent in the monitoring program. The representativeness criteria will be satisfied by following the RI Work Plan and by the use of proper sampling techniques and appropriate laboratory procedures. Sample collection procedures (see SAP Appendix A) describe sample homogenization techniques for soil samples and stabilization procedures for water samples that will aid in ensuring that a sample is representative of Site conditions. Representativeness will be assessed on this project through the use of MS, MSD, field blank, and field duplicate samples.

6.2.2.3 Completeness

Completeness is a measure of the amount of valid data obtained from a measurement system compared to the amount that was expected to be obtained under normal conditions. Rejected data, or sampling points that do not yield usable samples count against the percent completeness. The completeness goal for this project is for completeness to be greater than 90 percent. Following completion of analytical testing, completeness will be calculated as a percent using the following equation:

$$Completeness\ (\%) = \frac{Number\ of\ valid\ data}{Number\ of\ targeted\ data}\ x\ 100$$

Data = # of samples X # of parameters per sample

6.3 Acceptance criteria for quality of existing data

Analytical results from previous Site investigations were used to help design the scope for this investigation. Barr performed a QA/QC review of historical data sets that were used and a comparison was made between the detection limits used and the current cleanup levels. A summary of that review is in RI Work Plan Appendix D. The data obtained prior to this QAPP and used to help define the work in the RI Work Plan was considered acceptable for development of the Work Plan.

7.0 Study design

7.1 Study boundaries

The Site study area is defined on Figure 3. AOCs that will be investigated in the RI are shown on Figure 12.

7.2 Field data collection

7.2.1 Sampling locations and frequency

The sampling locations and frequencies were selected to meet the data quality objective of delineating the extent of impacts for pursuant to the evaluation of remedial actions. Sample locations were targeted near operational features (e.g. petroleum use) to assess the most likely location of potential impacts and were also targeted in areas of known impacts to delineate the extent of those impacts. Where potential dispersed impacts are present due to past operations, area-wide sampling is planned. Further details are provided in the SAP.

7.2.2 Field parameters and laboratory analytes to be measured

The parameters that will be measured in the field or tested in the laboratory from samples collected in the field are listed in Table 2 through Table 4.

8.0 Field procedures

8.1 Measurement and sampling procedures

Analytical samples will be collected in the field in accordance with the SOPs in the SAP.

8.2 Containers, preservation methods, holding times

The sample containers, preservation, and holding times associated with the anticipated analytical tests are provided in Table 8 and Table 9.

Table 8 Sample containers, preservation, and holding times – soil*

Parameter	Matrix	Weight of Sample (g)	Container^	Preservative	Holding Time
TPH-Gx: Gasoline	Soil	5, 10, or 25	2-40 mL VOA vials with Teflon septum cap collected by field coring device kit	Cool, ≤ 6 °C, 1:1 w/chemical preservation (e.g., methanol, sodium bisulfate). Additional unpreserved for %moisture if preservation used	Analyze within 14 Days
TPH-Dx: Diesel and Heavy Oil	Soil	Full, no headspace	4 oz. jar w/ PTFE-lined lid	Cool, ≤ 6 °C	Extract within 14 Days / Analyze within 40 Days of Extraction
VOCs	Soil	5, 10, or 25	2-40 mL VOA vials with Teflon septum cap collected by field coring device kit	Cool, ≤ 6 °C, 1:1 w/chemical preservation (e.g., methanol, sodium bisulfate). Additional unpreserved for %moisture if preservation used	Analyze within 14 Days
SVOCs	Soil	Full, no headspace	4 oz. jar w/ PTFE-lined lid	Cool, ≤ 6 °C	Extract within 14 Days / Analyze within 40 Days of Extraction
Metals	Soil	Full, no headspace	4 oz. jar w/ PTFE-lined lid	None	Analyze within 6 months
Hexavalent Chromium	Soil	Full, no headspace	4 oz. jar w/ PTFE-lined lid	Cool, ≤ 6 °C	Analyze within 28 days
PCBs	Soil	Full, no headspace	4 oz. jar w/ PTFE-lined lid	Cool, ≤ 6 °C	None
Chlorinated Pesticides/Herbicides	Soil	Full, no headspace	4 oz. jar w/ PTFE-lined lid	Cool, ≤ 6 °C	Extract within 14 Days / Analyze within 40 Days of Extraction

* Containers are the same for soil and sediment sampling

^ Sample volume noted. Additional volume will be required for laboratory QC.

Table 9 Sample containers, preservation, and holding times – water*

Parameter	Matrix	Size and Number of Containers^	Container	Preservative	Holding Time
TPH-Gx: Gasoline	Water	3-40 mL	VOA glass vials, Teflon septum cap	HCl, pH < 2, Zero Headspace; Cool, ≤ 6 °C	Analyze within 14 Days, 7 Days if pH > 2
TPH-Dx: Diesel and Heavy Oil	Water	1 L	Amber glass, Teflon septum cap	Cool, ≤ 6 °C	Analyze within 7 Days / Analyze within 40 Days of Extraction
VOCs	Water	3-40 mL	VOA glass vials, Teflon septum cap	HCl, pH < 2, Zero Headspace; Cool, ≤ 6 °C	Analyze within 14 Days, 7 Days if pH > 2
SVOCs	Water	2 L	Amber glass, Teflon septum cap	Cool, ≤ 6 °C	Analyze within 7 Days / Analyze within 40 Days of Extraction
Metals (collect field filtered and unfiltered)	Water	500 mL	Polyethylene	HNO3, pH < 2	Analyze within 6 months
Anion Parameters: Nitrate, Sulfate	Water	250 mL	Polyethylene	Cool, ≤ 6 °C	**Nitrate: Analyze within 48 hours** Sulfate: Analyze within 28 days
TOC	Water	250 mL	Amber glass	H_2SO_4, protect from sunlight; Cool, ≤ 6 °C	Analyze within 28 days

* Containers are the same for groundwater and surface water sampling

^ Sample volume noted. Additional volume will be required for laboratory QC.

8.3 Equipment decontamination

The decontamination procedures and additional information on the field equipment and sampling techniques is provided in the Barr field SOPs located in the SAP.

8.4 Sample ID

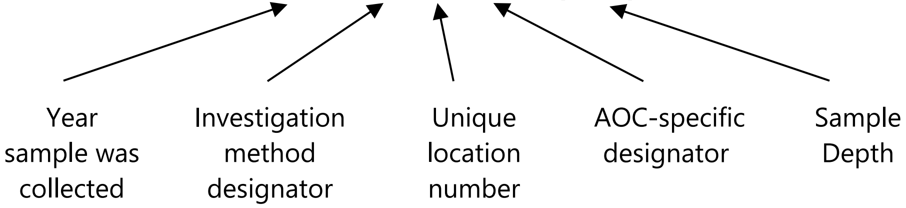
8.4.1 Soil sample ID

Each sample collected for this investigation will be represented by four designators:

1. The year the sample is collected and the identifier RI;
2. Two letters representing the type of investigation method;
3. A two-digit unique location number;
4. A Site-specific AOC designator from where the sample is collected. In the case of soil samples, the sample depth will also be included.

For example, a soil sample collected from a test pit at a depth of 1 – 2 feet below ground surface at the Wood Waste Landfill Remnant (AOC 1) will be labeled as follows:

2018RI-TP-01-AOC1 (1′-2′)



Soil sampling method designator

Soil samples will be assigned the following designator for each type of sample.

- **SB (Soil Boring)**: Represents a soil boring installed with a Rotasonic drill rig or similar rig for the purpose of collecting information on stratigraphy or for collecting soil samples, groundwater samples from temporary wells or soil gas samples from temporary soil gas wells.
- **TP (Test Pit):** Represents a test pit excavated for the purpose of observing subsurface conditions or for collecting soil samples.
- **SS (Surface Soil):** Represents a surface soil sample collected with hand tools beneath the surface vegetation and the rooting zone.
- **PB (Pond Bottom):** Represents a sample collected from settled solids and soil beneath the former operational ponds.

Unique location number

The two digit unique location number for soil sampling will start with the number 01 for each type of investigation method and continue in order (02, 03, etc.) as the investigation progresses, regardless of the AOC from where the sample was collected. For example, the first surface soil sample collected will be represented by the designation 2017RI-SS-01-XXX (X′-X′), where XXX is the AOC-specific designator and (X′-X′) is the sample depth.

Site-specific AOC designator

The Site-specific AOC designator is the number assigned to the AOC to distinguish where the sample is collected. The Site-specific designators are listed next to the AOC titles in Figure 12.

8.4.2 Groundwater sample ID

Groundwater samples collected from monitoring wells (new and existing) will be represented by the well identification number (MW-XX). Newly installed monitoring wells will start with the well identification number MW-19 and continue in order (MW-20, MW-21, etc.) as the investigation progresses.

Groundwater samples collected from temporary wells will be identified similar to soil samples with the year, TW method identifier, unique location identifier, and AOC-specific designator. For example, 2017RI-TW-01-AOC16 represents a sample collected from a temporary well in the Fuel Distribution System (AOC 16).

8.4.3 Surface water sample ID

Surface water samples will be represented by the surface water monitoring location identification provided below.

- REC – Recycle Pond
- SET – Settling Pond

8.4.4 Soil gas well sample ID

Soil gas samples from soil gas wells (new and existing) will be represented by the soil gas well identification number (GP-XX). Newly installed soil gas monitoring wells will start with the well identification number GP-45 and continue in order (GP-46, GP-47, etc.) as the investigation progresses.

8.4.5 QA/QC sample ID

In addition to investigation soil, groundwater, and soil gas samples, QA/QC samples consisting of field blanks, field duplicates, equipment blanks, methanol blanks, and matrix spikes and matrix spike duplicates will be used at the rates described in Table 5. QA/QC samples will be identified by the following codes, followed by a sequential number.

- **M (Field [Masked] Duplicate Sample):** Represents a duplicate soil or groundwater sample collected to give a measure of the precision associated with sample collection, preservation, and storage, as well as with laboratory procedures. (Example: M-1, M-2).
- **FB (Field Blank Sample):** Represents a field blank sample collected to determine whether the field environment has contaminated the sample. (Example: FB-1, FB-2).
- **EB (Equipment Blank Sample):** Represents an equipment rinsate sample collected to determine whether the sample transporting procedures, equipment cleaning procedures, and/or environments has contaminated the sample. (Example: EB-1, EB-2).

- **TB (Trip Blank):** Represents a sample collected from a container filled by the laboratory with ultra clean water for QA/QC procedures to determine if contamination has occurred during the sampling process. (Example: TB-1, TB-2).

8.5 Chain of custody

The sample ID, sample collection date and time, and the number of containers will be noted on the chain-of-custody form. Samples will be packaged and shipped according to Barr's SOPs for sample collection and transportation to the laboratory. The sample packaging and shipment procedures summarized below will be used so the samples will arrive at the laboratory with the chain-of-custody intact.

- The field sampler will be responsible for the care and custody of the samples until they are transferred or dispatched. As few people as possible will handle the samples.
- The sample containers will be identified by use of sample labels with location numbers, and date and time of collection.
- Sample labels will be completed for each sample using waterproof ink unless prohibited by weather conditions. For example, a field data sheet notation would explain that a pencil was used to fill out the sample tag because the ballpoint pen would not function in freezing weather.
- Samples will be packaged for shipment with a completed and signed chain-of-custody record enclosed in a plastic bag. A SOP with chain-of-custody instructions is provided in the SAP and an example of a chain-of-custody form is in Appendix C to this QAPP.
- Shipping containers will be sealed and secured with custody tape for shipment to the laboratory via an overnight delivery service for receipt of delivery within two days of sample collection. Samples may be held for shipment, under appropriate storage conditions for up to four days (e.g., due to holidays or special circumstances) unless sample holding times dictate a faster delivery.

When transferring the possession of samples, the individuals relinquishing and receiving will sign, date, and note the time on the chain-of-custody. This record documents transfer of custody of samples from the sampler to another person or to the laboratory. This will not include transport people such as messengers or overnight delivery service employees.

Shipments will be accompanied by the chain-of-custody record identifying the contents. The original record will accompany the shipment, and the pink and gold copies will be retained by the sampler and returned to Barr. A copy all chain-of-custody forms will be provided in the RI Report.

8.6 Field log requirements

Field data sheets will provide the means of recording field data collection activities. Information on field documentation is included in the SOPs in the SAP. Copies of field data sheets will be included in the RI Report.

9.0 Laboratory procedures

9.1 Lab procedures

The analytes that are to be tested in the laboratory and the associated preparation and analytical measurement methods are summarized in Table 2 and Table 3. In addition, the preparation methods, where applicable, are summarized in Table 10.

Table 10 Measurement methods

Analyte	Sample Matrix	Sample Prep Method	Analytical (Instrumental) Method
TPH-Gx: Gasoline	Soil	EPA Method 5035	NWTPH-Gx
	Water	Laboratory SOP NWTPHGx_Gasoline_v2.2	
TPH-Dx: Diesel and Heavy Oil	Soil	EPA Method 3550; With and Without Silica Gel Cleanup	NWTPH-Dx/Dx Ext.
	Water	EPA Method 3510; With and Without Silica Gel Cleanup	
VOCs	Soil	EPA Method 5035	EPA Method 8260: Standard and Low Level
	Water	EPA Method 5030	
SVOCs	Soil	EPA Method 3550	EPA Method 8270: Standard and Low Level
	Water	EPA Method 3510 and EPA Method 3520	
Metals	Soil	EPA Methods 3050	EPA Method 6020
	Water	EPA Methods 3010	EPA Method 6020
Hexavalent Chromium	Soil	Laboratory SOP Hexavalent Chromium by Spectrophotometry	EPA Method 7196
PCBs	Soil	EPA Method 3550 with and without silica gel and Florsil Cleanup	EPA Method 8082
Pesticides	Soil	EPA Method 3550	EPA Method 8081
Herbicides	Soil	EPA Method 3550	EPA Method 8151A
Anion Parameters: Nitrate, Sulfate	Water	Laboratory SOP Inorganic Anions by Ion Chromatography	EPA Method 300
TOC	Water	Laboratory SOP Total Organic Carbon in Water	SM 5310C

9.2 Laboratory accredited for methods

Fremont is an accredited laboratory by the Department of Ecology Environmental Laboratory Accreditation Program. Fremont's primary National Environmental Laboratory Accreditation Program (NELAP) accreditation is through the Oregon Public Health Division. Copies of their certificates and scope of accreditation are in Appendix B to this QAPP.

10.0 Quality control procedures

10.1 Field and laboratory quality control

Field quality control requirements

QC procedures for field equipment will include calibrating the instruments per manufacturer's instructions or as described in the SOPs in the SAP, measuring duplicate samples, and checking the reproducibility of the measurements by taking multiple or continuous readings for example, on purged water during sampling. Possible corrective actions that could be implemented when needed are summarized in Section 10.2.

Assessment of field sampling precision and bias will occur by collecting field duplicate and field blank samples for laboratory analysis. Collection of these samples will be in accordance with the applicable procedures in the SOPs in the SAP. Whenever possible, samples will be collected from the cleanest location to the dirtiest, whenever the extent of the contamination is known. A summary of field QA/QC samples for this project is presented in Table 5.

Field blank samples will consist of analyte-free water exposed to environmental conditions at the sampling site by transferring the water from one sample container to another or by removing the lid and exposing a container filled with analyte-free water to the atmosphere for the time necessary to fill a sampling container. The analyte-free water will be provided by the laboratory and expected to be non-detect for all investigation parameters. Field blank samples measure the potential for sample cross contamination due to site conditions. Field blank samples will be submitted to the laboratory with investigation samples and analyzed for the same parameters as the investigation samples.

In the event that field equipment is reused, an equipment blank sample will be collected. Equipment blank samples will follow the same procedure as a field blank except it will include the analyte-free water placed into contact with sampling equipment to assess the effectiveness of decontamination procedures or possible sources of field contamination.

Field precision will be assessed through the collection and analysis of field duplicate samples. RPDs will be calculated for the detected analytes from investigation and field duplicate samples where both the native and field duplicate sample concentrations are greater than five times the PQL. The equation to be used to determine precision (RPD) and the field duplicate precision limits are in Section 6.2.1.1. An exceedance of these limits will result in corrective actions by the Barr Data QA manager.

Laboratory quality assurance program overview

The purpose of a laboratory's QA program is to determine that analytical results are scientifically sound, legally defensible, of known and documented quality, and will accurately reflect the medium being tested. QA oversight is performed throughout sample processing from initial order/entry, through the analytical system, to the final report. This is done through various policies, procedures, and QC checks. The Laboratory QA Manager has the authority and responsibility for implementing, maintaining, and correcting the quality system and for ensuring compliance with all regulatory compliance quality standards. The Laboratory QA Manager works with laboratory staff to establish effective quality control and assessment processes and has the authority to stop work in response to quality problems.

Internal laboratory quality control procedures

Internal laboratory QC procedures are established, implemented, and maintained by the laboratory. They will include data integrity training, document control, control of records, measurement traceability, analysis of proficiency testing (PT) samples, and internal auditing. Detailed information regarding each of these procedures, along with other internal laboratory policies and procedures, are included in the laboratory's QAM. These policies and procedures are established in order to meet requirements of accreditation bodies and applicable programs, as well as the project's quality objectives. QC procedures are used to continually assess performance of the laboratory's QC systems.

Laboratory quality control checks

Fremont produces quality analytical data through the use of overall quality assurance systems that are supported by documented quality control checks. The particular types and frequencies of quality control checks are defined in the laboratory's SOPs and QAM. These documents are retained at the laboratory and are available upon request for review. Laboratory acceptance criteria are included with each analytical report and a summary of laboratory QA/QC limits, are in Table 2 and Table 3. An exceedance of these limits will result in corrective actions by the laboratory, in accordance with the laboratory quality assurance manual.

10.2 Corrective action processes

The Field Manager will be responsible that the samples are collected and handled according to the established plan (RI Work Plan, SAP, and this QAPP). The Data QA Manager will review the historical data and other Site data to verify that representativeness and comparability are being achieved. If a specific analytical value is outside normal historical trends, or if other issues are noted during data verification, corrective actions will be undertaken. Examples of corrective action include a request for laboratory data review, reanalysis of samples, or recollection and analysis of samples. Decisions to repeat sample collection and/or analyses will be made by the Project Manager or Project Coordinator based on the extent of the deficiency and its importance in the overall context of the project. Corrective action is implemented only after approval by the Ecology Project Manager and OfficeMax and Owners representatives or their designee.

11.0 Management procedures

11.1 Data recording and reporting

Field data reporting will be conducted principally through the transmission of report sheets containing tabulated results of the measurements made in the field. Field documentation of field instrument calibrations, well logs, boring logs, sample identifications, etc. will be contained in the field reports. Examples of field forms used for field reports are included in the SAP.

Laboratory data reported and field generated data will be reduced and verified prior to reporting. All field or laboratory data will be subjected to the procedures summarized in the subsections below before dissemination. All data from field activities and laboratory analysis will be made available to Ecology after reduction and validation.

Field data reduction procedures

Barr uses document management software that stores templates of the forms developed for use in the field. The field forms are included in the SAP. The forms are stored in the document management software and are updated on an ongoing basis. The use of water quality meters, PIDs, and soil gas meters will generate measurements read directly from the meters following calibration per the manufacturer's instructions. Such data will be written into field data sheets immediately after measurements are taken. If errors are made, results will be legibly crossed out, initialed and dated by the field member, and corrected in a space adjacent to the original entry. Later, when the result forms required for this study are complete, the Data QA Manager and/or Field Manager will proofread the forms to determine whether any errors have been made by the field crew.

Laboratory data reduction procedure

The Fremont Laboratory QA Manager reviews data generated in the laboratory for compliance with method, laboratory and, where appropriate, project requirements. An electronic data file is generated by the instrument and saved on the laboratory’s computer network. The data file is loaded into the laboratory’s database. During data processing, the program checks QC measurements for acceptability. QC analyses that do not meet the QC criteria are flagged. The results are checked by the analyst to insure that a narrative is provided and the appropriate flag is attached.

Any data that does not meet QA requirements is either re-analyzed or flagged. When the analyst has finished the primary review, another appropriately qualified individual in the laboratory checks the bench sheet for the following items:

- All required information has been recorded on the bench sheet.
- QC criteria have been met or exceptions are documented in the comments section of the bench sheet.
- Manual calculations are checked for accuracy.

When these checks have been completed, the reviewer signs and dates the data review sheet to document that the review has been performed. Once all analyses for a sample set have been completed, the folder with the raw data is turned into for preparation of the final report. The results are reviewed again for completeness and accuracy by the Laboratory Director, or designee, and the final report is generated and sent to Barr.

The Laboratory QA Manager, or designee, completes a more detailed review of a minimum of 10% of all data packages for completeness and accuracy either prior to, or after reporting. Findings from these reviews are recorded and brought to the attention of the laboratory management team so appropriate action can be taken as needed.

Data will be appropriately qualified in the laboratory report. Case narratives will be prepared that will include information concerning data that fell outside acceptance limits, and any other anomalous conditions encountered during sample analysis. Upon approval by the Laboratory Director, or designee, the laboratory's final report will be sent to Barr. More information on laboratory data reduction is in the individual analytical SOPs, which are retained at the laboratory and are available for review upon request.

11.2 Laboratory data package requirements

The laboratory project manager will perform a final review of the report summaries and case narratives to determine that the report meets project requirements. In addition to the chain-of-custody forms, the report format for soil and water data will consist of the following:

- Date of issuance
- Project name and number
- Condition of samples upon receipt at the laboratory
- Sample collection and receipt date
- Laboratory analyses performed
- Methods used for analyses
- Laboratory batch number
- Sample preparation and analysis dates
- Sample results (including units and percent moisture and/or solids data used in dry weight corrections, if applicable)
- Laboratory PQL for each analyte
- QC data and acceptance criteria (including method blank sample results, LCS recoveries, MS and MSD sample recoveries and RPDs, surrogate standard recoveries, and/or laboratory duplicate RPDs, as applicable)
- Discussion and/or qualification of any laboratory QC checks that failed to meet acceptance criteria
- Discussion and/or qualification of any holding times that were not met
- Data qualifier definitions
- Discussion of technical problems or other conditions which may have created analytical difficulties
- Any deviations from intended analytical strategies
- Signature of the Laboratory Director or designee
- Electronic Data Deliverable (EDD) in EQuIS 4 File Format

11.3 Electronic transfer requirements

The EDD data will be verified against the laboratory hard copy report by a Barr data technician to verify that the results in the EDD and the hardcopy report are consistent. The EDD will be entered into a Barr computer database and the data will be presented in a spreadsheet format to be used in RI Report tables.

11.4 EIM data upload procedures

The data will be submitted to Ecology in the electronic format consistent with its EIM requirements.

12.0 Audits and reports

12.1 Field, laboratory, and other audits

Audits of both field and laboratory activities may be conducted to verify that sampling and analyses are performed in accordance with the procedures established in the RI Work Plan, SAP, and this QAPP. If the laboratory is selected for an audit, the costs, terms and parameters of the audit will be agreed upon in advance. The audits of field and laboratory activities can include two separate, independent parts: internal and external audits. Results of audits are used to improve sampling and laboratory procedures and SOPs and to provide confidence in the field and laboratory results.

12.1.1 Field audits

Internal audits of field activities (sampling and measurements) may be conducted by the Data QA Manager or designee (i.e. someone not directly associated with the sampling activity). A circumstance that could necessitate a field audit would be as part of a corrective action. The audits will include examination of field sampling records, field instrument calibration and operating records, sample collection, sample handling, QA procedures, and chain-of-custody documentation in conformance with the established procedures. If, during the course of the internal audit, the auditor observes any practice that is believed to have the potential to jeopardize the data, sampling will be suspended and the Barr Project Manager will be contacted to discuss the issue. If it is determined that the issue cannot be immediately resolved, sampling will be suspended and resumed only after measures to correct the practice are evaluated and implemented as needed by the Project Manager and Data QA Manager. A copy of the field audit checklist is in Appendix D to this QAPP. The Data QA Manager will complete the audit checklist and identify deficiencies to the Project Manager.

12.1.2 Laboratory audits

12.1.2.1 Internal audits

Internal audits of laboratory activities are conducted under the direction of the Laboratory QA Manager and are comprised of system, process, and electronic data audits. A system audit is an annual audit of the implementation of the quality system in the laboratory. A process audit is an audit of the operational areas in the laboratory to evaluate conformance with operational and technical procedures. An electronic data audit examines the chromatographic data. All audit findings are documented and reported to the laboratory director and department managers for review. Additional information regarding laboratory audits is provided in Section 19 of Fremont's QAM, which is on file at the laboratory and may be reviewed upon request.

12.1.2.2 External audits

As part of their NELAP accreditations, Fremont is audited by their primary NELAP Accreditation Body along with other non-NELAP states and agencies. A copy of Fremont's most recent NELAP certificates and scopes of accreditation applicable to work in Washington are in Appendix B. The laboratory's NELAP accreditation requires participation in the analysis of PT samples. The Laboratory Director, QA Manager, and the laboratory staff review results of the PT samples.

12.2 Reporting and schedule

The proposed project schedule, including the data-reporting schedule is presented above in Section 5.4. The RI Report will be prepared by Barr and Fulcrum and will undergo extensive internal review. The final report will include a data quality section that describes the QA/QC performed as prescribed in this QAPP.

13.0 Data verification and validation

Data verification (data review) is defined as an evaluation of performance against predetermined requirements such as an analytical method, SOP, or QAM procedures. It is performed during or at the end of field or laboratory data collection activities. The goal of data verification is to document that the reported results reflect what was actually done. Data validation is the evaluation of the technical usability of the data. It focuses on the particular data needs for a project as defined in project-specific documentation (e.g., SAP or QAPP). Data verification begins with the outputs from data verification. Data verification and validation will be performed as described below.

13.1 Field data verification

The Barr Data QA Manager will review field data for completeness and errors. Additionally, during preparation of the final field report, Barr technical field staff will verify their documentation for accuracy and completeness. If any errors are found, the field personnel will be contacted and corrective action (Section 10.2) will be initiated.

13.2 Laboratory data verification

The Barr Data QA Manager will complete a verification of laboratory data. The data verification by the Barr QA Manager will check that the samples were collected and handled according to the established plan (RI Work Plan, SAP, and this QAPP). One hundred percent of the data will be verified.

The data reviewer will identify any out-of-control data points and data omissions and work with the laboratory to correct data deficiencies. Decisions to repeat sample collection and analyses will be made by the Barr Project Coordinator based on the extent of the deficiency and its importance in the overall context of the project.

Laboratory verification

The laboratory data review is described in Section 11.1 as well as in the laboratory’s QAM, which is retained at the laboratory and is available for review upon request.

Barr data verification

The Barr Data QA Manager will conduct a systematic review of the data reported by the laboratory in accordance with Barr’s routine level data evaluation SOPs in Appendix E to this QAPP. The SOPs are based on QA elements within the USEPA Contract Laboratory Program National Functional Guidelines. Data quality evaluation procedures will use the QC recovery limits in Table 2 and Table 3 and/or in the laboratory reports. The specific requirements that will be checked during data verification (where applicable) are:

- Holding times
- Preservation
- Blank sample data

- LCS data
- MS sample data
- Surrogate recovery data
- Duplicate sample data

The data reviewer will identify any out-of-control results and data omissions and work with the laboratory to correct any data deficiencies.

Barr data validation

The Barr Data QA Manager will examine the data packages for completeness. Deliverables will include sample chain-of-custody forms, analytical results, and QC summaries. The Barr Data QA Manager will determine whether all required items are present and request copies of missing deliverables. The Barr Data QA Manager will review any issues found during data verification and will compare QC data outside laboratory QC limits against the limits included in the laboratory report to determine the usability (validate) of the data. Upon completing data verification and validation in accordance with Barr's routine level data evaluation SOPs (Appendix E to this QAPP), a routine level QC report will be compiled and submitted. The Barr Data QA Manager will indicate whether the data are usable for the project as reported, usable as an estimated concentration, or unusable. Qualifiers applied during data validation will be shown on the tabulated form of the data and described in the QA section of the RI Report. The laboratory results will not undergo full data validation (i.e., review of raw data including calibration, internal standards, tune checks, etc.) based on the USEPA Contract Laboratory Program National Functional Guidelines for Organic Review unless questions arise during routine data review.

14.0 Data quality (usability) assessment

14.1 Process for determining if project objectives were met

The analytical results will be compared to meet the project quality objectives that are summarized in Section 6 of this QAPP. This data reconciliation process may involve multiple steps depending on the results of the initial QA review. Data that has been qualified (by the laboratory or by Barr) will be assessed based on the particular circumstances surrounding the sample. For example, if multiple compounds are detected in a method or field blank, and in the associated samples at comparable concentrations (as defined in Appendix E to this QAPP), the data result will likely be treated as a false positive concentration and considered to not be representative or accurate. In contrast, if the sample location is critical (e.g., compliance boundary), the data may need to be rejected and another sample collected. This also applies to qualifications based on failure to meet precision-based criteria for matrix spike/matrix spike duplicates or field duplicates if the result affected are critical to project decision-making. Corrective actions may include resampling and/or reanalysis of the sample. The laboratory limits may be elevated above appropriate criteria due to dilutions or matrix interferences, affecting the sensitivity of the analysis. In these cases, the importance of the non-detect data to decision-making will be evaluated and potential corrective actions may include using the qualified data or resampling.

14.2 Treatment of non-detected results

Interpretation of the non-detect results will be based on a variety of factors including: the amount of detected results in the dataset, elevated PQLs due to dilution or matrix interferences, and the relationship between the PQL and the cleanup level.

14.3 Data analysis and presentation methods

The data will be compiled from each monitoring event or investigation stage and summarized in tabular form. Select data may also be shown in graphical form where helpful.

14.4 Sampling design evaluation

The sampling design will be evaluated based on the MQOs of comparability, representativeness, and completeness. Comparability of the data is best assessed by comparing results to existing data. If deviation from historical analytical or sampling methods has occurred, the data may not be comparable to historical data, so efforts to maintain consistent data collection procedures are important within the RI. Representativeness will be evaluated based on the data study design being followed, as described in the RI Work Plan and the associated SAP and this QAPP, and the data being of sufficient quality to be useable. In cases where completeness criteria are not met, the completeness of the subset of data most critical for decision-making will be assessed to determine whether missing data could result in decision errors.

Additional factors that can be considered when evaluating and reconciling the data with data quality objectives are:

- Data time-series or historical trends
- Spatial distributions of results such as similar and dissimilar results from adjacent sample locations
- Outlier analyses
- Statistical interpretation of large data sets when statistical sampling protocols are used
- Relationship of detected results to known Site history information. For example, soil or groundwater results from an area with previous documentation of historical operations
- Relationship of detected results to transient site conditions such as a plume in migrating groundwater
- Relationship of detected results to site conditions such as geologic stratigraphy, historic site use (filling, previous impacted soil excavation, and capping), and proximity to neighboring contamination sources

14.5 Documentation of assessment

A data usability statement will be included in the final RI Report. Data usability assessment is the process of evaluating validated data to determine if the data can be used for the purposes of the project (i.e., to answer the environmental questions or to make environmental decisions). Data usability will include the following sequence of evaluation:

- First, individual data sets will be evaluated to identify the measurement performance/usability issues or problems affecting the ultimate achievement of project DQOs.
- Second, an overall evaluation of all data generated for the project will be performed.
- Finally, the project-specific measurement performance criteria and data validation criteria will be evaluated to determine if they were appropriate for meeting project DQOs.

In order to perform the data evaluation steps above, the reported data will be supported by complete data packages, which include sample receipt and tracking information, COC records, tabulated data summary forms, and analytical data for all field samples, standards, QC checks and QC samples, and all other project-specific documents that are generated.

15.0 References

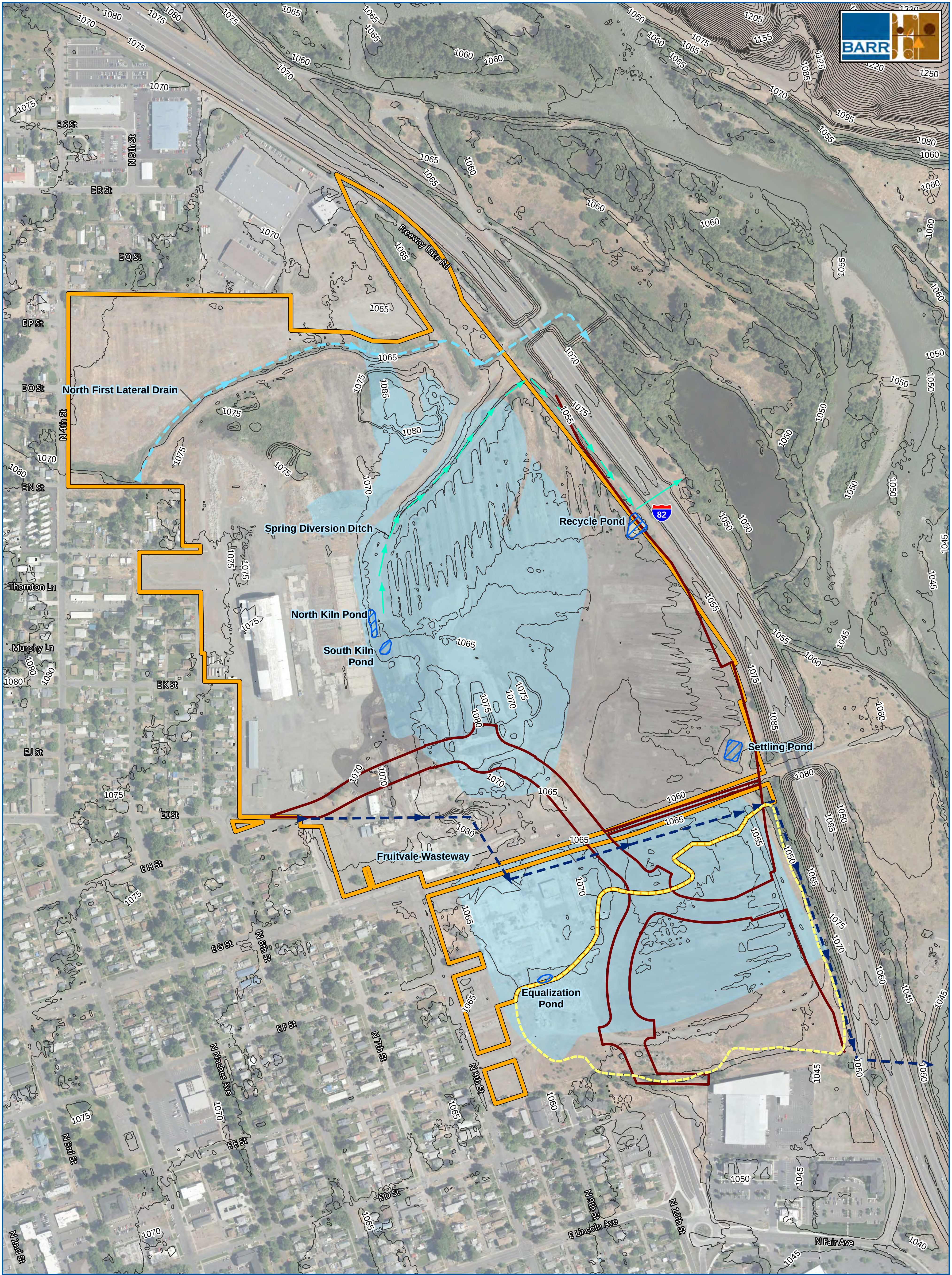
Ecology, 2016. *Guidelines for Preparing Quality Assurance Project Plans for Environmental Studies*. Environmental Assessment Program, Washington State Department of Ecology, Olympia, WA. http://www.ecy.wa.gov/programs/eap/qa/docs/GranteeQAPP/

USEPA, 2001. *Requirements for Quality Assurance Project Plans for Environmental Data Operations*, USEPA QA/R-5, Quality Assurance Division, March 2001. https://www.epa.gov/sites/production/files/2016-06/documents/r5-final_0.pdf

USEPA, 2006. *Guidance on Systematic Planning Using the Data Quality Objectives Process*, USEPA QA/G-4, Quality Assurance Division, February 2006. https://www.epa.gov/sites/production/files/documents/guidance_systematic_planning_dqo_process.pdf

Large Figures

Barr Footer: ArcGIS 10.6, 2018-08-30 12:16 File: I:\Projects\47\39\1001\Maps\Reports\20170106_RI_Work_Plan\Figure 3 - Site Layout.mxd User: kac2



- Yakima Mill Site Boundary
- Approximate Extent of Municipal Solid Waste (Landfill Site)
- Former Mill Operation Ponds
- Historical Log Pond Extent (1947)
- Fruitvale Wasteway
- North First Lateral Drain
- Spring Diversion Ditch
- 5ft Contour (Puget Sound LiDAR Consortium (PSLC), 2005)
- Proposed Roadway Right-of-Way

Note: Log yard material recovery has resulted in changes in topography relative to 2005 survey.

Background Aerial Imagery Source: City of Yakima (June 2017)

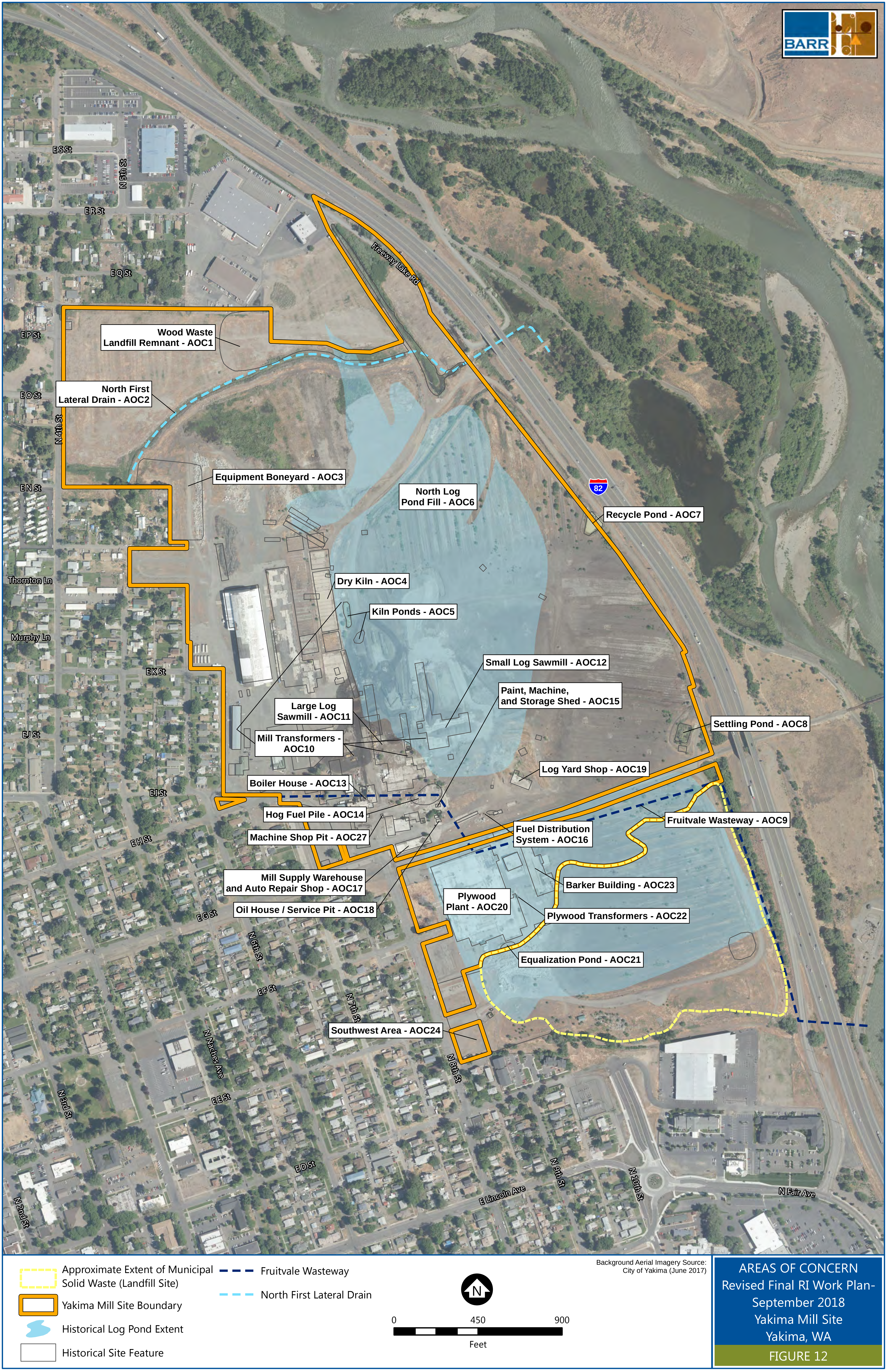
N

0 450 900

Feet

SITE LAYOUT
Revised Final RI Work Plan-
September 2018
Yakima Mill Site
Yakima, WA

FIGURE 3



Background Aerial Imagery Source:
City of Yakima (June 2017)

AREAS OF CONCERN
Revised Final RI Work Plan-
September 2018
Yakima Mill Site
Yakima, WA

FIGURE 12

Large Table

Large Table 1
Data Quality Objectives
Yakima QAPP

Problem	Goal of the Study	Information Inputs	Study Boundaries	Decision Rule	Tolerable Limits on Decision Errors	Optimize Design for Obtaining Data
Potential impacts to soil resulting from operations at the Site. Site operations varied across the Site with a range of contaminants of concern for each AOC.	The goal is the collection of sufficient information to determine the nature and extent of impacts that have resulted from the releases of hazardous substances, including petroleum products, into soil at the Site. As set forth in WAC 173-340-350, the purpose of the RI/FS is to collect, develop, and evaluate sufficient information regarding the Site to select a cleanup action under WAC 173-340-360 through 173-340-390.	Decision inputs include location of samples spatially, depth and proximity to groundwater, field screening results, and analytical data.	The spatial boundaries are shown on Figure 2 of the Work Plan. Sample locations for each AOC are provided in Work Plan Figures 13-23. There are no temporal boundaries for soil sampling. A Stage 2 to the RI may be completed if additional investigation is necessary.	Decision regarding whether cleanup actions will be evaluated is based on comparison of soil concentrations to MTCA Method A and Method B cleanup levels and where the concentration of analytes may impact terrestrial plants and animals.	Multiple lines of evidence will be used to minimize potential for false positives through decision errors. Potential lines of evidence for a localized feature include: field screening results (applicable to petroleum impacts or fill), duplicate sample results, adjacent sample results, and corroboration of impacts with the operational feature (e.g. petroleum impacts beneath a fuel distribution pipe). Potential lines of evidence for area-wide sampling include: duplicate sample results, adjacent sample results, and statistical evaluation.	The sampling design is based on whether soil impacts are potentially localized or dispersed. Potentially localized impacts near an operational feature, or where previous impacts have been identified, will be evaluated with targeted sampling. Potentially dispersed impacts will be evaluated with area-wide sampling.
Potential impacts to groundwater resulting from operations at the Site. Site operations varied across the Site.	The goal is the collection of sufficient information to determine the nature and extent of impacts that have resulted from the releases of hazardous substances, including petroleum products that may have impacted groundwater at the Site. As set forth in WAC 173-340-350, the purpose of the RI/FS is to collect, develop, and evaluate sufficient information regarding the Site to select a cleanup action under WAC 173-340-360 through 173-340-390.	Decision inputs include location of samples spatially, water level measurements, field measurements using a water quality meter, and analytical data.	The spatial boundaries are shown on Figure 2 of the Work Plan. Sample locations for the groundwater monitoring network are provided on Work Plan Figure 24. The temporal boundaries are quarterly sampling to monitor changes in groundwater quality and level over time. A Stage 2 to the RI may be completed if additional investigation is necessary.	Decision regarding whether cleanup actions will be evaluated is based on comparison of groundwater concentrations to MTCA Method A and Method B cleanup levels and USEPA secondary MCLs for drinking water.	Statistical methods will be utilized to perform data evaluations to support the decision rule consistent with the EPA Unified Guidance. Multiple lines of evidence will be used to determine if sample results reflect Site impacts. Potential lines of evidence include: data consistency from quarterly sampling, groundwater flow patterns, analytical results with and without silica gel cleanup (applicable to diesel range organics), analytical results compared to geochemical conditions (applicable to metals concentrations), and other factors.	The sampling design is based on the requirement for spatial coverage to evaluate conditions throughout the Site and temporal coverage to evaluate seasonal fluctuations. Detection of contaminants of concern (COC)s during the first two rounds of monitoring will be used to evaluate which parameters need additional monitoring for temporal variability. Groundwater monitoring results in combination with historical sampling results will provide a data set suitable for conducting statistical trend analyses.

Appendices

Appendix A

Acronyms and Abbreviations

Acronyms and Abbreviations

%R	Percent recovery
ANAB	ANSI-ASQ National Accreditation Board
CFR	Code of Federal Regulations
DQO	Data quality objective
DO	Dissolved oxygen
e.g.	For example
EDD	Electronic data deliverable
EIM	Environmental Information Management database
GC/MS	Gas chromatograph / mass spectrometer
LCS	Laboratory control sample
MDL	Method detection limit
MQO	Measurement quality objective
MS	Matrix spike
MSD	Matrix spike duplicate
NA	Not applicable
NELAP	National Environmental Laboratory Accreditation Program
ORP	Oxidation-Reduction Potential
OSHA	Occupational Safety and Health Administration
PHASP	Project Health and Safety Plan
PID	Photoionization detector
PCB	polychlorinated biphenyls
PT	Proficiency testing
QA	Quality assurance
QAM	Quality Assurance Manual
QAPP	Quality Assurance Project Plan
QC	Quality control
RPD	Relative percent difference
RSD	Relative standard deviation
SOP	Standard operating procedures
SRM	Standard reference materials
USEPA	U.S. Environmental Protection Agency
WAC	Washington Administrative Code

Units of Measurement

%	percent
°C	degrees centigrade
cfs	cubic feet per second
dw	dry weight
ft	feet
g	gram, a unit of mass
kg	kilograms, a unit of mass equal to 1,000 grams
m	meter
mm	millimeter
mg	milligram
mg/Kg	milligrams per kilogram (parts per million)
mg/L	milligrams per liter (parts per million)
mL	milliliter
mV	millivolts
NTU	nephelometric turbidity units
ppm	parts per million
su	standard units
µg/Kg	micrograms per kilogram (parts per billion)
µg/L	micrograms per liter (parts per billion)
µmhos/cm	micromhos per centimeter
µS/cm	microsiemens per centimeter, a unit of conductivity
ww	wet weight

Appendix B

Laboratory Certifications

STATE OF WASHINGTON

DEPARTMENT OF ECOLOGY

PO Box 488 • Manchester, WA 98353-0488 • (360) 871-8840

August 05, 2016

Ms. Nicole Masters
Fremont Analytical, Inc.
3600 Fremont Ave N
Seattle,WA 98103

Dear Ms. Masters:

Thank you for your application for renewal in the Environmental Laboratory Accreditation Program. Enclosed is a Certificate of Accreditation covering the one-year period beginning July 9, 2016 and a current Scope of Accreditation.

Renewal of accreditation is based in part on review of your lab's performance over the past year as evidenced by participation in proficiency testing (PT) studies.

Accreditation is based in part on Third Party recognition of the Labs Oregon NELAP accreditation.

Accreditation is based in part on Third Party recognition of the Labs DoD accreditation.

Formaldehyde in Air analyzed by EPA TO-11A was added to the Labs scope of accreditation at the Labs request and submission of required documentation.

As a reminder, continued participation in the Ecology Lab Accreditation Program requires the lab to:

- Submit a renewal application and fees annually.
- Report significant changes in facility, personnel, analytical methods, equipment, the lab's quality assurance (QA) manual or QA procedures as they occur.
- Participate in proficiency testing studies semi-annually, with the following exception: **For each parameter where all PT results were satisfactory, you are required to submit only one PT result over this next year, and in subsequent years, as long as the results are satisfactory.**
- Submit copies of current third-party Scopes of Accreditation when they are available.

YOUR RIGHT TO APPEAL

You have a right to appeal Ecology's decision to the Pollution Control Hearing Board (PCHB) within 30 days of the date of receipt of this decision letter. The appeal process is governed by Chapter 43.21B RCW and Chapter 371-08 WAC. "Date of receipt" is defined in RCW 43.21B.001(2).

To appeal you must do the following within 30 days of the date of receipt of this decision:

- File your appeal and a copy of this decision with the PCHB (see addresses below). Filing means actual receipt by the PCHB during regular business hours.
- Serve a copy of your appeal and this decision on Ecology in paper form - by mail or in person. (See addresses below.) E-mail is not accepted.

You must also comply with other applicable requirements in Chapter 43.21B RCW and Chapter 371-08 WAC.

ADDRESS AND LOCATION INFORMATION

Street Addresses	Mailing Addresses
Department of Ecology Attn: Appeals Processing Desk 300 Desmond Drive SE Lacey, WA 98503	**Department of Ecology** Attn: Appeals Processing Desk PO Box 47608 Olympia, WA 98504-7608
Pollution Control Hearings Board 1111 Israel Road SW STE 301 Tumwater, WA 98501	**Pollution Control Hearings Board** PO Box 40903 Olympia, WA 98504-0903

If you have any questions concerning the accreditation of your lab, please contact Kamilee Ginder at (360) 871-8841, fax (360) 871-8849, or by e-mail at kamilee.ginder@ecy.wa.gov.

Sincerely,

Alan D. Rue
Lab Accreditation Unit Supervisor

AR:KG:kg
Enclosures

The State of Washington
Department of Ecology

Fremont Analytical, Inc.
Seattle, WA

has complied with provisions set forth in Chapter 173-50 WAC and is hereby recognized by the Department of Ecology as an ACCREDITED LABORATORY for the analytical parameters listed on the accompanying Scope of Accreditation. This certificate is effective July 9, 2016 and shall expire July 8, 2017.

Witnessed under my hand on August 5, 2016

Alan D. Rue
Lab Accreditation Unit Supervisor

Laboratory ID
C910

WASHINGTON STATE DEPARTMENT OF ECOLOGY

ENVIRONMENTAL LABORATORY ACCREDITATION PROGRAM

SCOPE OF ACCREDITATION

Fremont Analytical, Inc.

Seattle, WA

is accredited for the analytes listed below using the methods indicated. Full accreditation is granted unless stated otherwise in a note. Accreditation for U.S. Environmental Protection Agency (EPA) "Test Methods for Evaluating Solid Waste, Physical/Chemical Methods" (SW-846) is for the latest version of the method. SM refers to EPA approved editions of "Standard Methods for the Examination of Water and Wastewater." ASTM is the American Society for Testing and Materials. Other references are described in notes.

Matrix/Analyte	Method	Notes
Air		
Carbon dioxide	EPA 3C	
Carbon monoxide	EPA 3C	
Hydrogen	EPA 3C	
Methane	EPA 3C	
Nitrogen	EPA 3C	
Oxygen	EPA 3C	
Formaldehyde	EPA TO-11A Rev 2 (1999)	6
Carbon disulfide	ASTM D5504-08	
Carbonyl sulfide	ASTM D5504-08	
Dimethyl disulfide	ASTM D5504-08	
Dimethyl Sulfide	ASTM D5504-08	
Ethyl Mercaptan	ASTM D5504-08	
Hydrogen sulfide	ASTM D5504-08	
Isobutyl Mercaptan	ASTM D5504-08	
Isopropyl Mercaptan	ASTM D5504-08	
Methyl Mercaptan	ASTM D5504-08	
n-Butyl Mercaptan	ASTM D5504-08	
n-Propyl Mercaptan	ASTM D5504-08	
t-Butyl Mercaptan	ASTM D5504-08	
1,1,1-Trichloroethane	EPA TO-15 Rev. 2 (1999)	5
1,1,2,2-Tetrachloroethane	EPA TO-15 Rev. 2 (1999)	5

Matrix/Analyte	Method	Notes
1,1,2-Trichloro-1,2,2-trifluoroethane (Freon 113)	EPA TO-15 Rev. 2 (1999)	5
1,1,2-Trichloroethane	EPA TO-15 Rev. 2 (1999)	5
1,1-Dichloroethane	EPA TO-15 Rev. 2 (1999)	5
1,1-Dichloroethylene	EPA TO-15 Rev. 2 (1999)	5
1,2,3-Trimethylbenzene	EPA TO-15 Rev. 2 (1999)	5
1,2,4-Trichlorobenzene	EPA TO-15 Rev. 2 (1999)	5
1,2,4-Trimethylbenzene	EPA TO-15 Rev. 2 (1999)	5
1,2-Dibromoethane (EDB, Ethylene dibromide)	EPA TO-15 Rev. 2 (1999)	5
1,2-Dichloro-1,1,2,2-tetrafluoroethane (Freon 114)	EPA TO-15 Rev. 2 (1999)	5
1,2-Dichlorobenzene	EPA TO-15 Rev. 2 (1999)	5
1,2-Dichloroethane (Ethylene dichloride)	EPA TO-15 Rev. 2 (1999)	5
1,2-Dichloropropane	EPA TO-15 Rev. 2 (1999)	5
1,3,5-Trimethylbenzene	EPA TO-15 Rev. 2 (1999)	5
1,3-Butadiene	EPA TO-15 Rev. 2 (1999)	5
1,3-Dichlorobenzene	EPA TO-15 Rev. 2 (1999)	5
1,4-Dichlorobenzene	EPA TO-15 Rev. 2 (1999)	5
1,4-Dioxane (1,4- Diethyleneoxide)	EPA TO-15 Rev. 2 (1999)	5
1-Propene	EPA TO-15 Rev. 2 (1999)	5
2,3-Dimethylheptane	EPA TO-15 Rev. 2 (1999)	5
2,3-Dimethylpentane	EPA TO-15 Rev. 2 (1999)	5
2-Butanone (Methyl ethyl ketone, MEK)	EPA TO-15 Rev. 2 (1999)	5
2-Hexanone	EPA TO-15 Rev. 2 (1999)	5
2-Methylbutane (Isopentane)	EPA TO-15 Rev. 2 (1999)	5
2-Propanol	EPA TO-15 Rev. 2 (1999)	5
3-Ethyltoluene	EPA TO-15 Rev. 2 (1999)	5
4-Ethyltoluene	EPA TO-15 Rev. 2 (1999)	5
4-Isopropyltoluene (p-Cymene)	EPA TO-15 Rev. 2 (1999)	5
4-Methyl-2-pentanone (MIBK)	EPA TO-15 Rev. 2 (1999)	5
Acetone	EPA TO-15 Rev. 2 (1999)	5
Acrolein (Propenal)	EPA TO-15 Rev. 2 (1999)	5
APH Aliphatics C5-C8	EPA TO-15 Rev. 2 (1999)	5
APH Aliphatics C9-C12	EPA TO-15 Rev. 2 (1999)	5
APH Aromatics C9-C10	EPA TO-15 Rev. 2 (1999)	5
Benzene	EPA TO-15 Rev. 2 (1999)	5
Benzyl chloride	EPA TO-15 Rev. 2 (1999)	5
Bromochloromethane	EPA TO-15 Rev. 2 (1999)	5

Matrix/Analyte	**Method**	**Notes**
Bromodichloromethane	EPA TO-15 Rev. 2 (1999)	5
Bromoform	EPA TO-15 Rev. 2 (1999)	5
Carbon disulfide	EPA TO-15 Rev. 2 (1999)	5
Carbon tetrachloride	EPA TO-15 Rev. 2 (1999)	5
Chlorobenzene	EPA TO-15 Rev. 2 (1999)	5
Chlorodibromomethane	EPA TO-15 Rev. 2 (1999)	5
Chloroethane	EPA TO-15 Rev. 2 (1999)	5
Chloroform	EPA TO-15 Rev. 2 (1999)	5
cis-1,2-Dichloroethylene	EPA TO-15 Rev. 2 (1999)	5
cis-1,3-Dichloropropene	EPA TO-15 Rev. 2 (1999)	5
Cyclohexane	EPA TO-15 Rev. 2 (1999)	5
Dichlorodifluoromethane (Freon-12)	EPA TO-15 Rev. 2 (1999)	5
Ethane	EPA TO-15 Rev. 2 (1999)	5
Ethanol	EPA TO-15 Rev. 2 (1999)	5
Ethene	EPA TO-15 Rev. 2 (1999)	5
Ethyl acetate	EPA TO-15 Rev. 2 (1999)	5
Ethylbenzene	EPA TO-15 Rev. 2 (1999)	5
Ethyl-t-butylether (ETBE)	EPA TO-15 Rev. 2 (1999)	5
Formaldehyde	EPA TO-15 Rev. 2 (1999)	5
Gasoline range organics (GRO)	EPA TO-15 Rev. 2 (1999)	5
Hexachlorobutadiene	EPA TO-15 Rev. 2 (1999)	5
Hexamethylcyclotrisiloxane (D3)	EPA TO-15 Rev. 2 (1999)	5
Hexamethyldisiloxane	EPA TO-15 Rev. 2 (1999)	5
Hexane	EPA TO-15 Rev. 2 (1999)	1
Isopropylbenzene	EPA TO-15 Rev. 2 (1999)	5
m+p-xylene	EPA TO-15 Rev. 2 (1999)	5
Methyl bromide (Bromomethane)	EPA TO-15 Rev. 2 (1999)	5
Methyl chloride (Chloromethane)	EPA TO-15 Rev. 2 (1999)	5
Methyl methacrylate	EPA TO-15 Rev. 2 (1999)	5
Methyl tert-butyl ether (MTBE)	EPA TO-15 Rev. 2 (1999)	5
Methylene chloride (Dichloromethane)	EPA TO-15 Rev. 2 (1999)	5
Naphthalene	EPA TO-15 Rev. 2 (1999)	5
n-Butane	EPA TO-15 Rev. 2 (1999)	5
n-Butylcyclohexane	EPA TO-15 Rev. 2 (1999)	5
n-Decane	EPA TO-15 Rev. 2 (1999)	5
n-Dodecane	EPA TO-15 Rev. 2 (1999)	5

Matrix/Analyte	**Method**	**Notes**
n-Heptane	EPA TO-15 Rev. 2 (1999)	5
n-Nonane	EPA TO-15 Rev. 2 (1999)	5
n-Octane	EPA TO-15 Rev. 2 (1999)	5
n-Propane	EPA TO-15 Rev. 2 (1999)	5
n-Undecane	EPA TO-15 Rev. 2 (1999)	5
Octamethylcyclotetrasiloxane (D4)	EPA TO-15 Rev. 2 (1999)	5
Octamethyltrisiloxane-L3 (MDM)	EPA TO-15 Rev. 2 (1999)	5
o-Xylene	EPA TO-15 Rev. 2 (1999)	5
Pentamethyldisiloxane	EPA TO-15 Rev. 2 (1999)	5
Styrene	EPA TO-15 Rev. 2 (1999)	5
Tetrachloroethylene (Perchloroethylene)	EPA TO-15 Rev. 2 (1999)	5
Tetrahydrofuran (THF)	EPA TO-15 Rev. 2 (1999)	5
Toluene	EPA TO-15 Rev. 2 (1999)	5
trans-1,2-Dichloroethylene	EPA TO-15 Rev. 2 (1999)	5
trans-1,3-Dichloropropylene	EPA TO-15 Rev. 2 (1999)	5
Trichloroethene (Trichloroethylene)	EPA TO-15 Rev. 2 (1999)	5
Trichlorofluoromethane (Freon 11)	EPA TO-15 Rev. 2 (1999)	5
Vinyl acetate	EPA TO-15 Rev. 2 (1999)	5
Vinyl chloride	EPA TO-15 Rev. 2 (1999)	5
Drinking Water		
Turbidity	EPA 180.1_2_1993	
Bromide	EPA 300.0_2.1_1993	
Chloride	EPA 300.0_2.1_1993	
Fluoride	EPA 300.0_2.1_1993	3
Nitrate	EPA 300.0_2.1_1993	
Nitrite	EPA 300.0_2.1_1993	
Orthophosphate	EPA 300.0_2.1_1993	
Sulfate	EPA 300.0_2.1_1993	
Solids, Total Dissolved	SM 2540 C-97	
Cyanide, Total	SM 4500-CN$^-$ E-99	
Total organic carbon	SM 5310 B-00	
Total Organic Carbon	SM 5310 C-00	
Aluminum	EPA 200.8_5.4_1994	
Antimony	EPA 200.8_5.4_1994	
Arsenic	EPA 200.8_5.4_1994	
Barium	EPA 200.8_5.4_1994	

Matrix/Analyte	Method	Notes
Beryllium	EPA 200.8_5.4_1994	
Cadmium	EPA 200.8_5.4_1994	
Chromium	EPA 200.8_5.4_1994	
Copper	EPA 200.8_5.4_1994	
Hardness, Total (as CaCO3)	EPA 200.8_5.4_1994	
Lead	EPA 200.8_5.4_1994	
Manganese	EPA 200.8_5.4_1994	
Mercury	EPA 200.8_5.4_1994	3
Nickel	EPA 200.8_5.4_1994	
Selenium	EPA 200.8_5.4_1994	
Silver	EPA 200.8_5.4_1994	
Thallium	EPA 200.8_5.4_1994	
Zinc	EPA 200.8_5.4_1994	
Mercury	EPA 245.1_3_1994	
Total Coli/Ecoli - count	EPA 1604 (MI Medium)	4
Total Coli/Ecoli - detect	EPA 1604 (MI Medium)	4
Fecal coliform-count	SM 9222 D (m-FC)-97	4
Non-Potable Water		
n-Hexane Extractable Material (O&G)	EPA 1664A_1_1999	
Turbidity	EPA 180.1_2_1993	
Bromide	EPA 300.0_2.1_1993	
Chloride	EPA 300.0_2.1_1993	
Fluoride	EPA 300.0_2.1_1993	
Nitrate	EPA 300.0_2.1_1993	
Nitrate + Nitrite	EPA 300.0_2.1_1993	
Nitrite	EPA 300.0_2.1_1993	
Orthophosphate	EPA 300.0_2.1_1993	
Sulfate	EPA 300.0_2.1_1993	
Phosphorus, total	EPA 365.3_1978	
Alkalinity	SM 2320 B-97	
Hardness (calc.)	SM 2340 B-97	
Specific Conductance	SM 2510 B-97	
Solids, Total	SM 2540 B-97	
Solids, Total Dissolved	SM 2540 C-97	
Solids, Total Suspended	SM 2540 D-97	

Matrix/Analyte	Method	Notes
Cyanide, Total	SM 4500-CN^{-} E-99	
Ammonia	SM 4500-NH3 D-97	
Sulfide	SM 4500-S2^{-} F-00	
Chemical Oxygen Demand (COD)	SM 5220 D-97	
Dissolved Organic Carbon	SM 5310 B-00	
Total Organic Carbon	SM 5310 B-00	
Total Organic Carbon	SM 5310 C-00	
Mercury	EPA 1631 E-02	3,5
Aluminum	EPA 200.8_5.4_1994	
Antimony	EPA 200.8_5.4_1994	
Arsenic	EPA 200.8_5.4_1994	
Barium	EPA 200.8_5.4_1994	
Beryllium	EPA 200.8_5.4_1994	
Boron	EPA 200.8_5.4_1994	
Cadmium	EPA 200.8_5.4_1994	
Calcium	EPA 200.8_5.4_1994	
Chromium	EPA 200.8_5.4_1994	
Cobalt	EPA 200.8_5.4_1994	
Copper	EPA 200.8_5.4_1994	
Iron	EPA 200.8_5.4_1994	
Lead	EPA 200.8_5.4_1994	
Magnesium	EPA 200.8_5.4_1994	
Manganese	EPA 200.8_5.4_1994	
Mercury	EPA 200.8_5.4_1994	
Molybdenum	EPA 200.8_5.4_1994	
Nickel	EPA 200.8_5.4_1994	
Potassium	EPA 200.8_5.4_1994	
Selenium	EPA 200.8_5.4_1994	
Silver	EPA 200.8_5.4_1994	
Sodium	EPA 200.8_5.4_1994	
Strontium	EPA 200.8_5.4_1994	
Thallium	EPA 200.8_5.4_1994	
Tin	EPA 200.8_5.4_1994	
Titanium	EPA 200.8_5.4_1994	
Vanadium	EPA 200.8_5.4_1994	
Zinc	EPA 200.8_5.4_1994	

Matrix/Analyte	Method	Notes
Mercury	EPA 245.1_3_1994	
Mercury	EPA 245.7_2005	3
Iron	SM 3500-Fe B-97	5
Aroclor-1016 (PCB-1016)	EPA 608	1,5
Aroclor-1221 (PCB-1221)	EPA 608	1,5
Aroclor-1232 (PCB-1232)	EPA 608	1,5
Aroclor-1242 (PCB-1242)	EPA 608	1,5
Aroclor-1248 (PCB-1248)	EPA 608	1,5
Aroclor-1254 (PCB-1254)	EPA 608	1,5
Aroclor-1260 (PCB-1260)	EPA 608	1,5
Aroclor-1262 (PCB-1262)	EPA 608	1,5
Aroclor-1268 (PCB-1268)	EPA 608	1,5
Ethane	EPA RSK-175	
Ethene	EPA RSK-175	
Methane	EPA RSK-175	
1,1,1,2-Tetrachloroethane	EPA 624	1,5
1,1,1-Trichloroethane	EPA 624	1,5
1,1,2,2-Tetrachloroethane	EPA 624	1,5
1,1,2-Trichloro-1,2,2-trifluoroethane (Freon 113)	EPA 624	1,5
1,1,2-Trichloroethane	EPA 624	1,5
1,1-Dichloroethane	EPA 624	1,5
1,1-Dichloroethylene	EPA 624	1,5
1,1-Dichloropropene	EPA 624	1,5
1,2,3-Trichlorobenzene	EPA 624	1,5
1,2,3-Trichloropropane	EPA 624	1,5
1,2,3-Trimethylbenzene	EPA 624	1,5
1,2,4-Trichlorobenzene	EPA 624	1,5
1,2-Dibromo-3-chloropropane (DBCP)	EPA 624	1,5
1,2-Dibromoethane (EDB, Ethylene dibromide)	EPA 624	1,5
1,2-Dichlorobenzene	EPA 624	1,5
1,2-Dichloroethane (Ethylene dichloride)	EPA 624	1,5
1,2-Dichloropropane	EPA 624	1,5
1,3,5-Trimethylbenzene	EPA 624	1,5
1,3-Dichlorobenzene	EPA 624	1,5
1,3-Dichloropropane	EPA 624	1,5
1,4-Dichlorobenzene	EPA 624	1,5

Matrix/Analyte	Method	Notes
1,4-Dioxane (1,4- Diethyleneoxide)	EPA 624	1,5
2,2-Dichloropropane	EPA 624	1,5
2-Butanone (Methyl ethyl ketone, MEK)	EPA 624	1,5
2-Chloroethyl vinyl ether	EPA 624	5
2-Chlorotoluene	EPA 624	1,5
2-Hexanone	EPA 624	1,5
2-Nitropropane	EPA 624	5
4-Chlorotoluene	EPA 624	1,5
4-Isopropyltoluene (p-Cymene)	EPA 624	1,5
4-Methyl-2-pentanone (MIBK)	EPA 624	1,5
Acetone	EPA 624	1,5
Acrylonitrile	EPA 624	5
Allyl chloride (3-Chloropropene)	EPA 624	1,5
Benzene	EPA 624	1,5
Bromobenzene	EPA 624	1,5
Bromochloromethane	EPA 624	1,5
Bromodichloromethane	EPA 624	1,5
Bromoethane (Ethyl Bromide)	EPA 624	5
Bromoform	EPA 624	1,5
Carbon disulfide	EPA 624	1,5
Carbon tetrachloride	EPA 624	1,5
Chlorobenzene	EPA 624	1,5
Chlorodibromomethane	EPA 624	1,5
Chloroethane (Ethyl chloride)	EPA 624	1,5
Chloroform	EPA 624	1,5
cis-1,2-Dichloroethylene	EPA 624	1,5
cis-1,3-Dichloropropene	EPA 624	1,5
Dibromomethane (Methylene bromide)	EPA 624	1,5
Dichlorodifluoromethane (Freon-12)	EPA 624	1,5
Diethyl ether	EPA 624	1,5
Ethyl acetate	EPA 624	1,5
Ethyl methacrylate	EPA 624	5
Ethylbenzene	EPA 624	1,5
Iodomethane (Methyl iodide)	EPA 624	1,5
Isopropylbenzene	EPA 624	1,5
m+p-xylene	EPA 624	1,5

Matrix/Analyte	Method	Notes
Methacrylonitrile	EPA 624	5
Methyl acrylate	EPA 624	5
Methyl bromide (Bromomethane)	EPA 624	1,5
Methyl chloride (Chloromethane)	EPA 624	1,5
Methyl methacrylate	EPA 624	5
Methyl tert-butyl ether (MTBE)	EPA 624	1,5
Methylene chloride (Dichloromethane)	EPA 624	1,5
n-Butylbenzene	EPA 624	1,5
n-Hexane	EPA 624	1,5
Nitrobenzene	EPA 624	1,5
n-Propylbenzene	EPA 624	1,5
o-Xylene	EPA 624	1,5
sec-Butylbenzene	EPA 624	1,5
Styrene	EPA 624	1,5
tert-amylmethylether (TAME)	EPA 624	5
tert-Butylbenzene	EPA 624	1,5
Tetrachloroethylene (Perchloroethylene)	EPA 624	1,5
Tetrahydrofuran (THF)	EPA 624	1,5
Toluene	EPA 624	1,5
trans-1,2-Dichloroethylene	EPA 624	1,5
trans-1,3-Dichloropropylene	EPA 624	1,5
trans-1,4-Dichloro-2-butene	EPA 624	1,5
Trichloroethene (Trichloroethylene)	EPA 624	1,5
Trichlorofluoromethane (Freon 11)	EPA 624	1,5
Vinyl acetate	EPA 624	1,5
Vinyl chloride	EPA 624	1,5
1,2,4-Trichlorobenzene	EPA 625	1,5
1,2-Dichlorobenzene	EPA 625	1,5
1,2-Dinitrobenzene	EPA 625	5
1,3-Dichlorobenzene	EPA 625	1,5
1,3-Dinitrobenzene (1,3-DNB)	EPA 625	5
1,4-Dichlorobenzene	EPA 625	1,5
1,4-Dinitrobenzene	EPA 625	5
1-Methylnaphthalene	EPA 625	1,5
2,3,4,6-Tetrachlorophenol	EPA 625	5
2,3,5,6-Tetrachlorophenol	EPA 625	5

Matrix/Analyte	Method	Notes
2,4,5-Trichlorophenol	EPA 625	1,5
2,4,6-Trichlorophenol	EPA 625	1,5
2,4-Dichlorophenol	EPA 625	1,5
2,4-Dimethylphenol	EPA 625	1,5
2,4-Dinitrophenol	EPA 625	5
2,4-Dinitrotoluene (2,4-DNT)	EPA 625	1,5
2,6-Dinitrotoluene (2,6-DNT)	EPA 625	1,5
2-Chloronaphthalene	EPA 625	1,5
2-Methylphenol (o-Cresol)	EPA 625	1,5
2-Nitroaniline	EPA 625	1,5
2-Nitrophenol	EPA 625	1,5
3-Methylphenol (m-Cresol)	EPA 625	1,5
3-Nitroaniline	EPA 625	5
4-Bromophenyl phenyl ether (BDE-3)	EPA 625	1,5
4-Chloro-3-methylphenol	EPA 625	1,5
4-Chloroaniline	EPA 625	1,5
4-Chlorophenyl phenylether	EPA 625	1,5
4-Methylphenol (p-Cresol)	EPA 625	1,5
4-Nitroaniline	EPA 625	5
4-Nitrophenol	EPA 625	1,5
Acenaphthene	EPA 625	1,5
Acenaphthylene	EPA 625	1,5
Aniline	EPA 625	5
Anthracene	EPA 625	1,5
Azobenzene	EPA 625	5
Benzo(a)anthracene	EPA 625	1,5
Benzo(a)pyrene	EPA 625	1,5
Benzo(g,h,i)perylene	EPA 625	1,5
Benzo(k)fluoranthene	EPA 625	1,5
Benzo[b]fluoranthene	EPA 625	1,5
Benzoic acid	EPA 625	5
Benzyl alcohol	EPA 625	1,5
bis(2-Chloroethoxy)methane	EPA 625	1,5
bis(2-Chloroethyl) ether	EPA 625	1,5
bis(2-Chloroisopropyl) ether	EPA 625	1,5
Butyl benzyl phthalate	EPA 625	1,5

Matrix/Analyte	Method	Notes
Carbazole	EPA 625	1,5
Chrysene	EPA 625	1,5
Di(2-ethylhexyl)adipate	EPA 625	1
Dibenz(a,h) anthracene	EPA 625	1,5
Dibenzofuran	EPA 625	1,5
Diethyl phthalate	EPA 625	1,5
Dimethyl phthalate	EPA 625	1,5
Di-n-butyl phthalate	EPA 625	1,5
Di-n-octyl phthalate	EPA 625	1,5
Diphenylamine	EPA 625	1,5
Fluoranthene	EPA 625	1,5
Fluorene	EPA 625	1,5
Hexachlorobenzene	EPA 625	1,5
Hexachlorobutadiene	EPA 625	1,5
Hexachlorocyclopentadiene	EPA 625	1,5
Hexachloroethane	EPA 625	1,5
Indeno(1,2,3-cd) pyrene	EPA 625	1,5
Isophorone	EPA 625	1,5
Naphthalene	EPA 625	1,5
Nitrobenzene	EPA 625	1,5
N-Nitrosodiethylamine	EPA 625	5
N-Nitrosodimethylamine	EPA 625	5
N-Nitroso-di-n-propylamine	EPA 625	1
N-Nitrosodiphenylamine	EPA 625	5
Pentachlorophenol	EPA 625	1,5
Phenanthrene	EPA 625	1,5
Phenol	EPA 625	1,5
Pyrene	EPA 625	1,5
Pyridine	EPA 625	5
Total Coli/Ecoli - count	EPA 1604 (MI Medium)	2,4
Fecal coliform-count	SM 9222 D (m-FC)-97	4
Solid and Chemical Materials		
Chromium, Hexavalent	EPA 7196A_1_1992	
pH	EPA 9045C_3_1995	
Total Organic Carbon	EPA 9060A_1_2004	
Cation Exchange Capacity	EPA 9081	6

Matrix/Analyte	Method	Notes
Aluminum	EPA 6020A_(2/07)	
Antimony	EPA 6020A_(2/07)	
Arsenic	EPA 6020A_(2/07)	
Barium	EPA 6020A_(2/07)	
Beryllium	EPA 6020A_(2/07)	
Boron	EPA 6020A_(2/07)	
Cadmium	EPA 6020A_(2/07)	
Calcium	EPA 6020A_(2/07)	
Chromium	EPA 6020A_(2/07)	
Cobalt	EPA 6020A_(2/07)	
Copper	EPA 6020A_(2/07)	
Iron	EPA 6020A_(2/07)	
Lead	EPA 6020A_(2/07)	
Magnesium	EPA 6020A_(2/07)	
Manganese	EPA 6020A_(2/07)	
Mercury	EPA 6020A_(2/07)	
Molybdenum	EPA 6020A_(2/07)	
Nickel	EPA 6020A_(2/07)	
Potassium	EPA 6020A_(2/07)	
Selenium	EPA 6020A_(2/07)	
Silver	EPA 6020A_(2/07)	
Sodium	EPA 6020A_(2/07)	
Strontium	EPA 6020A_(2/07)	
Thallium	EPA 6020A_(2/07)	
Tin	EPA 6020A_(2/07)	
Titanium	EPA 6020A_(2/07)	
Vanadium	EPA 6020A_(2/07)	
Zinc	EPA 6020A_(2/07)	
Mercury, Liquid Waste	EPA 7470A_1_1994	
Mercury, Solid Waste	EPA 7471B_(1/98)	
1,2-Dibromoethane (EDB, Ethylene dibromide)	EPA 8011-94	1,5
Dibromochloropropane	EPA 8011-94	1,5
Ethylene glycol	EPA 8015B_2_1996	
Propylene glycol	EPA 8015B_2_1996	
Benzene	EPA 8021B_2_(12/96)	
Ethylbenzene	EPA 8021B_2_(12/96)	

Matrix/Analyte	Method	Notes
m+p-xylene	EPA 8021B_2_(12/96)	
o-Xylene	EPA 8021B_2_(12/96)	
Toluene	EPA 8021B_2_(12/96)	
Xylene (total)	EPA 8021B_2_(12/96)	
4,4'-DDD	EPA 8081B_(2/07)	
4,4'-DDE	EPA 8081B_(2/07)	
4,4'-DDT	EPA 8081B_(2/07)	
Aldrin	EPA 8081B_(2/07)	
alpha-BHC (alpha-Hexachlorocyclohexane)	EPA 8081B_(2/07)	
alpha-Chlordane	EPA 8081B_(2/07)	
beta-BHC (beta-Hexachlorocyclohexane)	EPA 8081B_(2/07)	
Chlordane (tech.)	EPA 8081B_(2/07)	
delta-BHC	EPA 8081B_(2/07)	
Dieldrin	EPA 8081B_(2/07)	
Endosulfan I	EPA 8081B_(2/07)	
Endosulfan II	EPA 8081B_(2/07)	
Endosulfan sulfate	EPA 8081B_(2/07)	
Endrin	EPA 8081B_(2/07)	
Endrin aldehyde	EPA 8081B_(2/07)	
Endrin ketone	EPA 8081B_(2/07)	
gamma-BHC (Lindane, gamma-Hexachlorocyclohexane)	EPA 8081B_(2/07)	
gamma-Chlordane	EPA 8081B_(2/07)	
Heptachlor	EPA 8081B_(2/07)	
Heptachlor epoxide	EPA 8081B_(2/07)	
Methoxychlor	EPA 8081B_(2/07)	
Aroclor-1016 (PCB-1016)	EPA 8082A_(2/07)	
Aroclor-1221 (PCB-1221)	EPA 8082A_(2/07)	
Aroclor-1232 (PCB-1232)	EPA 8082A_(2/07)	
Aroclor-1242 (PCB-1242)	EPA 8082A_(2/07)	
Aroclor-1248 (PCB-1248)	EPA 8082A_(2/07)	
Aroclor-1254 (PCB-1254)	EPA 8082A_(2/07)	
Aroclor-1260 (PCB-1260)	EPA 8082A_(2/07)	
2,4,5-T	EPA 8151A_(1/98)	
2,4-D	EPA 8151A_(1/98)	
2,4-DB	EPA 8151A_(1/98)	
Dalapon	EPA 8151A_(1/98)	

Matrix/Analyte	Method	Notes
Dicamba	EPA 8151A_(1/98)	
Dichloroprop (Dichlorprop)	EPA 8151A_(1/98)	
Dinoseb (2-sec-butyl-4,6-dinitrophenol, DNBP)	EPA 8151A_(1/98)	
MCPA	EPA 8151A_(1/98)	
MCPP	EPA 8151A_(1/98)	
Silvex (2,4,5-TP)	EPA 8151A_(1/98)	
C8-C10 Aliphatic EPH	WDOE EPH_(1997)	
C8-C10 Aromatic EPH	WDOE EPH_(1997)	
>C10-C12 Aliphatic EPH	WDOE EPH_(1997)	
>C10-C12 Aromatic EPH	WDOE EPH_(1997)	
>C12-C16 Aliphatic EPH	WDOE EPH_(1997)	
>C12-C16 Aromatic EPH	WDOE EPH_(1997)	
>C16-C21 Aliphatic EPH	WDOE EPH_(1997)	
>C16-C21 Aromatic EPH	WDOE EPH_(1997)	
>C21-C34 Alpihatic EPH	WDOE EPH_(1997)	
>C21-C34 Aromatic EPH	WDOE EPH_(1997)	
Diesel range organics (DRO)	WDOE NWTPH-Dx_(1997)	
Gasoline range organics (GRO)	WDOE NWTPH-Gx_(1997)	
C8-C10 Aromatic VPH	WDOE VPH_(1997)	
C5-C6 Aliphatic VPH	WDOE VPH_(1997)	
>C10-C12 Aliphatic VPH	WDOE VPH_(1997)	
>C10-C12 Aromatic VPH	WDOE VPH_(1997)	
>C12-C13 Aromatic VPH	WDOE VPH_(1997)	
>C6-C8 Aliphatic VPH	WDOE VPH_(1997)	
>C8-C10 Aliphatic VPH	WDOE VPH_(1997)	
1,1,1,2-Tetrachloroethane	EPA 8260C_(8/06)	
1,1,1-Trichloroethane	EPA 8260C_(8/06)	
1,1,2,2-Tetrachloroethane	EPA 8260C_(8/06)	
1,1,2-Trichloroethane	EPA 8260C_(8/06)	
1,1-Dichloroethane	EPA 8260C_(8/06)	
1,1-Dichloroethylene	EPA 8260C_(8/06)	
1,1-Dichloropropene	EPA 8260C_(8/06)	
1,2,3-Trichlorobenzene	EPA 8260C_(8/06)	
1,2,3-Trichloropropane	EPA 8260C_(8/06)	
1,2,4-Trichlorobenzene	EPA 8260C_(8/06)	

Matrix/Analyte	Method	Notes
1,2,4-Trimethylbenzene	EPA 8260C_(8/06)	
1,2-Dibromo-3-chloropropane (DBCP)	EPA 8260C_(8/06)	
1,2-Dibromoethane (EDB, Ethylene dibromide)	EPA 8260C_(8/06)	
1,2-Dichlorobenzene	EPA 8260C_(8/06)	
1,2-Dichloroethane (Ethylene dichloride)	EPA 8260C_(8/06)	
1,2-Dichloropropane	EPA 8260C_(8/06)	
1,3,5-Trimethylbenzene	EPA 8260C_(8/06)	
1,3-Dichlorobenzene	EPA 8260C_(8/06)	
1,3-Dichloropropane	EPA 8260C_(8/06)	
1,4-Dichlorobenzene	EPA 8260C_(8/06)	
2,2-Dichloropropane	EPA 8260C_(8/06)	
2-Chlorotoluene	EPA 8260C_(8/06)	
4-Chlorotoluene	EPA 8260C_(8/06)	
4-Isopropyltoluene (p-Cymene)	EPA 8260C_(8/06)	
Benzene	EPA 8260C_(8/06)	
Bromobenzene	EPA 8260C_(8/06)	
Bromochloromethane	EPA 8260C_(8/06)	
Bromodichloromethane	EPA 8260C_(8/06)	
Bromoform	EPA 8260C_(8/06)	
Carbon tetrachloride	EPA 8260C_(8/06)	
Chlorobenzene	EPA 8260C_(8/06)	
Chlorodibromomethane	EPA 8260C_(8/06)	
Chloroethane (Ethyl chloride)	EPA 8260C_(8/06)	
Chloroform	EPA 8260C_(8/06)	
cis-1,2-Dichloroethylene	EPA 8260C_(8/06)	
cis-1,3-Dichloropropene	EPA 8260C_(8/06)	
Dibromomethane	EPA 8260C_(8/06)	
Dichlorofluoromethane (Freon 21)	EPA 8260C_(8/06)	
Ethylbenzene	EPA 8260C_(8/06)	
Hexachlorobutadiene	EPA 8260C_(8/06)	
Isopropylbenzene	EPA 8260C_(8/06)	
Methyl bromide (Bromomethane)	EPA 8260C_(8/06)	
Methyl chloride (Chloromethane)	EPA 8260C_(8/06)	
Methylene chloride (Dichloromethane)	EPA 8260C_(8/06)	
Naphthalene	EPA 8260C_(8/06)	
n-Butylbenzene	EPA 8260C_(8/06)	

Matrix/Analyte	Method	Notes
n-Propylbenzene	EPA 8260C_(8/06)	
sec-Butylbenzene	EPA 8260C_(8/06)	
Styrene	EPA 8260C_(8/06)	
tert-Butylbenzene	EPA 8260C_(8/06)	
Tetrachloroethylene (Perchloroethylene)	EPA 8260C_(8/06)	
Toluene	EPA 8260C_(8/06)	
trans-1,2-Dichloroethylene	EPA 8260C_(8/06)	
trans-1,3-Dichloropropylene	EPA 8260C_(8/06)	
Trichloroethene (Trichloroethylene)	EPA 8260C_(8/06)	
Trichlorofluoromethane (Freon 11)	EPA 8260C_(8/06)	
Vinyl chloride	EPA 8260C_(8/06)	
Xylene (total)	EPA 8260C_(8/06)	
1,2,4,5-Tetrachlorobenzene	EPA 8270D_(2/07)	
1,2,4-Trichlorobenzene	EPA 8270D_(2/07)	
1,2-Dibromo-3-chloropropane (DBCP)	EPA 8270D_(2/07)	
1,2-Dichlorobenzene	EPA 8270D_(2/07)	
1,2-Dinitrobenzene	EPA 8270D_(2/07)	
1,2-Diphenylhydrazine	EPA 8270D_(2/07)	
1,3,5-Trinitrobenzene (1,3,5-TNB)	EPA 8270D_(2/07)	
1,3-Dichlorobenzene	EPA 8270D_(2/07)	
1,3-Dinitrobenzene (1,3-DNB)	EPA 8270D_(2/07)	
1,4-Dichlorobenzene	EPA 8270D_(2/07)	
1,4-Dinitrobenzene	EPA 8270D_(2/07)	
1-Chloronaphthalene	EPA 8270D_(2/07)	
1-Naphthylamine	EPA 8270D_(2/07)	
2,3,4,6-Tetrachlorophenol	EPA 8270D_(2/07)	
2,4,5-Trichlorophenol	EPA 8270D_(2/07)	
2,4,5-Trimethylaniline	EPA 8270D_(2/07)	
2,4,6-Trichlorophenol	EPA 8270D_(2/07)	
2,4-Diaminotoluene	EPA 8270D_(2/07)	
2,4-Dichlorophenol	EPA 8270D_(2/07)	
2,4-Dimethylphenol	EPA 8270D_(2/07)	
2,4-Dinitrophenol	EPA 8270D_(2/07)	
2,4-Dinitrotoluene (2,4-DNT)	EPA 8270D_(2/07)	
2,6-Dichlorophenol	EPA 8270D_(2/07)	
2,6-Dinitrotoluene (2,6-DNT)	EPA 8270D_(2/07)	

Matrix/Analyte	Method	Notes
2-Aminoanthraquinone	EPA 8270D_(2/07)	
2-Chloronaphthalene	EPA 8270D_(2/07)	
2-Chlorophenol	EPA 8270D_(2/07)	
2-Cyclohexyl-4,6-dinitrophenol	EPA 8270D_(2/07)	
2-Methylnaphthalene	EPA 8270D_(2/07)	
2-Methylphenol (o-Cresol)	EPA 8270D_(2/07)	
2-Naphthylamine	EPA 8270D_(2/07)	
2-Nitroaniline	EPA 8270D_(2/07)	
2-Nitrophenol	EPA 8270D_(2/07)	
3-(Chloromethyl) pyridine hydrochloride	EPA 8270D_(2/07)	
3,3'-Dichlorobenzidine	EPA 8270D_(2/07)	
3-Methylcholanthrene	EPA 8270D_(2/07)	
3-Methylphenol (m-Cresol)	EPA 8270D_(2/07)	
3-Nitroaniline	EPA 8270D_(2/07)	
4,4'-DDD	EPA 8270D_(2/07)	
4,4'-DDE	EPA 8270D_(2/07)	
4,4'-DDT	EPA 8270D_(2/07)	
4,4'-Methylenebis(2-chloroaniline)	EPA 8270D_(2/07)	
4,6-Dinitro-2-methylphenol	EPA 8270D_(2/07)	
4-Bromophenyl phenyl ether (BDE-3)	EPA 8270D_(2/07)	
4-Chloro-1,2-phenylenediamine	EPA 8270D_(2/07)	
4-Chloro-1,3-phenylenediamine	EPA 8270D_(2/07)	
4-Chloro-3-methylphenol	EPA 8270D_(2/07)	
4-Chloroaniline	EPA 8270D_(2/07)	
4-Chlorophenol	EPA 8270D_(2/07)	
4-Chlorophenyl phenylether	EPA 8270D_(2/07)	
4-Dimethyl aminoazobenzene	EPA 8270D_(2/07)	
4-Methylphenol (p-Cresol)	EPA 8270D_(2/07)	
4-Nitroaniline	EPA 8270D_(2/07)	
4-Nitrobiphenyl	EPA 8270D_(2/07)	
4-Nitrophenol	EPA 8270D_(2/07)	
5-Chloro-2-methylaniline	EPA 8270D_(2/07)	
a,a-Dimethylphenethylamine	EPA 8270D_(2/07)	
Acenaphthene	EPA 8270D_(2/07)	
Acenaphthylene	EPA 8270D_(2/07)	
Acetophenone	EPA 8270D_(2/07)	

Matrix/Analyte	Method	Notes
Aldrin	EPA 8270D_(2/07)	
alpha-BHC (alpha-Hexachlorocyclohexane)	EPA 8270D_(2/07)	
Aminoazobenzene	EPA 8270D_(2/07)	
Anilazine	EPA 8270D_(2/07)	
Aniline	EPA 8270D_(2/07)	
Anthracene	EPA 8270D_(2/07)	
Aramite	EPA 8270D_(2/07)	
Atrazine	EPA 8270D_(2/07)	
Azinphos-methyl (Guthion)	EPA 8270D_(2/07)	
Barban	EPA 8270D_(2/07)	
Benzidine	EPA 8270D_(2/07)	
Benzo(a)anthracene	EPA 8270D_(2/07)	
Benzo(a)pyrene	EPA 8270D_(2/07)	
Benzo(g,h,i)perylene	EPA 8270D_(2/07)	
Benzo(k)fluoranthene	EPA 8270D_(2/07)	
Benzo[b]fluoranthene	EPA 8270D_(2/07)	
Benzoic acid	EPA 8270D_(2/07)	
Benzyl alcohol	EPA 8270D_(2/07)	
beta-BHC (beta-Hexachlorocyclohexane)	EPA 8270D_(2/07)	
Biphenyl	EPA 8270D_(2/07)	
bis(2-Chloroethoxy)methane	EPA 8270D_(2/07)	
bis(2-Chloroethyl) ether	EPA 8270D_(2/07)	
bis(2-Chloroisopropyl) ether	EPA 8270D_(2/07)	
Bromoxynil octanate	EPA 8270D_(2/07)	
Butyl benzyl phthalate	EPA 8270D_(2/07)	
Captafol	EPA 8270D_(2/07)	
Captan	EPA 8270D_(2/07)	
Carbaryl (Sevin)	EPA 8270D_(2/07)	
Carbazole	EPA 8270D_(2/07)	
Carbofuran (Furaden)	EPA 8270D_(2/07)	
Carbophenothion	EPA 8270D_(2/07)	
Chlordane (tech.)	EPA 8270D_(2/07)	
Chlorfenvinphos	EPA 8270D_(2/07)	
Chlorpyrifos	EPA 8270D_(2/07)	
Chrysene	EPA 8270D_(2/07)	
Coumaphos	EPA 8270D_(2/07)	

Matrix/Analyte	Method	Notes
Crotoxyphos	EPA 8270D_(2/07)	
delta-BHC	EPA 8270D_(2/07)	
Demeton	EPA 8270D_(2/07)	
Demeton-o	EPA 8270D_(2/07)	
Demeton-s	EPA 8270D_(2/07)	
Di(2-ethylhexyl)adipate	EPA 8270D_(2/07)	
Di(2-ethylhexyl)phthalate	EPA 8270D_(2/07)	
Diallate	EPA 8270D_(2/07)	
Dibenz(a,h) acridine	EPA 8270D_(2/07)	
Dibenz(a,h) anthracene	EPA 8270D_(2/07)	
Dibenz(a,j) acridine	EPA 8270D_(2/07)	
Dibenzo(a,e) pyrene	EPA 8270D_(2/07)	
Dibenzofuran	EPA 8270D_(2/07)	
Dibenzothiophene	EPA 8270D_(2/07)	
Dichlorovos (DDVP, Dichlorvos)	EPA 8270D_(2/07)	
Dicrotophos	EPA 8270D_(2/07)	
Dieldrin	EPA 8270D_(2/07)	
Diethyl phthalate	EPA 8270D_(2/07)	
Diethyl sulfate	EPA 8270D_(2/07)	
Dimethoate	EPA 8270D_(2/07)	
Dimethyl phthalate	EPA 8270D_(2/07)	
Di-n-butyl phthalate	EPA 8270D_(2/07)	
Dinocap	EPA 8270D_(2/07)	
Di-n-octyl phthalate	EPA 8270D_(2/07)	
Dinoseb (2-sec-butyl-4,6-dinitrophenol, DNBP)	EPA 8270D_(2/07)	
Diphenylamine	EPA 8270D_(2/07)	
Disulfoton	EPA 8270D_(2/07)	
Endosulfan I	EPA 8270D_(2/07)	
Endosulfan II	EPA 8270D_(2/07)	
Endosulfan sulfate	EPA 8270D_(2/07)	
Endrin	EPA 8270D_(2/07)	
Endrin aldehyde	EPA 8270D_(2/07)	
Endrin ketone	EPA 8270D_(2/07)	
EPN	EPA 8270D_(2/07)	
Ethion	EPA 8270D_(2/07)	
Ethyl carbamate (Urethane)	EPA 8270D_(2/07)	

Matrix/Analyte	Method	Notes
Ethyl methanesulfonate	EPA 8270D_(2/07)	
Famphur	EPA 8270D_(2/07)	
Fensulfothion	EPA 8270D_(2/07)	
Fenthion	EPA 8270D_(2/07)	
Fluchloralin	EPA 8270D_(2/07)	
Fluoranthene	EPA 8270D_(2/07)	
Fluorene	EPA 8270D_(2/07)	
gamma-BHC (Lindane, gamma-Hexachlorocyclohexane)	EPA 8270D_(2/07)	
Heptachlor	EPA 8270D_(2/07)	
Heptachlor epoxide	EPA 8270D_(2/07)	
Hexachlorobenzene	EPA 8270D_(2/07)	
Hexachlorobutadiene	EPA 8270D_(2/07)	
Hexachlorocyclopentadiene	EPA 8270D_(2/07)	
Hexachloroethane	EPA 8270D_(2/07)	
Hexachlorophene	EPA 8270D_(2/07)	
Hexachloropropene	EPA 8270D_(2/07)	
Hexamethylphosphoramide (HMPA)	EPA 8270D_(2/07)	
Hydroquinone	EPA 8270D_(2/07)	
Indeno(1,2,3-cd) pyrene	EPA 8270D_(2/07)	
Isodrin	EPA 8270D_(2/07)	
Isophorone	EPA 8270D_(2/07)	
Malathion	EPA 8270D_(2/07)	
Maleic anhydride	EPA 8270D_(2/07)	
Methoxychlor	EPA 8270D_(2/07)	
Methyl parathion (Parathion, methyl)	EPA 8270D_(2/07)	
Mevinphos	EPA 8270D_(2/07)	
Mirex	EPA 8270D_(2/07)	
Monocrotophos	EPA 8270D_(2/07)	
Naled	EPA 8270D_(2/07)	
Naphthalene	EPA 8270D_(2/07)	
n-Hexadecane	EPA 8270D_(2/07)	
Nicotine	EPA 8270D_(2/07)	
Nitrobenzene	EPA 8270D_(2/07)	
Nitroquinoline-1-oxide	EPA 8270D_(2/07)	
n-Nitrosodiethylamine	EPA 8270D_(2/07)	
n-Nitrosodimethylamine	EPA 8270D_(2/07)	

Matrix/Analyte	Method	Notes
n-Nitroso-di-n-butylamine	EPA 8270D_(2/07)	
N-Nitroso-di-n-propylamine	EPA 8270D_(2/07)	
n-Nitrosodiphenylamine	EPA 8270D_(2/07)	
n-Nitrosomethylethalamine	EPA 8270D_(2/07)	
n-Nitrosomorpholine	EPA 8270D_(2/07)	
n-Nitrosopiperidine	EPA 8270D_(2/07)	
n-Nitrosopyrrolidine	EPA 8270D_(2/07)	
n-Tetradecane	EPA 8270D_(2/07)	
o,o,o-Triethyl phosphorothioate	EPA 8270D_(2/07)	
Octamethyl pyrophosphoramide	EPA 8270D_(2/07)	
Parathion	EPA 8270D_(2/07)	
p-Benzoquinone	EPA 8270D_(2/07)	
p-Cresidine	EPA 8270D_(2/07)	
Pentachlorobenzene	EPA 8270D_(2/07)	
Pentachloronitrobenzene	EPA 8270D_(2/07)	
Pentachlorophenol	EPA 8270D_(2/07)	
Phenacetin	EPA 8270D_(2/07)	
Phenanthrene	EPA 8270D_(2/07)	
Phenobarbital	EPA 8270D_(2/07)	
Phenol	EPA 8270D_(2/07)	
Phorate	EPA 8270D_(2/07)	
Pyrene	EPA 8270D_(2/07)	
Pyridine	EPA 8270D_(2/07)	
Resorcinol	EPA 8270D_(2/07)	
Safrole	EPA 8270D_(2/07)	
Strychnine	EPA 8270D_(2/07)	
Sulfallate	EPA 8270D_(2/07)	
Terbufos	EPA 8270D_(2/07)	
Tetrachlorvinphos (Stirophos, Gardona)	EPA 8270D_(2/07)	
Tetraethyl dithiopyrophosphate	EPA 8270D_(2/07)	
Tetraethyl pyrophosphate (TEPP)	EPA 8270D_(2/07)	
Thionazin (Zinophos)	EPA 8270D_(2/07)	
Thiophenol (Benzenethiol)	EPA 8270D_(2/07)	
Toxaphene (Chlorinated camphene)	EPA 8270D_(2/07)	
Trifluralin (Treflan)	EPA 8270D_(2/07)	
Trimethyl phosphate	EPA 8270D_(2/07)	

Matrix/Analyte	Method	Notes
1-Methylnaphthalene	EPA 8270D_(2/07) SIM	
2-Methylnaphthalene	EPA 8270D_(2/07) SIM	
Acenaphthene	EPA 8270D_(2/07) SIM	
Acenaphthylene	EPA 8270D_(2/07) SIM	
Anthracene	EPA 8270D_(2/07) SIM	
Azinphos-methyl (Guthion)	EPA 8270D_(2/07) SIM	
Benzo(a)anthracene	EPA 8270D_(2/07) SIM	
Benzo(a)pyrene	EPA 8270D_(2/07) SIM	
Benzo(g,h,i)perylene	EPA 8270D_(2/07) SIM	
Benzo(k)fluoranthene	EPA 8270D_(2/07) SIM	
Benzo[b]fluoranthene	EPA 8270D_(2/07) SIM	
Bolstar (Sulprofos)	EPA 8270D_(2/07) SIM	
Chlorpyrifos	EPA 8270D_(2/07) SIM	
Chrysene	EPA 8270D_(2/07) SIM	
Coumaphos	EPA 8270D_(2/07) SIM	
Demeton	EPA 8270D_(2/07) SIM	
Diazinon	EPA 8270D_(2/07) SIM	
Dibenz(a,h) anthracene	EPA 8270D_(2/07) SIM	
Dichlorvos	EPA 8270D_(2/07) SIM	
Dimethoate	EPA 8270D_(2/07) SIM	
Disulfoton	EPA 8270D_(2/07) SIM	
EPN	EPA 8270D_(2/07) SIM	
Ethoprop	EPA 8270D_(2/07) SIM	
Fensulfothion	EPA 8270D_(2/07) SIM	
Fenthion	EPA 8270D_(2/07) SIM	
Fluoranthene	EPA 8270D_(2/07) SIM	
Fluorene	EPA 8270D_(2/07) SIM	
Indeno(1,2,3-cd) pyrene	EPA 8270D_(2/07) SIM	
Malathion	EPA 8270D_(2/07) SIM	
Merphos	EPA 8270D_(2/07) SIM	
Methyl parathion (Parathion, methyl)	EPA 8270D_(2/07) SIM	
Mevinphos	EPA 8270D_(2/07) SIM	
Monocrotophos	EPA 8270D_(2/07) SIM	
Naled	EPA 8270D_(2/07) SIM	
Naphthalene	EPA 8270D_(2/07) SIM	
Parathion, ethyl	EPA 8270D_(2/07) SIM	

Matrix/Analyte	Method	Notes
Pentachlorophenol	EPA 8270D_(2/07) SIM	
Phenanthrene	EPA 8270D_(2/07) SIM	
Phorate	EPA 8270D_(2/07) SIM	
Pyrene	EPA 8270D_(2/07) SIM	
Ronnel	EPA 8270D_(2/07) SIM	
Sulfotepp	EPA 8270D_(2/07) SIM	
Tetrachlorvinphos (Stirophos, Gardona)	EPA 8270D_(2/07) SIM	
Tetraethyl pyrophosphate (TEPP)	EPA 8270D_(2/07) SIM	
Tokuthion (Prothiophos)	EPA 8270D_(2/07) SIM	
Trichloronate	EPA 8270D_(2/07) SIM	
Particle Size Distribution	ASTM D 422	
Ignitability	ASTM D93-02	
Ignitability	EPA 1010A - 2004	

Accredited Parameter Note Detail

(1) Accreditation based in part on recognition of Laboratory Accreditation Bureau DoD accreditation. (2) Method is not approved for NPDES testing under 40 CFR 136.3.(3) Provisional accreditation pending submittal of acceptable Proficiency Testing (PT) results (WAC 173-50-110).(4) Provisional accreditation pending submittal of acceptable corrective action report.(5) Accreditation based in part on recognition of Oregon NELAP accreditation. (6) Interim accreditation pending the successful completion of an on-site audit to verify method capabilities (WAC 173-50-100).

08/05/2016

Authentication Signature
Alan D. Rue, Lab Accreditation Unit Supervisor

Date

OREGON

Environmental Laboratory Accreditation Program

ORELAP Fields of Accreditation

ORELAP ID: WA100009

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3600 Fremont Ave. N
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EPA CODE: WA01224

Certificate: WA100009 - 010

Issue Date: 5/10/2017 Expiration Date: 5/9/2018

As of 5/10/2017 this list supersedes all previous lists for this certificate number.

MATRIX	Reference	Code	Analyte	Code	Description
Air					
	EPA TO-15			10248803	VOCs collected in Canisters by GC/MS
		5160	1,1,1-Trichloroethane		
		5110	1,1,2,2-Tetrachloroethane		
		5195	1,1,2-Trichloro-1,2,2-trifluoroethane (Freon 113)		
		5165	1,1,2-Trichloroethane		
		4630	1,1-Dichloroethane		
		4640	1,1-Dichloroethylene		
		5182	1,2,3-Trimethylbenzene		
		5155	1,2,4-Trichlorobenzene		
		5210	1,2,4-Trimethylbenzene		
		4585	1,2-Dibromoethane (EDB, Ethylene dibromide)		
		4695	1,2-Dichloro-1,1,2,2-tetrafluoroethane (Freon-114)		
		4610	1,2-Dichlorobenzene		
		4635	1,2-Dichloroethane (Ethylene dichloride)		
		4655	1,2-Dichloropropane		
		5215	1,3,5-Trimethylbenzene		
		9318	1,3-Butadiene		
		4615	1,3-Dichlorobenzene		
		4620	1,4-Dichlorobenzene		
		4735	1,4-Dioxane (1,4- Diethyleneoxide)		
		4836	1-Propene (Propylene)		
		4687	2,3-Dimethylheptane		
		4671	2,3-Dimethylpentane		
		4410	2-Butanone (Methyl ethyl ketone, MEK)		
		4860	2-Hexanone (MBK)		
		4938	2-Methylbutane (Isopentane)		
		4531	3-Ethyltoluene (1-Methyl-3-ethylbenzene)		
		4542	4-Ethyltoluene		
		4910	4-Isopropyltoluene (p-Cymene)		
		4995	4-Methyl-2-pentanone (MIBK)		
		4315	Acetone		
		4325	Acrolein (Propenal)		
		3792	APH Aliphatics C5-C8		
		3793	APH Aliphatics C9-C12		
		3794	APH Aromatics C9-C10		
		4375	Benzene		
		5635	Benzyl chloride		

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Environmental Laboratory Accreditation Program

ORELAP Fields of Accreditation

ORELAP ID: WA100009

Fremont Analytical, Inc.
3600 Fremont Ave. N
Seattle, WA 98103

EPA CODE: WA01224

Certificate: WA100009 - 010

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Air	EPA TO-15	4390	Bromochloromethane
		4395	Bromodichloromethane
		4400	Bromoform
		4450	Carbon disulfide
		4455	Carbon tetrachloride
		4475	Chlorobenzene
		4575	Chlorodibromomethane
		4485	Chloroethane (Ethyl chloride)
		4505	Chloroform
		4645	cis-1,2-Dichloroethylene
		4680	cis-1,3-Dichloropropene
		4555	Cyclohexane
		4625	Dichlorodifluoromethane (Freon-12)
		4747	Ethane
		4750	Ethanol
		4752	Ethene
		4755	Ethyl acetate
		4765	Ethylbenzene
		4770	Ethyl-t-butylether (ETBE) (2-Ethoxy-2-methylpropane)
		4815	Formaldehyde
		9408	Gasoline range organics (GRO)
		4835	Hexachlorobutadiene
		9427	Hexamethylcyclotrisiloxane
		9428	Hexamethyldisiloxane
		4895	Isopropyl alcohol (2-Propanol, Isopropanol)
		4900	Isopropylbenzene (Cumene)
		5240	m+p-xylene
		4950	Methyl bromide (Bromomethane)
		4960	Methyl chloride (Chloromethane)
		4990	Methyl methacrylate
		5000	Methyl tert-butyl ether (MTBE)
		4975	Methylene chloride (Dichloromethane)
		5005	Naphthalene
		5007	n-Butane
		6442	n-Butylcyclohexane
		5875	n-Decane
		6235	n-Dodecane
		4825	n-Heptane
		4855	n-Hexane
		5026	n-Nonane
		5027	n-Octane
		5029	n-Propane

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Air	EPA TO-15	6747	n-Undecane		
		7522	Octamethylcyclotetrasiloxane		
		9613	Octamethyltrisiloxane		
		5250	o-Xylene		
		9614	Pentamethyldisiloxane		
		5100	Styrene		
		5115	Tetrachloroethylene (Perchloroethylene)		
		5120	Tetrahydrofuran (THF)		
		5140	Toluene		
		4700	trans-1,2-Dichloroethylene		
		4685	trans-1,3-Dichloropropylene		
		5170	Trichloroethene (Trichloroethylene)		
		5175	Trichlorofluoromethane (Fluorotrichloromethane, Freon 11)		
		5225	Vinyl acetate		
		5235	Vinyl chloride		
Drinking Water	EPA 180.1 2			10011800	Turbidity - Nephelometric
		2055	Turbidity		
	EPA 200.8 5.4			10014605	Metals by ICP-MS
		1000	Aluminum		
		1005	Antimony		
		1010	Arsenic		
		1015	Barium		
		1020	Beryllium		
		1030	Cadmium		
		1040	Chromium		
		1055	Copper		
		1760	Hardness (calc.)		
		1075	Lead		
		1090	Manganese		
		1105	Nickel		
		1140	Selenium		
		1150	Silver		
		1165	Thallium		
		1190	Zinc		
	SM 4500-CN$^-$ E 21st ED			20096202	Cyanide by Colorimetric Method
		1635	Cyanide		
	SM 4500-CN$^-$ G 21st ED			20097001	Cyanide by Cyanides Amenable to Chlorination after Distillation
		1510	Amenable cyanide		

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Drinking Water	SM 4500-P E 21st ED			20124009	Phosphorus by Ascorbic Acid Method
		1870	Orthophosphate as P		
Non-Potable Water	EPA 1631E			10237204	Mercury in Water by Oxidation, Purge & Trap, and Cold Vapor Atomic Fluorescence
		1095	Mercury		
	EPA 1664A (HEM)			10127807	N-Hexane Extractable Material (Oil and Grease) by Extraction and Gravimetry
		1803	n-Hexane Extractable Material (O&G)		
	EPA 180.1 2			10011800	Turbidity - Nephelometric
		2055	Turbidity		
	EPA 245.1 3			10036609	Mercury by Cold Vapor Atomic Absorption
		1095	Mercury		
	EPA 245.7			10038003	Mercury by Cold Vapor Fluorescence
		1095	Mercury		
	EPA 300.0			10053006	Ion chromatography - anions.
		1540	Bromide		
		1575	Chloride		
		1730	Fluoride		
		1810	Nitrate as N		
		1820	Nitrate-nitrite		
		1840	Nitrite as N		
		1870	Orthophosphate as P		
		1910	Phosphorus, total		
		2000	Sulfate		
	EPA 3010A			10133605	Acid Digestion of Aqueous samples and Extracts for Total Metals
		8031	Extraction/Preparation		
	EPA 3510C			10138202	Separatory Funnel Liquid-liquid extraction
		8031	Extraction/Preparation		
	EPA 3520C			10139001	Continuous Liquid-liquid extraction
		8031	Extraction/Preparation		
	EPA 6020			10156000	Inductively Coupled Plasma-Mass Spectrometry
		1000	Aluminum		
		1005	Antimony		
		1010	Arsenic		
		1015	Barium		
		1020	Beryllium		
		1030	Cadmium		

Non-Potable Water	EPA 6020	1035	Calcium		
		1040	Chromium		
		1050	Cobalt		
		1055	Copper		
		1070	Iron		
		1075	Lead		
		1085	Magnesium		
		1090	Manganese		
		1095	Mercury		
		1100	Molybdenum		
		1105	Nickel		
		1910	Phosphorus, total		
		1125	Potassium		
		1140	Selenium		
		1150	Silver		
		1155	Sodium		
		1160	Strontium		
		1165	Thallium		
		1175	Tin		
		1185	Vanadium		
		1190	Zinc		
	EPA 608			10103603	Organochlorine Pesticides & PCBs by GC/ECD
		8880	Aroclor-1016 (PCB-1016)		
		8885	Aroclor-1221 (PCB-1221)		
		8890	Aroclor-1232 (PCB-1232)		
		8895	Aroclor-1242 (PCB-1242)		
		8900	Aroclor-1248 (PCB-1248)		
		8905	Aroclor-1254 (PCB-1254)		
		8910	Aroclor-1260 (PCB-1260)		
		8912	Aroclor-1262 (PCB-1262)		
		8913	Aroclor-1268 (PCB-1268)		
	EPA 624			10107207	Volatile Organic Compounds by purge and trap GC/MS
		5105	1,1,1,2-Tetrachloroethane		
		5160	1,1,1-Trichloroethane		
		5110	1,1,2,2-Tetrachloroethane		
		5195	1,1,2-Trichloro-1,2,2-trifluoroethane (Freon 113)		
		5165	1,1,2-Trichloroethane		
		4630	1,1-Dichloroethane		
		4640	1,1-Dichloroethylene		
		4670	1,1-Dichloropropene		
		5150	1,2,3-Trichlorobenzene		

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EPA CODE: WA01224

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Non-Potable Water	EPA 624	5180	1,2,3-Trichloropropane
		5182	1,2,3-Trimethylbenzene
		5155	1,2,4-Trichlorobenzene
		4570	1,2-Dibromo-3-chloropropane (DBCP)
		4585	1,2-Dibromoethane (EDB, Ethylene dibromide)
		4610	1,2-Dichlorobenzene
		4635	1,2-Dichloroethane (Ethylene dichloride)
		4655	1,2-Dichloropropane
		5215	1,3,5-Trimethylbenzene
		4615	1,3-Dichlorobenzene
		4660	1,3-Dichloropropane
		4620	1,4-Dichlorobenzene
		4735	1,4-Dioxane (1,4- Diethyleneoxide)
		4665	2,2-Dichloropropane
		4410	2-Butanone (Methyl ethyl ketone, MEK)
		4500	2-Chloroethyl vinyl ether
		4535	2-Chlorotoluene
		4860	2-Hexanone (MBK)
		5020	2-Nitropropane
		4540	4-Chlorotoluene
		4910	4-Isopropyltoluene (p-Cymene)
		4995	4-Methyl-2-pentanone (MIBK)
		4315	Acetone
		4340	Acrylonitrile
		4355	Allyl chloride (3-Chloropropene)
		4375	Benzene
		4385	Bromobenzene
		4390	Bromochloromethane
		4395	Bromodichloromethane
		4397	Bromoethane (Ethyl Bromide)
		4400	Bromoform
		4450	Carbon disulfide
		4455	Carbon tetrachloride
		4475	Chlorobenzene
		4575	Chlorodibromomethane
		4485	Chloroethane (Ethyl chloride)
		4505	Chloroform
		4645	cis-1,2-Dichloroethylene
		4680	cis-1,3-Dichloropropene
		4595	Dibromomethane (Methylene bromide)
		4625	Dichlorodifluoromethane (Freon-12)
		4725	Diethyl ether
		4755	Ethyl acetate

Non-Potable Water	EPA 624	4810	Ethyl methacrylate		
		4765	Ethylbenzene		
		4870	Iodomethane (Methyl iodide)		
		4900	Isopropylbenzene (Cumene)		
		5240	m+p-xylene		
		4925	Methacrylonitrile		
		4945	Methyl acrylate		
		4950	Methyl bromide (Bromomethane)		
		4960	Methyl chloride (Chloromethane)		
		4990	Methyl methacrylate		
		5000	Methyl tert-butyl ether (MTBE)		
		4975	Methylene chloride (Dichloromethane)		
		5005	Naphthalene		
		4435	n-Butylbenzene		
		4855	n-Hexane		
		5015	Nitrobenzene		
		5090	n-Propylbenzene		
		5250	o-Xylene		
		4440	sec-Butylbenzene		
		5100	Styrene		
		4370	T-amylmethylether (TAME)		
		4445	tert-Butylbenzene		
		5115	Tetrachloroethylene (Perchloroethylene)		
		5120	Tetrahydrofuran (THF)		
		5140	Toluene		
		4700	trans-1,2-Dichloroethylene		
		4685	trans-1,3-Dichloropropylene		
		4605	trans-1,4-Dichloro-2-butene		
		5170	Trichloroethene (Trichloroethylene)		
		5175	Trichlorofluoromethane (Fluorotrichloromethane, Freon 11)		
		5225	Vinyl acetate		
		5235	Vinyl chloride		
	EPA 625			10300002	Base/Neutrals and Acids by GC/MS
		5155	1,2,4-Trichlorobenzene		
		4610	1,2-Dichlorobenzene		
		6155	1,2-Dinitrobenzene		
		4615	1,3-Dichlorobenzene		
		6160	1,3-Dinitrobenzene (1,3-DNB)		
		4620	1,4-Dichlorobenzene		
		6165	1,4-Dinitrobenzene		
		6380	1-Methylnaphthalene		
		6735	2,3,4,6-Tetrachlorophenol		

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Non-Potable Water	EPA 625	6740	2,3,5,6-Tetrachlorophenol
		6835	2,4,5-Trichlorophenol
		6840	2,4,6-Trichlorophenol
		6000	2,4-Dichlorophenol
		6130	2,4-Dimethylphenol
		6175	2,4-Dinitrophenol
		6185	2,4-Dinitrotoluene (2,4-DNT)
		6190	2,6-Dinitrotoluene (2,6-DNT)
		5795	2-Chloronaphthalene
		6400	2-Methylphenol (o-Cresol)
		6460	2-Nitroaniline
		6490	2-Nitrophenol
		6405	3-Methylphenol (m-Cresol)
		6465	3-Nitroaniline
		5660	4-Bromophenyl phenyl ether (BDE-3)
		5700	4-Chloro-3-methylphenol
		5745	4-Chloroaniline
		5825	4-Chlorophenyl phenylether
		6410	4-Methylphenol (p-Cresol)
		6470	4-Nitroaniline
		6500	4-Nitrophenol
		5500	Acenaphthene
		5505	Acenaphthylene
		5545	Aniline
		5555	Anthracene
		5562	Azobenzene
		5575	Benzo(a)anthracene
		5580	Benzo(a)pyrene
		5590	Benzo(g,h,i)perylene
		5600	Benzo(k)fluoranthene
		5585	Benzo[b]fluoranthene
		5610	Benzoic acid
		5630	Benzyl alcohol
		5760	bis(2-Chloroethoxy)methane
		5765	bis(2-Chloroethyl) ether
		5780	bis(2-Chloroisopropyl) ether
		5670	Butyl benzyl phthalate
		5680	Carbazole
		5855	Chrysene
		5895	Dibenz(a,h) anthracene
		5905	Dibenzofuran
		6070	Diethyl phthalate
		6135	Dimethyl phthalate

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Matrix	Method	Analyte Code	Analyte	Method Code	Method Description
Non-Potable Water	EPA 625	5925	Di-n-butyl phthalate		
		6200	Di-n-octyl phthalate		
		6205	Diphenylamine		
		6265	Fluoranthene		
		6270	Fluorene		
		6275	Hexachlorobenzene		
		4835	Hexachlorobutadiene		
		6285	Hexachlorocyclopentadiene		
		4840	Hexachloroethane		
		6315	Indeno(1,2,3-cd) pyrene		
		6320	Isophorone		
		5005	Naphthalene		
		5015	Nitrobenzene		
		6525	n-Nitrosodiethylamine		
		6530	n-Nitrosodimethylamine		
		6535	n-Nitrosodiphenylamine		
		6605	Pentachlorophenol		
		6615	Phenanthrene		
		6625	Phenol		
		6665	Pyrene		
		5095	Pyridine		
	EPA 7470A			10165807	Mercury in Liquid Waste by Cold Vapor Atomic Absorption
		1095	Mercury		
	EPA 8011			10173009	1,2-Dibromoethane and 1,2-Dibromo-3-chloropropane by Microextraction and GC/ECD
		4585	1,2-Dibromoethane (EDB, Ethylene dibromide)		
		4580	Dibromochloropropane		
	EPA 8082A			10179201	Polychlorinated Biphenyls (PCBs) by GC/ECD
		8880	Aroclor-1016 (PCB-1016)		
		8885	Aroclor-1221 (PCB-1221)		
		8890	Aroclor-1232 (PCB-1232)		
		8895	Aroclor-1242 (PCB-1242)		
		8900	Aroclor-1248 (PCB-1248)		
		8905	Aroclor-1254 (PCB-1254)		
		8910	Aroclor-1260 (PCB-1260)		
		8912	Aroclor-1262 (PCB-1262)		
		8913	Aroclor-1268 (PCB-1268)		
	EPA 8260C			10307003	Volatile Organics: GC/MS (capillary column)
		5105	1,1,1,2-Tetrachloroethane		
		5160	1,1,1-Trichloroethane		

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Non-Potable Water	EPA 8260C	5110	1,1,2,2-Tetrachloroethane
		5195	1,1,2-Trichloro-1,2,2-trifluoroethane (Freon 113)
		5165	1,1,2-Trichloroethane
		4630	1,1-Dichloroethane
		4640	1,1-Dichloroethylene
		4670	1,1-Dichloropropene
		5150	1,2,3-Trichlorobenzene
		5180	1,2,3-Trichloropropane
		5155	1,2,4-Trichlorobenzene
		5210	1,2,4-Trimethylbenzene
		4570	1,2-Dibromo-3-chloropropane (DBCP)
		4585	1,2-Dibromoethane (EDB, Ethylene dibromide)
		4610	1,2-Dichlorobenzene
		4635	1,2-Dichloroethane (Ethylene dichloride)
		4655	1,2-Dichloropropane
		5215	1,3,5-Trimethylbenzene
		4615	1,3-Dichlorobenzene
		4660	1,3-Dichloropropane
		4620	1,4-Dichlorobenzene
		4735	1,4-Dioxane (1,4- Diethyleneoxide)
		4665	2,2-Dichloropropane
		4410	2-Butanone (Methyl ethyl ketone, MEK)
		4535	2-Chlorotoluene
		4860	2-Hexanone (MBK)
		5020	2-Nitropropane
		4540	4-Chlorotoluene
		4910	4-Isopropyltoluene (p-Cymene)
		4995	4-Methyl-2-pentanone (MIBK)
		4315	Acetone
		4340	Acrylonitrile
		4355	Allyl chloride (3-Chloropropene)
		4375	Benzene
		4385	Bromobenzene
		4390	Bromochloromethane
		4395	Bromodichloromethane
		4400	Bromoform
		4450	Carbon disulfide
		4455	Carbon tetrachloride
		4475	Chlorobenzene
		4575	Chlorodibromomethane
		4485	Chloroethane (Ethyl chloride)
		4505	Chloroform

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Non-Potable Water	EPA 8260C	4645	cis-1,2-Dichloroethylene
		4680	cis-1,3-Dichloropropene
		4595	Dibromomethane (Methylene bromide)
		4625	Dichlorodifluoromethane (Freon-12)
		4725	Diethyl ether
		4755	Ethyl acetate
		4810	Ethyl methacrylate
		4765	Ethylbenzene
		9408	Gasoline range organics (GRO)
		4835	Hexachlorobutadiene
		4840	Hexachloroethane
		4870	Iodomethane (Methyl iodide)
		4900	Isopropylbenzene (Cumene)
		5240	m+p-xylene
		4925	Methacrylonitrile
		4945	Methyl acrylate
		4950	Methyl bromide (Bromomethane)
		4960	Methyl chloride (Chloromethane)
		4990	Methyl methacrylate
		5000	Methyl tert-butyl ether (MTBE)
		4975	Methylene chloride (Dichloromethane)
		5005	Naphthalene
		4435	n-Butylbenzene
		4855	n-Hexane
		5015	Nitrobenzene
		5090	n-Propylbenzene
		5250	o-Xylene
		4440	sec-Butylbenzene
		5100	Styrene
		4370	T-amylmethylether (TAME)
		4445	tert-Butylbenzene
		5115	Tetrachloroethylene (Perchloroethylene)
		5120	Tetrahydrofuran (THF)
		5140	Toluene
		4700	trans-1,2-Dichloroethylene
		4685	trans-1,3-Dichloropropylene
		4605	trans-1,4-Dichloro-2-butene
		5170	Trichloroethene (Trichloroethylene)
		5175	Trichlorofluoromethane (Fluorotrichloromethane, Freon 11)
		5225	Vinyl acetate
		5235	Vinyl chloride

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Non-Potable Water	EPA 8260C SIM			10307105	Volatile Organic Compounds by GC/MS-SIM
		5155	1,2,4-Trichlorobenzene		
		4610	1,2-Dichlorobenzene		
		4615	1,3-Dichlorobenzene		
		4620	1,4-Dichlorobenzene		
		6380	1-Methylnaphthalene		
		5630	Benzyl alcohol		
		4835	Hexachlorobutadiene		
		5005	Naphthalene		
	EPA 8270D			10186002	Semivolatile Organic compounds by GC/MS
		5155	1,2,4-Trichlorobenzene		
		4610	1,2-Dichlorobenzene		
		6155	1,2-Dinitrobenzene		
		4615	1,3-Dichlorobenzene		
		6160	1,3-Dinitrobenzene (1,3-DNB)		
		4620	1,4-Dichlorobenzene		
		6165	1,4-Dinitrobenzene		
		6380	1-Methylnaphthalene		
		6735	2,3,4,6-Tetrachlorophenol		
		6740	2,3,5,6-Tetrachlorophenol		
		6835	2,4,5-Trichlorophenol		
		6840	2,4,6-Trichlorophenol		
		6000	2,4-Dichlorophenol		
		6130	2,4-Dimethylphenol		
		6175	2,4-Dinitrophenol		
		6185	2,4-Dinitrotoluene (2,4-DNT)		
		6190	2,6-Dinitrotoluene (2,6-DNT)		
		5795	2-Chloronaphthalene		
		5800	2-Chlorophenol		
		6385	2-Methylnaphthalene		
		6400	2-Methylphenol (o-Cresol)		
		6460	2-Nitroaniline		
		6490	2-Nitrophenol		
		6405	3-Methylphenol (m-Cresol)		
		6465	3-Nitroaniline		
		5660	4-Bromophenyl phenyl ether (BDE-3)		
		5700	4-Chloro-3-methylphenol		
		5745	4-Chloroaniline		
		5825	4-Chlorophenyl phenylether		
		6410	4-Methylphenol (p-Cresol)		
		6470	4-Nitroaniline		
		6500	4-Nitrophenol		

OREGON

Environmental Laboratory Accreditation Program

ORELAP Fields of Accreditation

ORELAP ID: WA100009

Fremont Analytical, Inc.
3600 Fremont Ave. N
Seattle, WA 98103

EPA CODE: WA01224

Certificate: WA100009 - 010

Issue Date: 5/10/2017 Expiration Date: 5/9/2018

As of 5/10/2017 this list supersedes all previous lists for this certificate number.

Non-Potable Water	EPA 8270D	5500	Acenaphthene
		5505	Acenaphthylene
		5545	Aniline
		5555	Anthracene
		5562	Azobenzene
		5575	Benzo(a)anthracene
		5580	Benzo(a)pyrene
		5590	Benzo(g,h,i)perylene
		5600	Benzo(k)fluoranthene
		5585	Benzo[b]fluoranthene
		5610	Benzoic acid
		5630	Benzyl alcohol
		5760	bis(2-Chloroethoxy)methane
		5765	bis(2-Chloroethyl) ether
		5780	bis(2-Chloroisopropyl) ether
		6062	bis(2-Ethylhexyl)adipate
		5670	Butyl benzyl phthalate
		5680	Carbazole
		5855	Chrysene
		6065	Di(2-ethylhexyl) phthalate (bis(2-Ethylhexyl)phthalate, DEHP)
		5895	Dibenz(a,h) anthracene
		5905	Dibenzofuran
		6070	Diethyl phthalate
		6135	Dimethyl phthalate
		5925	Di-n-butyl phthalate
		6200	Di-n-octyl phthalate
		6205	Diphenylamine
		6265	Fluoranthene
		6270	Fluorene
		6275	Hexachlorobenzene
		4835	Hexachlorobutadiene
		6285	Hexachlorocyclopentadiene
		4840	Hexachloroethane
		6315	Indeno(1,2,3-cd) pyrene
		6320	Isophorone
		5005	Naphthalene
		5015	Nitrobenzene
		6525	n-Nitrosodiethylamine
		6530	n-Nitrosodimethylamine
		6545	n-Nitrosodi-n-propylamine
		6535	n-Nitrosodiphenylamine
		6605	Pentachlorophenol
		6615	Phenanthrene

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Non-Potable Water	EPA 8270D	6625	Phenol		
		6665	Pyrene		
		5095	Pyridine		
	EPA 8270D SIM			10242509	Semivolatile Organic compounds by GC/MS Selective Ion Monitoring
		6380	1-Methylnaphthalene		
		6385	2-Methylnaphthalene		
		5500	Acenaphthene		
		5505	Acenaphthylene		
		5555	Anthracene		
		5575	Benzo(a)anthracene		
		5580	Benzo(a)pyrene		
		5590	Benzo(g,h,i)perylene		
		5600	Benzo(k)fluoranthene		
		5585	Benzo[b]fluoranthene		
		5670	Butyl benzyl phthalate		
		5855	Chrysene		
		5895	Dibenz(a,h) anthracene		
		6070	Diethyl phthalate		
		6135	Dimethyl phthalate		
		5925	Di-n-butyl phthalate		
		6200	Di-n-octyl phthalate		
		6265	Fluoranthene		
		6270	Fluorene		
		6315	Indeno(1,2,3-cd) pyrene		
		5005	Naphthalene		
		6605	Pentachlorophenol		
		6615	Phenanthrene		
		6665	Pyrene		
	EPA 9060A			10244801	Total Organic Carbon
		1710	Dissolved organic carbon (DOC)		
		2040	Total organic carbon		
	EPA TO-15			10248803	VOCs collected in Canisters by GC/MS
		4620	1,4-Dichlorobenzene		
		4735	1,4-Dioxane (1,4- Diethyleneoxide)		
		4671	2,3-Dimethylpentane		
		4410	2-Butanone (Methyl ethyl ketone, MEK)		
		4860	2-Hexanone (MBK)		
		4938	2-Methylbutane (Isopentane)		
		4995	4-Methyl-2-pentanone (MIBK)		
		4315	Acetone		
		4325	Acrolein (Propenal)		
		3792	APH Aliphatics C5-C8		

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Non-Potable Water	EPA TO-15	3793	APH Aliphatics C9-C12		
		3794	APH Aromatics C9-C10		
		4375	Benzene		
		5635	Benzyl chloride		
		4395	Bromodichloromethane		
		4747	Ethane		
		4815	Formaldehyde		
		9408	Gasoline range organics (GRO)		
		4900	Isopropylbenzene (Cumene)		
		5007	n-Butane		
		5875	n-Decane		
		6235	n-Dodecane		
		5026	n-Nonane		
		5027	n-Octane		
		5029	n-Propane		
		6747	n-Undecane		
	NWTPH-Dx			90018409	Oregon DEQ TPH Diesel Range
		9369	Diesel range organics (DRO)		
		9499	Motor Oil		
		2050	Total Petroleum Hydrocarbons (TPH)		
	NWTPH-Gx			90018603	Oregon DEQ TPH Gasoline Range Organics by GC/FID-PID Purge & Trap
		4375	Benzene		
		4765	Ethylbenzene		
		9408	Gasoline range organics (GRO)		
		5240	m+p-xylene		
		5250	o-Xylene		
		5140	Toluene		
	SM 2340 B 21st ED			20046406	Hardness by calculation
		1750	Hardness		
	SM 2510 B 21st ED			20048402	Conductivity by Probe
		1610	Conductivity		
	SM 2540 B 21st ED			20049201	Total Solids Dried at 103 - 105C
		1950	Residue-total		
	SM 2540 C 21st ED			20050208	Total Dissolved Solids Dried at 180C
		1955	Residue-filterable (TDS)		
	SM 2540 D 21st ED			20051007	Total Suspended Solids Dried at 103 - 105C
		1960	Residue-nonfilterable (TSS)		
	SM 3500-Fe B 21st ED			20068808	Iron by Phenanthroline Method
		1073	FE (II) (Ferous iron)		

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Non-Potable Water	SM 4500-CN^{-} E 21st ED	1635	Cyanide	20096202	Cyanide by Colorimetric Method
	SM 4500-CN^{-} G 21st ED	1510	Amenable cyanide	20097001	Cyanide by Cyanides Amenable to Chlorination after Distillation
	SM 4500-CN^{-} I 21st ED	1635	Cyanide	20097807	Cyanide by Weak Acid Dissociable Cyanide
	SM 4500-P E 21st ED	1870	Orthophosphate as P	20124009	Phosphorus by Ascorbic Acid Method
	SM 5220 D 21st ED	1565	Chemical oxygen demand	20136601	COD by Closed Reflux, Colorimetric Method
	SM 5310 C 21st ED	2040	Total organic carbon	20138607	TOC by Persulfate-Ultraviolet or Heated-Persulfate Oxidation Method
Solids					
	EPA 3050B	8031	Extraction/Preparation	10135601	Acid Digestion of Sediments, Sludges, and soils
	EPA 3545A	8031	Extraction/Preparation	10141001	Pressurized Fluid Extraction (PFE)
	EPA 3550C	8031	Extraction/Preparation	10142004	Ultrasonic Extraction
	EPA 5035A	8031	Extraction/Preparation	10284807	Closed-System Purge-and-Trap and Extraction for Volatile Organics in Soil and Waste Samples
	EPA 6020			10156000	Inductively Coupled Plasma-Mass Spectrometry
		1000	Aluminum		
		1005	Antimony		
		1010	Arsenic		
		1015	Barium		
		1020	Beryllium		
		1030	Cadmium		
		1035	Calcium		
		1040	Chromium		
		1050	Cobalt		
		1055	Copper		
		1070	Iron		
		1075	Lead		
		1085	Magnesium		
		1090	Manganese		

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Solids	EPA 6020	1095	Mercury		
		1100	Molybdenum		
		1105	Nickel		
		1140	Selenium		
		1150	Silver		
		1160	Strontium		
		1165	Thallium		
		1175	Tin		
		1185	Vanadium		
		1190	Zinc		
	EPA 7471A			10166208	Mercury in Solid Waste by Cold Vapor Atomic Absorption
		1095	Mercury		
	EPA 8082A			10179201	Polychlorinated Biphenyls (PCBs) by GC/ECD
		8880	Aroclor-1016 (PCB-1016)		
		8885	Aroclor-1221 (PCB-1221)		
		8890	Aroclor-1232 (PCB-1232)		
		8895	Aroclor-1242 (PCB-1242)		
		8900	Aroclor-1248 (PCB-1248)		
		8905	Aroclor-1254 (PCB-1254)		
		8910	Aroclor-1260 (PCB-1260)		
		8912	Aroclor-1262 (PCB-1262)		
		8913	Aroclor-1268 (PCB-1268)		
	EPA 8260C			10307003	Volatile Organics: GC/MS (capillary column)
		5105	1,1,1,2-Tetrachloroethane		
		5160	1,1,1-Trichloroethane		
		5110	1,1,2,2-Tetrachloroethane		
		5195	1,1,2-Trichloro-1,2,2-trifluoroethane (Freon 113)		
		5165	1,1,2-Trichloroethane		
		4630	1,1-Dichloroethane		
		4640	1,1-Dichloroethylene		
		4670	1,1-Dichloropropene		
		5150	1,2,3-Trichlorobenzene		
		5180	1,2,3-Trichloropropane		
		5155	1,2,4-Trichlorobenzene		
		5210	1,2,4-Trimethylbenzene		
		4570	1,2-Dibromo-3-chloropropane (DBCP)		
		4585	1,2-Dibromoethane (EDB, Ethylene dibromide)		
		4610	1,2-Dichlorobenzene		
		4635	1,2-Dichloroethane (Ethylene dichloride)		
		4655	1,2-Dichloropropane		

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Solids	EPA 8260C	5215	1,3,5-Trimethylbenzene
		4615	1,3-Dichlorobenzene
		4660	1,3-Dichloropropane
		4620	1,4-Dichlorobenzene
		4735	1,4-Dioxane (1,4- Diethyleneoxide)
		4665	2,2-Dichloropropane
		4410	2-Butanone (Methyl ethyl ketone, MEK)
		4535	2-Chlorotoluene
		4860	2-Hexanone (MBK)
		5020	2-Nitropropane
		4540	4-Chlorotoluene
		4910	4-Isopropyltoluene (p-Cymene)
		4995	4-Methyl-2-pentanone (MIBK)
		4315	Acetone
		4340	Acrylonitrile
		4355	Allyl chloride (3-Chloropropene)
		4375	Benzene
		4385	Bromobenzene
		4390	Bromochloromethane
		4395	Bromodichloromethane
		4400	Bromoform
		4450	Carbon disulfide
		4455	Carbon tetrachloride
		4475	Chlorobenzene
		4575	Chlorodibromomethane
		4485	Chloroethane (Ethyl chloride)
		4505	Chloroform
		4645	cis-1,2-Dichloroethylene
		4680	cis-1,3-Dichloropropene
		4595	Dibromomethane (Methylene bromide)
		4625	Dichlorodifluoromethane (Freon-12)
		4725	Diethyl ether
		4755	Ethyl acetate
		4810	Ethyl methacrylate
		4765	Ethylbenzene
		9408	Gasoline range organics (GRO)
		4835	Hexachlorobutadiene
		4840	Hexachloroethane
		4870	Iodomethane (Methyl iodide)
		4900	Isopropylbenzene (Cumene)
		5240	m+p-xylene
		4925	Methacrylonitrile
		4945	Methyl acrylate

Solids	EPA 8260C	4950	Methyl bromide (Bromomethane)		
		4960	Methyl chloride (Chloromethane)		
		4990	Methyl methacrylate		
		5000	Methyl tert-butyl ether (MTBE)		
		4975	Methylene chloride (Dichloromethane)		
		5005	Naphthalene		
		4435	n-Butylbenzene		
		4855	n-Hexane		
		5015	Nitrobenzene		
		5090	n-Propylbenzene		
		5250	o-Xylene		
		4440	sec-Butylbenzene		
		5100	Styrene		
		4370	T-amylmethylether (TAME)		
		4445	tert-Butylbenzene		
		5115	Tetrachloroethylene (Perchloroethylene)		
		5120	Tetrahydrofuran (THF)		
		5140	Toluene		
		4700	trans-1,2-Dichloroethylene		
		4685	trans-1,3-Dichloropropylene		
		4605	trans-1,4-Dichloro-2-butene		
		5170	Trichloroethene (Trichloroethylene)		
		5175	Trichlorofluoromethane (Fluorotrichloromethane, Freon 11)		
		5225	Vinyl acetate		
		5235	Vinyl chloride		
	EPA 8260C SIM			10307105	Volatile Organic Compounds by GC/MS-SIM
		5155	1,2,4-Trichlorobenzene		
		4610	1,2-Dichlorobenzene		
		4615	1,3-Dichlorobenzene		
		4620	1,4-Dichlorobenzene		
		6380	1-Methylnaphthalene		
		5630	Benzyl alcohol		
		4835	Hexachlorobutadiene		
		5005	Naphthalene		
	EPA 8270D			10186002	Semivolatile Organic compounds by GC/MS
		5155	1,2,4-Trichlorobenzene		
		4610	1,2-Dichlorobenzene		
		6155	1,2-Dinitrobenzene		
		4615	1,3-Dichlorobenzene		
		6160	1,3-Dinitrobenzene (1,3-DNB)		
		4620	1,4-Dichlorobenzene		

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Solids	EPA 8270D	6165	1,4-Dinitrobenzene
		6380	1-Methylnaphthalene
		6735	2,3,4,6-Tetrachlorophenol
		6740	2,3,5,6-Tetrachlorophenol
		6835	2,4,5-Trichlorophenol
		6840	2,4,6-Trichlorophenol
		6000	2,4-Dichlorophenol
		6130	2,4-Dimethylphenol
		6175	2,4-Dinitrophenol
		6185	2,4-Dinitrotoluene (2,4-DNT)
		6190	2,6-Dinitrotoluene (2,6-DNT)
		5795	2-Chloronaphthalene
		5800	2-Chlorophenol
		6385	2-Methylnaphthalene
		6400	2-Methylphenol (o-Cresol)
		6460	2-Nitroaniline
		6490	2-Nitrophenol
		6405	3-Methylphenol (m-Cresol)
		6465	3-Nitroaniline
		5660	4-Bromophenyl phenyl ether (BDE-3)
		5700	4-Chloro-3-methylphenol
		5745	4-Chloroaniline
		5825	4-Chlorophenyl phenylether
		6410	4-Methylphenol (p-Cresol)
		6470	4-Nitroaniline
		6500	4-Nitrophenol
		5500	Acenaphthene
		5505	Acenaphthylene
		5545	Aniline
		5555	Anthracene
		5562	Azobenzene
		5575	Benzo(a)anthracene
		5580	Benzo(a)pyrene
		5590	Benzo(g,h,i)perylene
		5600	Benzo(k)fluoranthene
		5585	Benzo[b]fluoranthene
		5610	Benzoic acid
		5630	Benzyl alcohol
		5760	bis(2-Chloroethoxy)methane
		5765	bis(2-Chloroethyl) ether
		5780	bis(2-Chloroisopropyl) ether
		6062	bis(2-Ethylhexyl)adipate
		5670	Butyl benzyl phthalate

Solids	EPA 8270D	5680	Carbazole		
		5855	Chrysene		
		6065	Di(2-ethylhexyl) phthalate (bis(2-Ethylhexyl)phthalate, DEHP)		
		5895	Dibenz(a,h) anthracene		
		5905	Dibenzofuran		
		6070	Diethyl phthalate		
		6135	Dimethyl phthalate		
		5925	Di-n-butyl phthalate		
		6200	Di-n-octyl phthalate		
		6205	Diphenylamine		
		6265	Fluoranthene		
		6270	Fluorene		
		6275	Hexachlorobenzene		
		4835	Hexachlorobutadiene		
		6285	Hexachlorocyclopentadiene		
		4840	Hexachloroethane		
		6315	Indeno(1,2,3-cd) pyrene		
		6320	Isophorone		
		5005	Naphthalene		
		5015	Nitrobenzene		
		6525	n-Nitrosodiethylamine		
		6530	n-Nitrosodimethylamine		
		6545	n-Nitrosodi-n-propylamine		
		6535	n-Nitrosodiphenylamine		
		6605	Pentachlorophenol		
		6615	Phenanthrene		
		6625	Phenol		
		6665	Pyrene		
		5095	Pyridine		
	EPA 8270D SIM			10242509	Semivolatile Organic compounds by GC/MS Selective Ion Monitoring
		6380	1-Methylnaphthalene		
		6385	2-Methylnaphthalene		
		5500	Acenaphthene		
		5505	Acenaphthylene		
		5555	Anthracene		
		5575	Benzo(a)anthracene		
		5580	Benzo(a)pyrene		
		5590	Benzo(g,h,i)perylene		
		5600	Benzo(k)fluoranthene		
		5585	Benzo[b]fluoranthene		
		5670	Butyl benzyl phthalate		
		5855	Chrysene		

Solids	EPA 8270D SIM	5895	Dibenz(a,h) anthracene		
		6070	Diethyl phthalate		
		6135	Dimethyl phthalate		
		5925	Di-n-butyl phthalate		
		6200	Di-n-octyl phthalate		
		6265	Fluoranthene		
		6270	Fluorene		
		6315	Indeno(1,2,3-cd) pyrene		
		5005	Naphthalene		
		6605	Pentachlorophenol		
		6615	Phenanthrene		
		6665	Pyrene		
	NWTPH-Dx			90018409	Oregon DEQ TPH Diesel Range
		9369	Diesel range organics (DRO)		
		9499	Motor Oil		
		2050	Total Petroleum Hydrocarbons (TPH)		
	NWTPH-Gx			90018603	Oregon DEQ TPH Gasoline Range Organics by GC/FID-PID Purge & Trap
		4375	Benzene		
		4765	Ethylbenzene		
		9408	Gasoline range organics (GRO)		
		5240	m+p-xylene		
		5250	o-Xylene		
		5140	Toluene		

Appendix C

Barr Forms

Barr Engineering Company
Definitions

Accuracy: Accuracy is the degree of agreement between an observed value and an accepted reference value. Accuracy measures the bias in a measurement system. Accuracy of laboratory results may be assessed using the analytical results of method blanks, field blanks, reagent/preparation blank, matrix spike/matrix spike duplicate samples and laboratory control samples. The percent recovery for (%R) matrix spikes and laboratory control samples will be calculated using the following equation:

$$\%R = \frac{SSR - SR}{SA} \times 100$$

Where: %R = % recovery
SSR = spiked sample result
SR = sample result
SA = spike added to native sample

NOTE: In the case of LCS and other laboratory-prepared samples, SR is zero.

Batch: Group of samples of the same matrix prepared for single or multiple analyses that will be analyzed during one operation at a given specific time frame. Typical size is 1-20 samples.

Blank: A sample designed to assess specific sources of contamination.

Calibration: Calibration is the process of checking, adjusting or determining by comparison under specified conditions an instrument's response to standards for each target compound to be analyzed. The source and accuracy of standards used for this purpose are integral to obtaining the best quality data.

Contamination: A component of a sample or an extract that is not representative of the environmental source of the sample. Contamination may stem from other samples, sampling equipment, while in transit, from laboratory reagents, laboratory environment, or analytical instruments.

Data Quality Specialist: An individual that is part of the Data Quality group at Barr Engineering and may be referred to as a Quality Assurance Manager, Quality Assurance Officer, or Quality Manager within Quality Assurance Project Plans or other project documentation.

Duplicate: A second aliquot of a sample that is treated the same as the original sample in order to determine the precision of the method.

Equipment (Rinsate) Blank: A sample of analyte-free water collected when rinsing sampling equipment. It measures the potential for sample cross contamination due to insufficient decontamination of sampling equipment.

Field Blank: A sample of analyte-free water exposed to environmental conditions at the sampling site by transferring from one sample container to another or by removing the lid and exposing a container filled with analyte-free water to the atmosphere for the time equivalent necessary to fill a container. It measures the potential for sample cross contamination due to site conditions.

Field Duplicate: A duplicate sample generated in the field, not in the laboratory. The sample identification is typically kept blind (masked) from the laboratory.

Holding Time: The maximum recommended amount of time samples may be held before they are processed.

***Instrument Blank*:** A blank designed to determine the level of contamination either associated with the analytical instruments, or resulting from carryover. It measures laboratory sources of contamination.

Laboratory Control Sample (LCS) and Laboratory Control Sample Duplicate (LCSD): A sample of analyte-free media spiked with known concentrations of target analytes that is carried through the same sample preparation and analytical procedures. LCS recoveries are used to estimate overall analytical method accuracy independent of sample matrix effects. The RPD between the LCS and LCSD is used to assess the overall analytical method precision. Also referred to as a Laboratory Fortified Blank.

Matrix: The predominant material of which the sample to be analyzed is composed (e.g. water, soil, sediment, etc.).

***Matrix Effect*:** In general, the effect of a particular matrix on the constituents with which it contacts. Matrix effects may prevent efficient purging/extraction of target analytes, and may affect DMC and surrogate recoveries. In addition, non-target analytes may be extracted from the matrix causing interferences.

Matrix Spike* (MS) *and Matrix Spike Duplicate (MSD): A sample spiked with known concentrations of target analytes that is carried through the sample preparation and analysis procedures in order to assess the accuracy of a method in a given sample matrix. The RPD between the MS and MSD is used to assess the precision of a method in a given sample matrix. Also referred to as a Laboratory Fortified Matrix.

Method Detection Limit (MDL): The MDL is defined as the minimum concentration of a substance that can be measured and reported with 99% confidence that the analyte concentration is greater than zero. EPA procedures for determining the MDL are given at 40 CFR 136, Appendix B.

Method Blank: A sample of a matrix similar to the batch of associated samples (when available) that is free from the analytes of interest and is processed simultaneously with and under the same conditions as samples through all steps of the analytical procedures, and in which no target analytes or interferences are present at concentrations that impact the analytical results for sample analyses. It measures laboratory sources of contamination.

Narrative: The portion of the data package which includes laboratory, contact, sample number identification, and descriptive documentation of any problems encountered in processing the samples, along with corrective action taken and problem resolution.

Precision. Precision measures the reproducibility of measurements under a given set of conditions. Precision of analytical laboratory data may be assessed by comparing the analytical results between matrix spike/matrix spike duplicates (MS/MSD), laboratory duplicates, or masked field samples (field duplicates). Field duplicate samples, when collected, processed, and analyzed by the same organization, provide intralaboratory precision information for the entire measurement system, including: sample acquisition, sample constituent heterogeneity, handling, shipping, storage, preparation, and analysis. Field duplicate samples are submitted to the laboratory as blind or mask samples. The relative percent difference (%RPD) will be calculated using the equation below for each pair of duplicate analysis.

$$RPD = \frac{|S - D|}{(S + D)/2} x\,100$$

Where: RPD = relative percent difference

S = original sample result

D = duplicate sample result

Quality Assurance Project Plan (QAPP): A formal document describing in comprehensive detail the necessary quality assurance (QA), quality control (QC), and other technical activities that must be implemented to ensure that the results of the work performed will satisfy the stated performance criteria.

Reporting Limit (RL): The RL is the lowest reported concentration, provided on the sample-analysis data report, after corrections have been made for sample dilution, sample weight, and (for soils and sediments) amount of moisture in the sample.

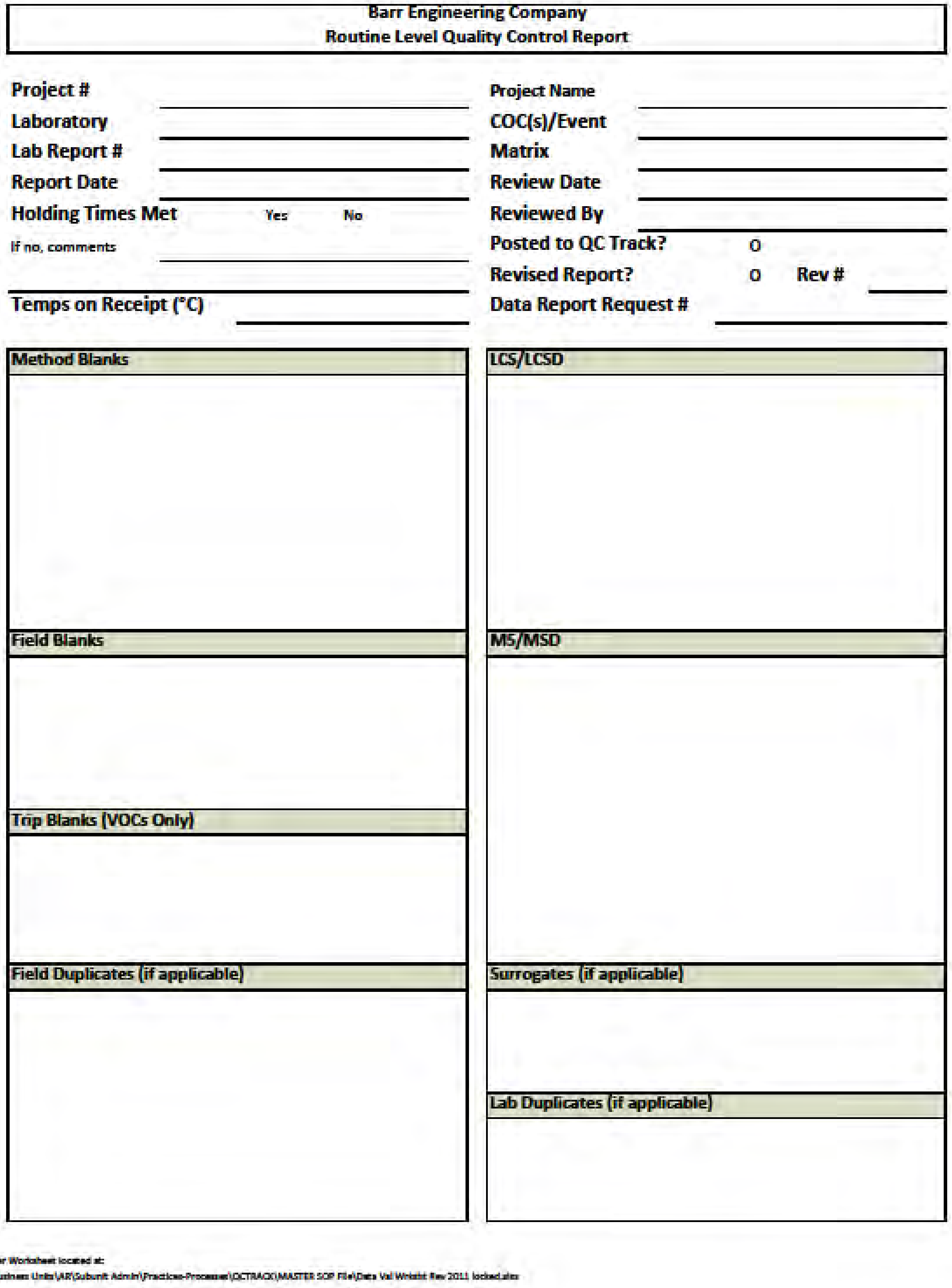
Sample Delivery Group (SDG): Identifies a group of samples for delivery, A sample delivery group is defined by the following, whichever is most frequent:

- Each set of field samples received; or
- Each 20 field samples within a sampling event; or
- Each 7 calendar day period (3 calendar day period for 7-day turnaround) during which field samples are received.

Barr Qualifiers/Footnotes

Qualifier	Definition
a	Estimated value, calculated using some or all values that are estimates.
b	Potential false positive value based on blank data validation procedures.
c	Coeluting compound.
e	Estimated value, exceeded the instrument calibration range.
h	EPA recommended sample preservation, extraction or analysis holding time was exceeded.
i	Indeterminate value based on failure of blind duplicate data to meet quality assurance criteria.
p	Relative percent difference is >40% (25% CLP pesticides) between primary and confirmation GC columns.
r	The presence of the compound is suspect based on the ID criteria of the retention time and relative retention time obtained from the examination of the chromatograms.
*	Estimated value, QA/QC criteria not met.
**	Unusable value, QA/QC criteria not met.
AT	Sample chromatogram is noted to be atypical of a petroleum product.

Routine Level Quality Control Report



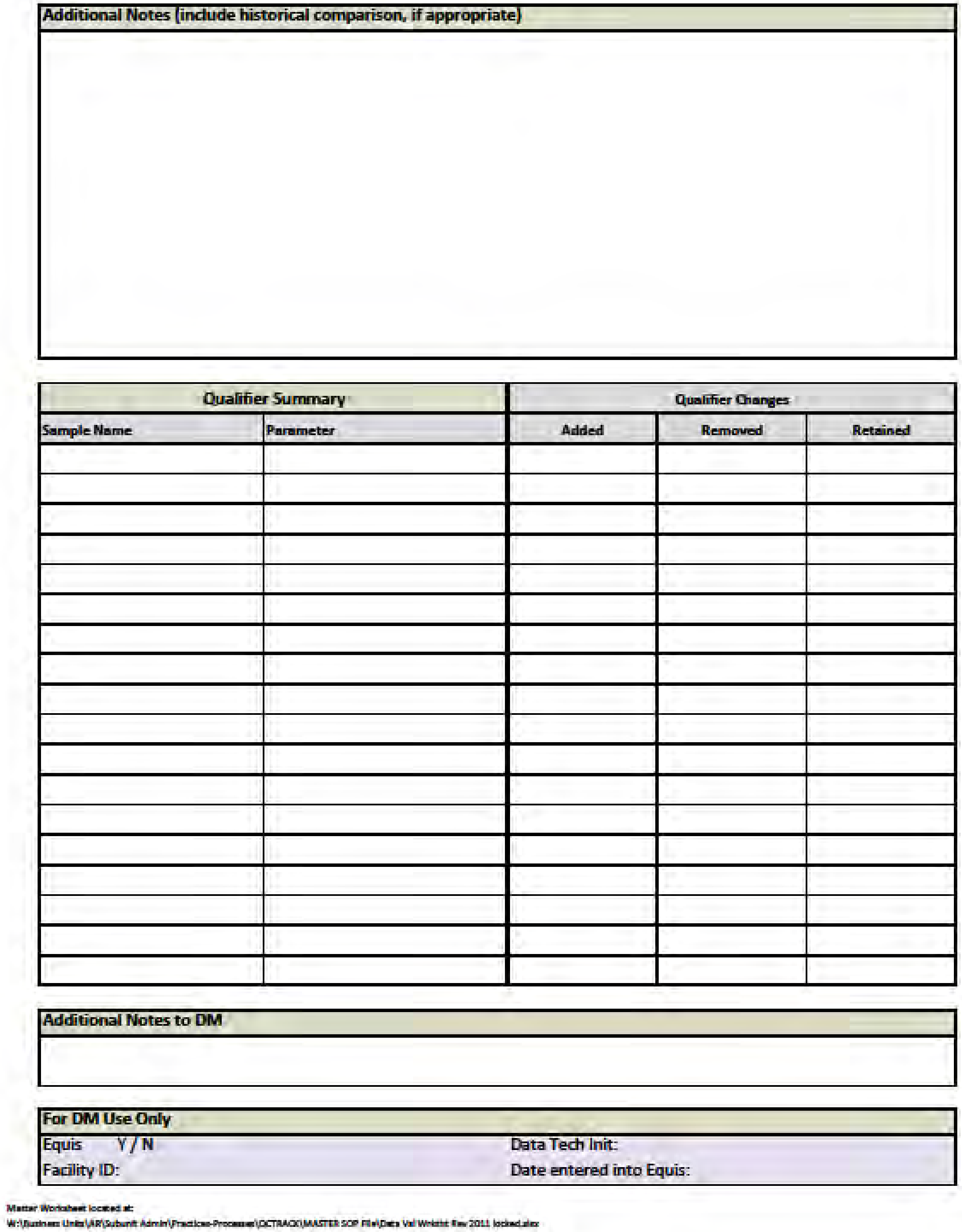
Barr Engineering Company
Routine Level Quality Control Report

Project #		**Project Name**	
Laboratory		**COC(s)/Event**	
Lab Report #		**Matrix**	
Report Date		**Review Date**	
Holding Times Met	Yes No	**Reviewed By**	
If no, comments		**Posted to QC Track?**	o
		Revised Report?	o **Rev #**
Temps on Receipt (°C)		**Data Report Request #**	

Method Blanks	**LCS/LCSD**
Field Blanks	**MS/MSD**
Trip Blanks (VOCs Only)	
Field Duplicates (if applicable)	**Surrogates (if applicable)**
	Lab Duplicates (if applicable)

Master Worksheet located at:
W:\Business Units\AR\Subunit Admin\Practices-Processes\QCTRACK\MASTER SOP File\Data Val Wrkbk Rev 2011 locked.xlsx

Routine Level Quality Control Report



Additional Notes (include historical comparison, if appropriate)

Qualifier Summary		Qualifier Changes		
Sample Name	**Parameter**	**Added**	**Removed**	**Retained**

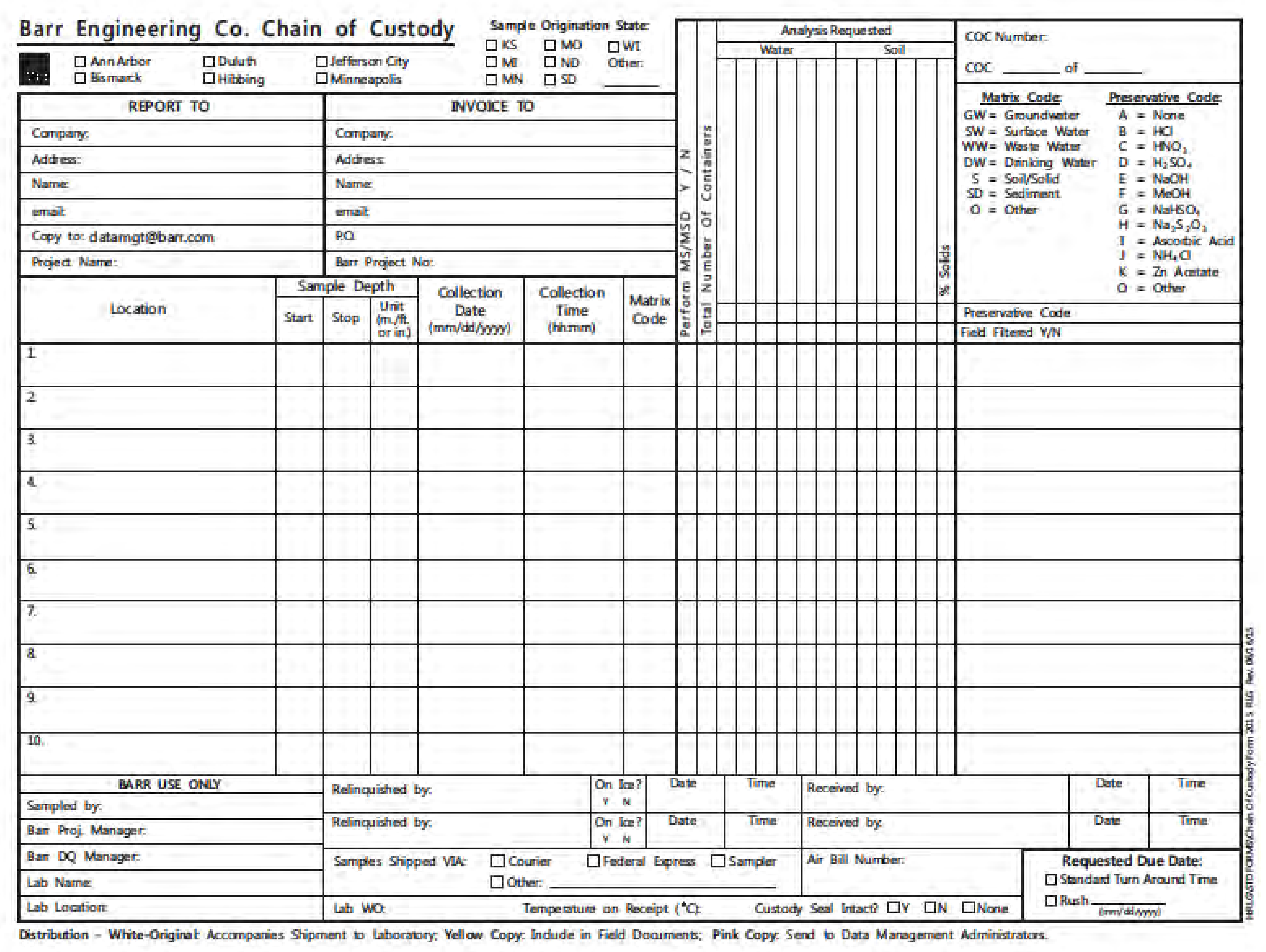
Additional Notes to DM

For DM Use Only

Equis Y / N	Data Tech Init:
Facility ID:	Date entered into Equis:

Master Worksheet located at:
W:\Business Units\AR\Subunit Admin\Practices-Processes\DCTRACK\MASTER SOP File\Data Val Wrksht Rev 2011 locked.xlsx

Chain of Custody Form



Barr Engineering Co. Chain of Custody

☐ Ann Arbor ☐ Duluth ☐ Jefferson City
☐ Bismarck ☐ Hibbing ☐ Minneapolis

Sample Origination State:
☐ KS ☐ MO ☐ WI
☐ MI ☐ ND Other: ________
☐ MN ☐ SD

COC Number:
COC ________ of ________

REPORT TO	INVOICE TO
Company:	Company:
Address:	Address:
Name:	Name:
email:	email:
Copy to: datamgt@barr.com	P.O.
Project Name:	Barr Project No:

Matrix Code:
GW = Groundwater
SW = Surface Water
WW = Waste Water
DW = Drinking Water
S = Soil/Solid
SD = Sediment
O = Other

Preservative Code:
A = None
B = HCl
C = HNO_3
D = H_2SO_4
E = NaOH
F = MeOH
G = $NaHSO_4$
H = $Na_2S_2O_3$
I = Ascorbic Acid
J = NH_4Cl
K = Zn Acetate
O = Other

Location	Sample Depth			Collection Date (mm/dd/yyyy)	Collection Time (hh:mm)	Matrix Code	Perform MS/MSD Y / N	Total Number Of Containers	Analysis Requested												
	Start	Stop	Unit (m./ft. or in.)						Water						Soil					% Solids	
																					Preservative Code
																					Field Filtered Y/N
1.																					
2.																					
3.																					
4.																					
5.																					
6.																					
7.																					
8.																					
9.																					
10.																					

BARR USE ONLY
Sampled by:
Barr Proj. Manager:
Barr DQ Manager:
Lab Name:
Lab Location:

Relinquished by:	On Ice? Y N	Date	Time	Received by:	Date	Time
Relinquished by:	On Ice? Y N	Date	Time	Received by:	Date	Time

Samples Shipped VIA: ☐ Courier ☐ Federal Express ☐ Sampler
☐ Other: ____________________

Air Bill Number:

Requested Due Date:
☐ Standard Turn Around Time
☐ Rush ________ (mm/dd/yyyy)

Lab WO: Temperature on Receipt (°C): Custody Seal Intact? ☐Y ☐N ☐None

Distribution – White-Original: Accompanies Shipment to Laboratory; **Yellow Copy:** Include in Field Documents; **Pink Copy:** Send to Data Management Administrators.

HRLGSTD FORMS\Chain Of Custody Form 2015 RLG Rev. 06/16/15

Appendix D

Barr Field Audit Checklist

BARR ENGINEERING COMPANY
FIELD AUDIT PROGRAM

FIELD AUDIT CHECKLIST

Site Name: ______________________________

Project Number: ______________________________

Date of Audit: ______________________________

Purpose of Audit: ______________________________

Field Personnel in Attendance:

Name	Company	Title

Auditing Personnel:

Name	Company	Title

Others Onsite/Visitors:

Name	Company	Title

This audit checklist and its supporting documentation should be reproduced in its entirety.

P:/qctrack/fieldaudit
Rev April, 2014

Weather Conditions: ________________________________

Well Locations Audited:

________________ ________________ ________________

________________ ________________ ________________

________________ ________________ ________________

Purpose of this audit is to evaluate the procedures conducted by the field personnel are consistent with the procedures set forth in the standard operating procedures (SOPs) published on Barr Engineering Company's BarrLink intranet and with the procedures set forth in the applicable project work plan, field sampling plan, sampling and analysis plan, quality assurance plan and/or health and safety plans. Where differences occur between the Barr SOPs and client or agency plans, the procedures set forth in the approved client or agency plans take precedence. Along with the audit results and observations, any procedural differences between the SOPs and the plans should be noted in the comments section of this field audit report.

1.0 List of SOPs and Work Plans Used During Field Audit Activities

Document Name	Date of Issue	Revision Number

This audit checklist and its supporting documentation should be reproduced in its entirety.

2.0 Advance Preparation for Sampling

	Acceptable Yes No	Comments

2.1 Coordination

Does the State, EPA or client need notification of sampling at this site? Was that completed?		
Were appropriate sample containers obtained from the laboratory?		
Were sample containers received in good condition?		

2.2 Sampling Equipment

Did the field technician have all the proper equipment to perform proper groundwater sampling operations based on the project specific requirements? Including: project reference material, in-line or vacuum filters, passive sampling bags, miscellaneous tools and supplies, transportation, pumps, bailers, power supplies, documentation and labeling, decontamination, health and safety, other personal gear.		

3.0 Preliminary Field Work

	Acceptable Yes No	Comments

3.1 Water Level Measurements

Was the water level read to the nearest 0.01 foot?		
Was a product interface probe necessary to measure LNAPL or DNAPL?		
Was the water level recorded on the Field Log Data Sheet?		
Was the water level verified with a second reading?		
Was the water level marker decontaminated appropriately?		

3.2 Equipment Types

Was the dedicated or new disposal equipment (including bailers, pumps, tubing, filters, passive sampling bags, etc.) used at each well? Any non-dedicated equipment used? List all equipment and describe if new, dedicated, or non-dedicated.		
Is the field sampling equipment appropriate for the job? Who supplied the water for the field blank sample? What type of water was it (i.e. distilled, DI, tap, lab-supplied, field office DI system, store bought?		
Were in-line or vacuum-style 0.45 micron sample filters used?		

3.3 Safety and Equipment Disposal

Ask to see a copy of the sampler's PHASP. Were the samplers using PPE and safety monitoring equipment appropriate to the job and meeting the requirements		

of the PHASP? List proof or exceptions.		
Where is PPE and contaminated equipment disposed of? How was it managed/disposed of?		

3.4 Sampling Technique

Were the wells sampled by standard, bailer, passive bags, or low-flow techniques? List each technique used at each well.		

This audit checklist and its supporting documentation should be reproduced in its entirety.

4.0 Sampling of Monitoring Wells

	Acceptable Yes No	Comments

4.1 Well Purging/Stabilization

Verify the correct order of purging/sampling is being followed? Was documentation completed as purging activities progressed?		
Was calibration of all field instruments, including a YSI Model 556 MPS (or similar) water quality meter, being used and is calibration being performed daily, throughout the day as necessary, and at the end of the day? Is the data being recorded on the correct form (Field Well Log)?		
Field stabilization parameters should be measured after several existing well volumes have been removed. Typically, between 3 and 5 well volumes are removed with stabilization readings obtained after the third, fourth and fifth column volumes.		
Target stabilization criteria is given below: • Temperature - ± 0.5°C of the most recent reading (in °C) • Specific Conductance (temperature corrected EC) – Readings from 0 to 500 must be within ±5 µmhos/cm @ 25°C. Readings from 500 to 5,000 must be within ±50 µmhos/cm@ 25°C. • Dissolved Oxygen ±5% of the most recent reading (in mg/L) • pH ±0.1 standard units of the most recent reading (in pH units) • Redox Potential - ORP Reading must be within ±0.01 units depending on the accuracy of the meter used. • Turbidity: ≥ to 10 NTU or +/- 5% if > 10 NTU Monitoring field parameters – Are reading times and stabilization criteria being met and the correct equipment used? Note deviation on Well Log Form.		

This audit checklist and its supporting documentation should be reproduced in its entirety.

	Acceptable		Comments
	Yes	No	
For low-yielding wells, were they purged dry and allowed to re-charge?			
If containerization of purge water is required, was it performed?			
Were the samples and containers being stored appropriately (clean, on ice, new and unopened)?			
Was care given to avoid placing clean sampling equipment (e.g. hoses, lines, etc.) on the ground or other potentially contaminated areas prior to use at the well?			
Was all non-dedicated or disposable sampling equipment decontaminated as required?			
What is the source and water type of the decontamination water and final rinse water?			
Was a clean bailer and line used for sample collection?			
For wells sampled with a bailer, is the bailer lowered slowly to minimize aeration?			
Were samples filtered as necessary using a 0.45 micron filter?			
Was in-line filtration employed for dedicated wells?			
Was the sampling completed "in-line" using dedicated equipment?			
Were vehicles or generator running during sample collection?			
Were the vehicles or generators downwind from the monitoring point?			

This audit checklist and its supporting documentation should be reproduced in its entirety.

	Acceptable Yes No	Comments
Were the correct analytical parameters being sampled for and the correct sample containers and preservatives being used? Were preservatives added in the lab or field?		
Were containers filled in the correct order? (i.e., volatiles, semi-volatiles, metals, general chemical)		
Was a chain-of-custody completed at the monitoring point?		
Were field QA/QC samples collected in the frequency as required?		
Were samples placed for “storage” within an acceptable time-frame and on ice (@ 4°C)?		
Were samples packaged for transport to the laboratory following local, state, federal shipping and transport regulations as described in the SOP?		
Were the samples or chemicals used for field measurements and any extra sample volumes not sent to the lab for analysis managed, stored and disposed of properly?		

This audit checklist and its supporting documentation should be reproduced in its entirety.

5.0 Documentation

	Acceptable		Comments
	Yes	No	

Were the Field Well Log Book and other supporting documentation filled out correctly?		
Were the samples labeled correctly?		
Were the COC used correctly and the COC form filled out correctly?		
Did the sampler list all exceptions to the sampling protocol in the field report?		
Were copies of the chain of custody forms and all other field documentation routed to the Data Administrator for filing on the company P:Drive/Workfiles/Analytical Data/Field Data?		

This audit checklist and its supporting documentation should be reproduced in its entirety.

6.0 Field Audit Checklist and Reporting

	Acceptable		Comments
	Yes	No	
Is this Field Audit Checklist completed in its entirety?			
Describe any key changes that need to be made to the sampling protocols.			
Save this Field Audit Checklist in the project folder in the P:Drive/Workfiles/Analytical Data/Field Data/Field Audit folder, when applicable, and give a copy to a Data Quality Specialist for inclusion in Barr's formal audit records in W:Drive/Buisness Units/AR/Subunit Admin/Practices-Processes/QCTRACK/AUDITS/Barr Field Audit.			

Additional Notes:

Auditor Instructions

Please indicate compliance with the specific element or requirement shown above in the **yes / no** column. Provide any specific details relating to the element or requirement in the Notes column. This may include personnel interviewed or evidence reviewed.

This audit checklist and its supporting documentation should be reproduced in its entirety.

Appendix E

Barr Data Evaluation Standard Operating Procedures

BARR

Standard Operating Procedure – Yakima Mill Site

Routine Level General Chemistry Data Evaluation

August 30, 2018

Approved By:

Dana Pasi	Dana Pasi	08/28/18
Print QA Manager	Signature	Date

Routine Level General Chemistry Data Evaluation

1.0 Scope and Applicability

This SOP is intended as a guidance document for the routine level evaluation of general chemistry data provided by laboratories to be used in the Yakima Mill Site Project.

This SOP is based on the recommendations of the associated approved analytical methods from USEPA, ASTM, and *Standard Methods for the Examination of Water and Wastewate*r and applies to routine general chemistry data evaluation including a variety of approved methods not limited to the following parameters:

Chromium VI (Hexavalent Chromium)	Nitrate
Sulfate	Total Organic Carbon (TOC)

The recommended procedures in this SOP should be followed unless conditions make it impractical or inappropriate to do so. Modifications should be noted in the applicable documentation and communicated to appropriate personnel. Significant changes may result in a revision or newly created SOP.

2.0 Limitations

- Level IV data evaluation is not covered in this SOP.

3.0 Responsibilities

The laboratory is responsible for generating data from the samples submitted for analysis. In instances where QC criteria are not met for the analysis of samples, the laboratory is responsible for reanalysis of the samples, provided reanalysis is possible (considering matrix interference, holding times and sample volume, etc.), or documenting the impact to the data.

The Data Quality Specialist is responsible for evaluating the data in accordance with this document, in addition to using professional judgment where necessary or appropriate. Also, project specific requirements, such as those specified in the Quality Assurance Project Plan (QAPP) and Sampling and Analysis Plan (SAP) should be applied before qualifying any data.

4.0 Procedure

The Quality Assurance/Quality Control (QA/QC) data detailed below are the most typical found in a routine level laboratory report. Other QA/QC data may be provided by the laboratory within the laboratory report case narrative, data qualifiers, or cover sheet and should be evaluated using professional judgment (e.g., initial calibration, calibration verification, internal standards, post digestion, serial dilution).

Definitions to common QA/QC terms and terms used within this SOP along with a list of Barr 'Data Qualifiers/Footnotes' that may be applied during review can be found in Barr's "Compendium of Data Quality Assessment Documentation" included in Appendix C of the QAPP.

4.1 Holding Time and Preservation

The purpose of holding time and preservation evaluation is to ascertain the validity of the analytical results based on the sample condition, preservation, and time elapsed between the date of sample collection and date of analysis.

The recommended holding time and preservation acceptance criteria are listed in Tables 2 and 3 in the SAP and Tables 8 and 9 in the QAPP for soil and water respectively.

If samples do not meet holding time, preservation and analysis recommendations, consider qualification with an "**h**".

If the sample was stored on ice upon collection and delivered to the laboratory the same day, the sample may exceed recommended temperature at the time of laboratory receipt. Professional judgment should be applied (considering temperature, matrix, magnitude of the exceedance, etc.) when evaluating the application of qualifiers when criteria are not met.

4.2 Blank Samples

Blank sample evaluation is conducted to determine the existence and magnitude of target analyte contamination as a result of activities in the field during collection and transport or from inter-laboratory sources.

- While not required for all methods, method blanks are recommended for all analysis. Evaluation pertains to the batch of samples analyzed with the method blank.
- Field or equipment blank collection and analysis frequency is included in Table 5 in the QAPP. Evaluation pertains to the field samples associated with the field or equipment blank.
- Blank analyses may not have involved the same weights, volumes, or dilution factors as the associated samples. Data reviewers may have to obtain raw data and/or convert the data to the same units for comparison purposes.

Table 1 – Guidelines for Blank Contamination

Sample Result	**Recommended Action for Associated Data**
Non-detect	No action required
< 5x blank concentration	Qualify with 'b'
≥ 5x blank concentration	Use professional judgment

b = Reported value may be a potential false positive based on blank data evaluation procedures

Note: Other multipliers of the blank contamination may be used based on professional judgment (common lab contaminant, etc.)

Professional judgment regarding the usability of the data should be used in cases where gross detections of target analytes are found in the blank sample. A number of factors may be considered including historical data, prior knowledge of the site conditions, target analytes involved, type of blank sample, etc. In such cases, it may be appropriate to qualify the affected data with '*****' (estimated value, QA/QC criteria not met) or '******' (unusable value, QA/QC criteria not met).

4.3 Laboratory Control Samples (LCS) and Laboratory Control Sample Duplicate Samples (LCSD)

The laboratory control sample is used to monitor the overall performance of each step during analysis, including sample preparation. The LCS should be analyzed:

- Once every preparation batch (typically 20 or less samples of the same matrix).
- Once for each matrix.

Laboratory control samples contain a known amount of each target compound and the percent recoveries are evaluated based on the criteria listed in QAPP Tables 2 and 3 for soil and water respectively. Percent recoveries are calculated for accuracy and the relative percent difference (RPD) is calculated for precision (when an LCSD was analyzed). Accuracy and precision equations can be found in 'Definitions' from Barr's "Compendium of Data Quality Assessment Documentation" included in Appendix C of the QAPP.

Table 2 – Guidelines for Laboratory Control Samples

Criteria	Recommended Action for Associated Data	
	Detect	Non-Detect
%R and RPD > Upper Limit	Qualify with '*'	No qualification
%R < Lower Limit	Qualify with '*' or '**', use professional judgment	
%R and RPD within Limits	No qualification	

* = Reported value is estimated and QA/QC criteria were not met
** = Reported value is unusable and QA/QC criteria were not met

4.4 Laboratory Duplicate Samples

Laboratory duplicate samples are separate aliquots of field samples analyzed to demonstrate acceptable method precision by the laboratory at the time of analysis. Field blanks and proficiency testing (PT) samples should not be used for duplicate analysis. The RPDs are calculated using the equation as provided in 'Definitions' from Barr's "Compendium of Data Quality Assessment Documentation" included in Appendix C of the QAPP and are not calculated where data are already qualified with b, U, <, or **. RPD results are dependent on the homogeneity of the samples.

Duplicates should be analyzed (whichever is more frequent):

- One from each matrix (soil or water)
- One from each SDG

The MS/MSD duplicate pairs may be substituted for laboratory duplicates.

Laboratory acceptance criteria listed in QAPP Tables 2 and 3 for soil and water respectively are used to evaluate RPDs.

Higher RPDs are expected when results are at or near the reporting limits and are not always indicative of poor precision. RPDs are typically only evaluated for samples where both the native and duplicate sample

concentrations are greater than five times (>5x) the RL. In cases where either of the samples (native or duplicate) is non-detect for a parameter and the other corresponding sample has detectable concentrations much greater than five times (>5x) the RL, professional judgment should be used to determine if qualification is appropriate.

Table 3 – Guidelines for Laboratory Duplicates	
% RPD	**Recommended Action for Associated Data**
RPD < Upper Limit	No action is required
RPD > Upper Limit	Both results are ≤ 5x RL, no action is required
RPD > Upper Limit	Both results are > 5x RL, consider qualifying with '*****'

* = Reported value is estimated and QA/QC criteria were not met

4.5 Field Duplicate Samples

Field duplicate samples (also known as "masked" or "blind" duplicate samples) are used to demonstrate acceptable precision and reproducibility of the field and laboratory procedures. Frequency of collection is included in Table 5 of the QAPP. The RPDs are calculated using the equation as provided under precision in 'Definitions' from Barr's "Compendium of Data Quality Assessment Documentation" included in Appendix C of the QAPP and are not calculated where data is already qualified with b, U, <, or **. RPD results are dependent on the homogeneity of the samples.

Acceptance criteria for field duplicate samples are ≤ 40% RPD for soil and sediment samples and ≤ 30% RPD for aqueous samples and are considered acceptable as included in QAPP Tables 2 and 3 respectively.

Higher RPDs are expected when results are at or near the reporting limits and are not always indicative of poor precision. RPDs are typically only evaluated for samples where both the native and duplicate sample concentrations are greater than five times (>5x) the RL. In cases where either of the samples (native or field duplicate) is non-detect for a parameter and the other corresponding sample has detectable concentrations much greater than five times (>5x) the RL, professional judgment should be used to determine if qualification is appropriate.

4.6 Matrix Spikes (MS) and Matrix Spike Duplicate (MSD) Samples

Matrix spike samples contain a known amount of a target compound and provide information about the effect of each samples' matrix on the sample preparation procedures and analytical results. Matrix spikes are typically analyzed at the following frequencies:

- 1 (MS/MSD pair) in every 20 samples
- 1 per preparation batch per matrix
- 1 per SDG

The percent recoveries are evaluated based on the criteria listed in QAPP Tables 2 and 3 for soil and water respectively. If a matrix spike recovery does not meet acceptance criteria and is not associated with a project sample, no further action is required unless other systematic evidence warrants qualification.

If the native concentration of a spiked sample is significantly greater than the spike added (>4x), spike recovery cannot be accurately evaluated, therefore the criteria do not apply. Professional judgment should be used for percent recoveries nominally outside laboratory acceptance criteria prior to qualifying data.

Solid samples may have highly variable concentrations of target analytes and percent recoveries (%R) may be influenced by the sampling precision and inherent sample homogeneity. Professional judgment should be used for difficult matrices and the acceptance criteria adjusted accordingly.

Table 4 – Guidelines for Matrix Spikes

Criteria	**Recommended Action for Associated Data**	
	Detect	**Non-Detect**
%R and RPD > Upper Limit	Qualify with '*'	No qualification
%R < Lower Limit	Qualify with '*' or '**', use professional judgment	
%R and RPD within Limits	No qualification	

* = Reported value is estimated and QA/QC criteria were not met
** = Reported value is unusable and QA/QC criteria were not met

While matrix spike duplicates are not required by all methods, if results for MSD analyses are reported, evaluate the RPD for MS and MSD pairs using the equation as provided under precision in 'Definitions' from Barr's "Compendium of Data Quality Assessment Documentation" included in Appendix C of the QAPP.

4.7 Overall Assessment

The chain-of-custody should be reviewed to determine if the laboratory report matches the requested analyses and that project specific parameters were analyzed as requested. The narrative and other supporting documentation should be evaluated to ensure that sample condition was appropriately documented by the laboratory upon receipt. If available, historical data should be used to assist with data evaluation. Any additional anomalies should be documented and evaluated, if necessary.

5.0 Quality Control and Quality Assurance (QA/QC)

The data review may include the completion of a Routine Level Quality Control Report (see Barr's "Compendium of Data Quality Assessment Documentation" included in Appendix C of the QAPP) as part of the evaluation process. Within each QC data section, the reviewer should include references to whether the QC data met or exceeded the acceptance criteria. The qualifiers, added, removed, or retained, should be documented also. Where multiple qualifiers may be applicable to a sample/analyte result, professional judgment should be used to determine if all qualifiers are necessary or if one qualifier would be sufficient to represent the deviations. A statement as to whether the data are acceptable as reported or acceptable with qualification(s) should also be included. If revised reports are required and the revision affects the sample results, notification should be given to the appropriate data management personnel and/or project team members.

The Data Quality Specialist will verify that the qualifiers associated with data tables match the Routine Level Quality Control Report.

6.0 Records

The Routine Level Quality Control Report should be saved to the appropriate internal Barr file and the link uploaded to the tracking system. Periodically, Data Quality staff should check for missing Routine Level Quality Control Reports in the tracking system to help maintain the most current information.

Documentation specific to this SOP are listed below and are available in Barr's "Compendium of Data Quality Assessment Documentation" included in Appendix C of the QAPP.

- Definitions
- Barr Qualifiers/Footnotes
- Routine Level Quality Control Report

Additional records information can be found in Barr's "Records Management System Manual".

7.0 References

Analytical methods listed under the 'Scope and Applicability' section of this SOP.

BARR

Standard Operating Procedure – Yakima Mill Site

Routine Level Metals Data Evaluation

August 30, 2018

Approved By:

Dana Pasi		Dana Pasi	08/28/18
Print	QA Manager	Signature	Date

Routine Level Metals Data Evaluation

1.0 Scope and Applicability

This SOP is intended as a guidance document for the routine level evaluation of metals data provided by laboratories to be used in the Yakima Mill Site Project.

This SOP is based on quality assurance elements, not the specific criteria, of *USEPA Contract Laboratory Program National Functional Guidelines (NFG) for Inorganic Data* and applies to routine metals data evaluation for analyses by the following technology:

- Inductively Coupled Plasma/Mass Spectrometry (ICP/MS) - Method: EPA 6020

2.0 Limitations

- Level IV data evaluation is not covered in this SOP.

3.0 Responsibilities

The laboratory is responsible for generating data from the samples submitted for analysis. In instances where QC criteria are not met for the analysis of samples, the laboratory is responsible for reanalysis of the samples, provided reanalysis is possible (considering matrix interference, holding times and sample volume, etc.), or documenting the impact to the data.

The Data Quality Specialist is responsible for evaluating the data in accordance with this document, in addition to using professional judgment where necessary or appropriate. Also, project specific requirements, such as those specified in the Quality Assurance Project Plan (QAPP) and Sampling and Analysis Plan (SAP) should be applied before qualifying any data.

4.0 Procedure

The Quality Assurance/Quality Control (QA/QC) data detailed below are the most typical found in a routine level laboratory report. Other QA/QC data may be provided by the laboratory within the laboratory report case narrative, data qualifiers, or cover sheet and should be evaluated using professional judgment (e.g., initial calibration, calibration verification, internal standards, post digestion, serial dilution).

Definitions to common QA/QC terms and terms used within this SOP along with a list of Barr 'Data Qualifiers/Footnotes' that may be applied during review can be found in Barr's "Compendium of Data Quality Assessment Documentation" included in Appendix C of the QAPP.

4.1 Holding Time and Preservation

The purpose of holding time and preservation evaluation is to ascertain the validity of the analytical results based on the sample condition, preservation, and time elapsed between the date of sample collection and date of analysis.

The recommended holding time and preservation acceptance criteria are listed in Tables 2 and 3 in the SAP and Tables 8 and 9 in the QAPP for soil and water respectively.

If samples do not meet holding time, preservation and analysis recommendations consider qualification with an "**h**". Professional judgment should be applied (matrix, magnitude of the exceedance, etc.) when evaluating the application of qualifiers when criteria are not met.

4.2 Blank Samples

Blank sample evaluation is conducted to determine the existence and magnitude of target analyte contamination as a result of activities in the field during collection and transport or from inter-laboratory sources.

- For each matrix, at least one method blank should be prepared and analyzed with each sample delivery group (SDG), or each batch digested (whichever is more frequent). Evaluation pertains to the batch of samples analyzed with the method blank.
- Field or equipment blank collection and analysis frequency is included in Table 5 in the QAPP. Evaluation pertains to the field samples associated with the field or equipment blank.
- Blank analyses may not have involved the same weights, volumes, or dilution factors as the associated samples. Data reviewers may have to obtain raw data and/or convert the data to the same units for comparison purposes.

Table 2 – Guidelines for Blank Contamination

Sample Result	Recommended Action for Associated Data
Non-detect	No action required
< 5x blank concentration	Qualify with 'b'
≥ 5x blank concentration	Use professional judgment

b = Reported value may be a potential false positive based on blank data evaluation procedures

Note: Other multipliers of the blank contamination may be used based on professional judgment (common lab contaminant, etc.)

Professional judgment regarding the usability of the data should be used in cases where gross detections of target analytes are found in the blank sample. A number of factors may be considered including historical data, prior knowledge of the site conditions, target analytes involved, type of blank sample, etc. In such cases, it may be appropriate to qualify the affected data with '*****' (estimated value, QA/QC criteria not met) or '******' (unusable value, QA/QC criteria not met).

4.3 Laboratory Control Samples (LCS) and Laboratory Control Sample Duplicate Samples (LCSD)

The laboratory control sample is used to monitor the overall performance of each step during analysis, including sample preparation. The LCS should be analyzed:

- Once every preparation batch (typically 20 or less samples of the same matrix).
- Once for each matrix.

Laboratory control samples contain a known amount of each target compound and the percent recoveries are evaluated based on the criteria listed in QAPP Tables 2 and 3 for soil and water respectively. Percent recoveries are calculated for accuracy and the relative percent difference (RPD) is calculated for precision (when an LCSD was analyzed). Accuracy and precision equations can be found in 'Definitions' from Barr's "Compendium of Data Quality Assessment Documentation" included in Appendix C of the QAPP.

Table 3 – Guidelines for Laboratory Control Samples		
Criteria	**Recommended Action for Associated Data**	
	Detect	**Non-Detect**
%R and RPD > Upper Limit	Qualify with '*'	No qualification
%R < Lower Limit	Qualify with '*' or '**', use professional judgment	
%R and RPD within Limits	No qualification	

* = Reported value is estimated and QA/QC criteria were not met
** = Reported value is unusable and QA/QC criteria were not met

4.4 Laboratory Duplicate Samples

Laboratory duplicate samples are separate aliquots of field samples analyzed to demonstrate acceptable method precision by the laboratory at the time of analysis. Field blanks and proficiency testing (PT) samples should not be used for duplicate analysis. The RPDs are calculated using the equation as provided in 'Definitions' from Barr's "Compendium of Data Quality Assessment Documentation" included in Appendix C of the QAPP and are not calculated where data are already qualified with b, U, <, or **. RPD results are dependent on the homogeneity of the samples.

Duplicates should be analyzed (whichever is more frequent):

- One from each matrix (soil or water)
- One from each SDG

The MS/MSD duplicate pairs may be substituted for laboratory duplicates.

Laboratory acceptance criteria listed in QAPP Tables 2 and 3 for soil and water respectively are used to evaluate RPDs.

Higher RPDs are expected when results are at or near the reporting limits and are not always indicative of poor precision. RPDs are typically only evaluated for samples where both the native and duplicate sample concentrations are greater than five times (>5x) the RL. In cases where either of the samples (native or duplicate) is non-detect for a parameter and the other corresponding sample has detectable concentrations much greater than five times (>5x) the RL, professional judgment should be used to determine if qualification is appropriate.

Table 4 – Guidelines for Laboratory Duplicates	
% RPD	**Recommended Action for Associated Data**
RPD < Upper Limit	No action is required
RPD > Upper Limit	Both results are ≤ 5x RL, no action is required

RPD > Upper Limit	Both results are > 5x RL, consider qualifying with '*****'

* = Reported value is estimated and QA/QC criteria were not met

4.5 Field Duplicate Samples

Field duplicate samples (also known as "masked" or "blind" duplicate samples) are used to demonstrate acceptable precision and reproducibility of the field and laboratory procedures. Frequency of collection is included in Table 5 of the QAPP. The RPDs are calculated using the equation as provided under precision in 'Definitions' from Barr's "Compendium of Data Quality Assessment Documentation" included in Appendix C of the QAPP and are not calculated where data is already qualified with b, U, <, or **. RPD results are dependent on the homogeneity of the samples.

Acceptance criteria for field duplicate samples are ≤ 40% RPD for soil and sediment samples and ≤ 30% RPD for aqueous samples and are considered acceptable as included in QAPP Tables 2 and 3 respectively.

Higher RPDs are expected when results are at or near the reporting limits and are not always indicative of poor precision. RPDs are typically only evaluated for samples where both the native and duplicate sample concentrations are greater than five times (>5x) the RL. In cases where either of the samples (native or field duplicate) is non-detect for a parameter and the other corresponding sample has detectable concentrations much greater than five times (>5x) the RL, professional judgment should be used to determine if qualification is appropriate.

4.6 Matrix Spikes (MS) and Matrix Spike Duplicate (MSD) Samples

Matrix spike samples contain a known amount of a target compound and provide information about the effect of each samples' matrix on the sample preparation procedures and analytical results. Matrix spikes are typically analyzed at the following frequencies:

- 1 (MS/MSD pair) in every 20 samples
- 1 per preparation batch per matrix
- 1 per SDG

The percent recoveries are evaluated based on the criteria listed in QAPP Tables 2 and 3 for soil and water respectively. If a matrix spike recovery does not meet acceptance criteria and is not associated with a project sample, no further action is required unless other systematic evidence warrants qualification.

If the native concentration of a spiked sample is significantly greater than the spike added (>4x), spike recovery cannot be accurately evaluated, therefore the criteria do not apply. Professional judgment should be used for percent recoveries nominally outside laboratory acceptance criteria prior to qualifying data.

Solid samples may have highly variable concentrations of target analytes and percent recoveries (%R) may be influenced by the sampling precision and inherent sample homogeneity. Professional judgment should be used for difficult matrices and the acceptance criteria adjusted accordingly.

Table 5 – Guidelines for Matrix Spikes

Criteria	Recommended Action for Associated Data	
	Detect	Non-Detect
%R and RPD > Upper Limit	Qualify with '*'	No qualification
%R < Lower Limit	Qualify with '*' or '**', use professional judgment	
%R and RPD within Limits	No qualification	

* = Reported value is estimated and QA/QC criteria were not met

** = Reported value is unusable and QA/QC criteria were not met

While matrix spike duplicates are not required by the method, if results for MSD analyses are reported, evaluate the RPD for MS and MSD pairs using the equation as provided under precision in 'Definitions' from Barr's "Compendium of Data Quality Assessment Documentation" included in Appendix C of the QAPP.

4.7 Overall Assessment

The chain-of-custody should be reviewed to determine if the laboratory report matches the requested analyses and that project specific parameters were analyzed as requested. The narrative and other supporting documentation should be evaluated to ensure that sample condition was appropriately documented by the laboratory upon receipt. If available, historical data should be used to assist with data evaluation. Any additional anomalies should be documented and evaluated, if necessary.

5.0 Quality Control and Quality Assurance (QA/QC)

The data review may include the completion of a Routine Level Quality Control Report (see Barr's "Compendium of Data Quality Assessment Documentation" included in Appendix C of the QAPP) as part of the evaluation process. Within each QC data section, the reviewer should include references to whether the QC data met or exceeded the acceptance criteria. The qualifiers, added, removed, or retained, should be documented. Where multiple qualifiers may be applicable to a sample/analyte result, professional judgment should be used to determine if all qualifiers are necessary or if one qualifier would be sufficient to represent the deviations. A statement as to whether the data are acceptable as reported or acceptable with qualification(s) should also be included. If revised reports are required and the revision affects the sample results, notification should be given to the appropriate data management personnel and/or project team members.

The Data Quality Specialist will verify that the qualifiers associated with data tables match the Routine Level Quality Control Report.

6.0 Records

The Routine Level Quality Control Report should be saved to the appropriate internal Barr file and the link uploaded to the tracking system. Periodically, Data Quality staff should check for missing Routine Level Quality Control Reports in the tracking system to help maintain the most current information.

Documentation specific to this SOP are listed below and are available in Barr's "Compendium of Data Quality Assessment Documentation" included in Appendix C of the QAPP.

- Definitions
- Barr Qualifiers/Footnotes
- Routine Level Quality Control Report

Additional records information can be found in Barr's "Records Management System Manual".

7.0 References

Environmental Protection Agency, *National Functional Guidelines for Inorganic Superfund Data Review.*

Analytical methods listed under the 'Scope and Applicability' section of this SOP.

BARR

Standard Operating Procedure – Yakima Mill Site

Routine Level Polychlorinated Biphenyl (PCB), Aroclor, Pesticide, and Herbicide Data Evaluation

August 30, 2018

Approved By:

Dana Pasi

Dana Pasi

08/28/18

Print QA Manager Signature

Date

Minneapolis, MN ● Hibbing, MN ● Duluth, MN ● Ann Arbor, MI ● Jefferson City, MO ● Bismarck, ND ● Calgary, AB, Canada ● Grand Rapids, MI ● Salt Lake City, UT

Routine Level Polychlorinated Biphenyl (PCB), Aroclor, Pesticide, and Herbicide Data Evaluation

1.0 Scope and Applicability

This SOP is intended as a guidance SOP for the routine level evaluation of polychlorinated biphenyl (PCB), Aroclor, pesticide, and herbicide data provided by laboratories to be used in the Yakima Mill Site Project

This SOP is based on quality assurance elements, not the specific criteria, of *USEPA Contract Laboratory Program National Functional Guidelines (NFG) for Organic Data* and applies to routine level PCB, Aroclor, pesticide, and herbicide data evaluation for analyses by the following technologies:

- Gas Chromatography/Electron Capture Detector (GC/ECD)
    - Method examples: EPA 8081, EPA 8082
- GC/ECD for Herbicides
    - Method example: EPA 8151

The recommended procedures in this SOP should be followed unless conditions make it impractical or inappropriate to do so. Modifications should be noted in the applicable documentation and communicated to appropriate personnel. Significant changes may result in a revision or newly created SOP.

2.0 Limitations

- Level IV data evaluation is not covered in this SOP.

3.0 Responsibilities

The laboratory is responsible for generating data from the samples submitted for analysis. In instances where QC criteria are not met for the analysis of samples, the laboratory is responsible for reanalysis of the samples, provided reanalysis is possible (considering matrix interference, holding times and sample volume, etc.), or documenting the impact to the data.

The Data Quality Specialist is responsible for evaluating the data in accordance with this document, in addition to using professional judgment where necessary or appropriate. Also, project specific requirements, such as those specified in the Quality Assurance Project Plan (QAPP) and Sampling and Analysis Plan (SAP) should be applied before qualifying any data.

4.0 Procedure

The Quality Assurance/Quality Control (QA/QC) data detailed below are the most typical found in a routine level laboratory report. Other QA/QC data may be provided by the laboratory within the laboratory report case narrative, data qualifiers, or cover sheet and should be evaluated using professional judgment (e.g., initial calibration, calibration verification, internal standards).

Definitions to common QA/QC terms and terms used within this SOP along with a list of Barr 'Data Qualifiers/Footnotes' that may be applied during review can be found in Barr's "Compendium of Data Quality Assessment Documentation" included in Appendix C of the QAPP.

4.1 Holding Time and Preservation

The purpose of holding time and preservation evaluation is to ascertain the validity of the analytical results based on the sample condition, preservation, and time elapsed between the date of sample collection and date of analysis.

The recommended holding time and preservation acceptance criteria are listed in Tables 2 and 3 in the SAP and Tables 8 and 9 in the QAPP for soil and water respectively.

If samples do not meet holding time, preservation and analysis recommendations, consider qualification with an "**h**".

If the sample was stored on ice upon collection and delivered to the laboratory the same day, the sample may exceed recommended temperature at the time of laboratory receipt. Professional judgment should be applied (considering temperature, matrix, magnitude of the exceedance, etc.) when evaluating the application of qualifiers when criteria are not met.

4.2 Blank Samples

Blank sample evaluation is conducted to determine the existence and magnitude of target analyte contamination as a result of activities in the field during collection and transport or from inter-laboratory sources.

- For each matrix, at least one method blank should be prepared and analyzed with each sample delivery group (SDG). Evaluation pertains to the batch of samples analyzed with the method blank.
- Field or equipment blank collection and analysis frequency is included in Table 5 in the QAPP. Evaluation pertains to the field samples associated with the field or equipment blank.
- Blank analyses may not have involved the same weights, volumes, or dilution factors as the associated samples. It may be easier to work with the raw data and/or convert the data to the same units for comparison purposes.

Table 1 – Guidelines for Blank Contamination	
Sample Result	**Recommended Action for Associated Data**
Non-detect	No action required
< 5x blank concentration	Qualify with ‘b’
≥ 5x blank concentration	Use professional judgment

b = Reported value may be a potential false positive based on blank data evaluation procedures

Note: Other multipliers of the blank contamination may be used based on professional judgment (common lab contaminant, etc.)

Professional judgment regarding the usability of the data should be used in cases where gross detections of target analytes are found in the blank sample. A number of factors may be considered including historical data, prior knowledge of the site conditions, target analytes involved, type of blank sample, etc. In such cases, it may be appropriate to qualify the affected data with ‘*****’ (estimated value, QA/QC criteria not met) or ‘******’ (unusable value, QA/QC criteria not met).

4.3 Surrogates

Surrogates are similar to analytes of interest in chemical composition, extraction, and chromatography but are not typically found in environmental samples. All samples (blanks, spiked samples, project samples, QC samples) should contain surrogates. If a sample does not contain surrogates, professional judgment should be used to determine if the reported results are useable or not. Acceptable evaluation of surrogate spikes may not be applicable if dilution of the sample was required. Percent recoveries are calculated for each surrogate and these are evaluated based on the criteria within the laboratory report. Percent recoveries are calculated using the equation provided under accuracy in ‘Definitions’ from Barr’s “Compendium of Data Quality Assessment Documentation” included in Appendix C of the QAPP.

Table 2 includes guidance to evaluate the surrogate recovery where a single surrogate is analyzed.

Table 2 – Guidelines for Single Surrogate		
Criteria	**Recommended Action for Associated Data**	
	Detect	**Non-Detect**
%R > Upper Limit	Qualify with ‘*’	No qualification
%R < Lower Limit	Qualify with ‘*’ or ‘**’, use professional judgment	
%R within Limits	No qualification	

‘*’ = reported value is estimated and QA/QA criteria were not met
‘**’ = reported value is unusable and QA/QC criteria were not met

Table 3 includes guidance where multiple surrogates are analyzed.

Table 3 – Guidelines for Multiple Surrogates		
Criteria	**Recommended Action for Associated Data**	
	Detect	**Non-Detect**
One %R < Lower Limit	No qualification may be necessary, use professional judgment	
Two or more %R < Lower Limit	Qualify with '*' or '**', use professional judgment	
Two or more %R > Upper Limit	Qualify fraction with '*'	No qualification
One %R > Upper Limit	No qualification may be necessary, use professional judgment	No qualification
All %R within Limits	No qualification	

'*' = Reported value is estimated and QA/QA criteria were not met
'**' = Reported value is unusable and QA/QC criteria were not met

4.4 Laboratory Control Samples (LCS) and Laboratory Control Sample Duplicate Samples (LCSD)

The laboratory control sample is used to monitor the overall performance of each step during analysis, including sample preparation. The LCS should be analyzed:

- Once every preparation batch (typically 20 or less samples of the same matrix).
- Once for each matrix.

Laboratory control samples may contain all target compounds or a subset (see *Table 4* for guidance) and the percent recoveries are evaluated based on the criteria listed in QAPP Tables 2 and 3 for soil and water respectively. Percent recoveries are calculated for accuracy and the relative percent difference (RPD) is calculated for precision (when an LCSD was analyzed). Accuracy and precision equations can be found in 'Definitions' from Barr's "Compendium of Data Quality Assessment Documentation" included in Appendix C of the QAPP.

Table 4 – Number of Suggested Target Compounds - LCS/LCSD and MS/MSD	
Number of Target Parameters	**Number of Spiked Compounds**
1-10 analytes	Spike all compounds
11-20 analytes	At least 10 compounds or 80% of all analytes, whichever is greater
More than 20 analytes	Spike at least 16 compounds

Table 5 – Guidelines for Laboratory Control Samples

Criteria	Recommended Action for Associated Data	
	Detect	**Non-Detect**
%R and RPD > Upper Limit	Qualify with '*'	No qualification
%R < Lower Limit	Qualify with '*' or '**', use professional judgment	
%R and RPD within Limits	No qualification	

'*' = Reported value is estimated and QA/QA criteria were not met
'**' = Reported value is unusable and QA/QC criteria were not met

4.5 Laboratory Duplicate Samples

Laboratory duplicate samples are separate aliquots of field samples analyzed to demonstrate acceptable method precision by the laboratory at the time of analysis. Field blanks and proficiency testing (PT) samples should not be used for duplicate analysis. The RPDs are calculated using the equation as provided in 'Definitions' from Barr's "Compendium of Data Quality Assessment Documentation" included in Appendix C of the QAPP and are not calculated where data are already qualified with b, U, <, or **. RPD results are dependent on the homogeneity of the samples.

Duplicates should be analyzed (whichever is more frequent):

- One from each matrix (soil or water)
- One from each SDG

The MS/MSD duplicate pairs may be substituted for laboratory duplicates.

Laboratory acceptance criteria listed in QAPP Tables 2 and 3 for soil and water respectively are used to evaluate RPDs.

Higher RPDs are expected when results are at or near the reporting limits and are not always indicative of poor precision. RPDs are typically only evaluated for samples where both the native and duplicate sample concentrations are greater than five times (>5x) the RL. In cases where either of the samples (native or duplicate) is non-detect for a parameter and the other corresponding sample has detectable concentrations much greater than five times (>5x) the RL, professional judgment should be used to determine if qualification is appropriate.

Table 6 – Guidelines for Laboratory Duplicates

% RPD	Recommended Action for Associated Data
RPD < Upper Limit	No action is required
RPD > Upper Limit	Both results are ≤ 5x RL, no action is required
RPD > Upper Limit	Both results are > 5x RL, consider qualifying with '*****'

* = Reported value is estimated and QA/QC criteria were not met

4.6 Field Duplicate Samples

Field duplicate samples (also known as “masked” or “blind” duplicate samples) are used to demonstrate acceptable precision and reproducibility of the field and laboratory procedures. Frequency of collection is included in Table 5 of the QAPP. The RPDs are calculated using the equation as provided under precision in ‘Definitions’ from Barr’s “Compendium of Data Quality Assessment Documentation” included in Appendix C of the QAPP and are not calculated where data is already qualified with b, U, <, or **. RPD results are dependent on the homogeneity of the samples.

Acceptance criteria for field duplicate samples are ≤ 40% RPD for soil and sediment samples and ≤ 30% RPD for aqueous samples and are considered acceptable as included in QAPP Tables 2 and 3 respectively.

Higher RPDs are expected when results are at or near the reporting limits and are not always indicative of poor precision. RPDs are typically only evaluated for samples where both the native and duplicate sample concentrations are greater than five times (>5x) the RL. In cases where either of the samples (native or field duplicate) is non-detect for a parameter and the other corresponding sample has detectable concentrations much greater than five times (>5x) the RL, professional judgment should be used to determine if qualification is appropriate.

4.7 Matrix Spikes (MS) and Matrix Spike Duplicate (MSD) Samples

Matrix spike samples may contain all target compounds or a subset (see *Table 4*) and provide information about the effect of each samples’ matrix on the sample preparation procedures and analytical results. Matrix spikes are typically analyzed at the following frequencies:

- 1 (MS/MSD pair) in every 20 samples
- 1 per preparation batch per matrix
- 1 per SDG

The percent recoveries are evaluated based on the criteria listed in QAPP Tables 2 and 3 for soil and water respectively. If a matrix spike recovery does not meet acceptance criteria and is not associated with a project sample, no further action is required unless other systematic evidence warrants qualification.

If the native concentration of a spiked sample is significantly greater than the spike added (>4x), spike recovery cannot be accurately evaluated, therefore the criteria do not apply. Professional judgment should be used for percent recoveries nominally outside laboratory acceptance criteria prior to qualifying data.

Solid samples may have highly variable concentrations of target analytes and percent recoveries (%R) may be influenced by the sampling precision and inherent sample homogeneity. Professional judgment should be used for difficult matrices and the acceptance criteria adjusted accordingly.

Table 7 – Guidelines for Matrix Spikes		
Criteria	**Recommended Action for Associated Data**	
	Detect	**Non-Detect**
%R and RPD > Upper Limit	Qualify with '*'	No qualification
%R < Lower Limit	Qualify with '*' or '**', use professional judgment	
%R and RPD within Limits	No qualification	

'*' = Reported value is estimated and QA/QA criteria were not met
'**' = Reported value is unusable and QA/QC criteria were not met

While matrix spike duplicates are not required by all methods, if results for MSD analyses are reported, evaluate the RPD for MS and MSD pairs using the equation as provided under precision in 'Definitions' from Barr's "Compendium of Data Quality Assessment Documentation" included in Appendix C of the QAPP.

4.8 Overall Assessment

The chain-of-custody should be reviewed to determine if the laboratory report matches the requested analyses and that project specific parameters were analyzed as requested. The narrative and other supporting documentation should be evaluated to ensure that sample condition was appropriately documented by the laboratory upon receipt. If available, historical data should be used to assist with data evaluation. Any additional anomalies should be documented and evaluated, if necessary.

5.0 Quality Control and Quality Assurance (QA/QC)

The data review may include the completion of a Routine Level Quality Control Report (see Barr's "Compendium of Data Quality Assessment Documentation" included in Appendix C of the QAPP) as part of the evaluation process. Within each QC data section, the reviewer should include references to whether the QC data met or exceeded the acceptance criteria. The qualifiers, added, removed, or retained, should be documented also. Where multiple qualifiers may be applicable to a sample/analyte result, professional judgment should be used to determine if all qualifiers are necessary or if one qualifier would be sufficient to represent the deviations. A statement as to whether the data are acceptable as reported or acceptable with qualification(s) should also be included. If revised reports are required and the revision affects the sample results, notification should be given to the appropriate data management personnel and/or project team members.

The Data Quality Specialist will verify that the qualifiers associated with data tables match the Routine Level Quality Control Report.

6.0 Records

The Routine Level Quality Control Report should be saved to the appropriate internal Barr file and the link uploaded to the tracking system. Periodically, Data Quality staff should check for missing Routine Level Quality Control Reports in the tracking system to help maintain the most current information.

Documentation specific to this SOP are listed below and are available in Barr's "Compendium of Data Quality Assessment Documentation" included in Appendix C of the QAPP.

- Definitions
- Barr Qualifiers/Footnotes
- Routine Level Quality Control Report

Additional records information can be found in Barr's "Records Management System Manual".

7.0 References

Environmental Protection Agency, *National Functional Guidelines for Superfund Organic Methods Data Review.*

Analytical methods listed under the 'Scope and Applicability' section of this SOP.

Standard Operating Procedure – Yakima Mill Site

Routine Level Semivolatile Organic Compounds (SVOC) and Diesel and Heavy Oil Data Evaluation

August 30, 2018

Approved By:

Dana Pasi	Dana Pasi	08/28/18
Print QA Manager	Signature	Date

Routine Level Semivolatile Organic Compounds (SVOC) and Diesel and Heavy Oil Data Evaluation

1.0 Scope and Applicability

This SOP is intended as a guidance SOP for the routine level evaluation of semivolatile organic compounds data provided by laboratories to be used in the Yakima Mill Site Project.

This SOP is based on quality assurance elements, not the specific criteria, of *USEPA Contract Laboratory Program National Functional Guidelines (NFG) for Organic Data* and applies to routine and diesel and heavy oil data evaluation for analyses by the following technologies:

- Gas Chromatography/Flame Ionization Detector (GC/FID) - Method: NWTPH-Dx
- Gas Chromatography/Mass Spectrometry (GC/MS) – Method: EPA 8270
- Gas Chromatography/Mass Spectrometry-Selective Ion Monitoring (GC/MS-SIM) – Method: EPA 8270

In the case of specific technologies and/or methods not listed above, the guidelines within this document will provide the basis upon which to make adequate professional judgment in the evaluation of data submitted for review.

The recommended procedures in this SOP should be followed unless conditions make it impractical or inappropriate to do so. Modifications should be noted in the applicable documentation and communicated to appropriate personnel. Significant changes may result in a revision or newly created SOP.

2.0 Limitations

- Level IV data evaluation is not covered in this SOP.

3.0 Responsibilities

The laboratory is responsible for generating data from the samples submitted for analysis. In instances where QC criteria are not met for the analysis of samples, the laboratory is responsible for reanalysis of the samples, provided reanalysis is possible (considering matrix interference, holding times and sample volume, etc.), or documenting the impact to the data.

The Data Quality Specialist is responsible for evaluating the data in accordance with this document, in addition to using professional judgment where necessary or appropriate. Also, project specific requirements, such as those specified in the Quality Assurance Project Plan (QAPP) or Sampling and Analysis Plan (SAP), should be applied before qualifying any data.

4.0 Procedure

The Quality Assurance/Quality Control (QA/QC) data detailed below are the most typical found in a routine level laboratory report. Other QA/QC data may be provided by the laboratory within the laboratory report case narrative, data qualifiers, or cover sheet and should be evaluated using professional judgment (e.g., initial calibration, calibration verification, internal standards).

Definitions to common QA/QC terms and terms used within this SOP along with a list of Barr 'Data Qualifiers/Footnotes' that may be applied during review can be found in Barr's "Compendium of Data Quality Assessment Documentation" included in Appendix C of the QAPP.

4.1 Holding Time and Preservation

The purpose of holding time and preservation evaluation is to ascertain the validity of the analytical results based on the sample condition, preservation, and time elapsed between the date of sample collection and date of analysis.

The recommended holding time and preservation acceptance criteria are listed in Tables 2 and 3 in the SAP and Tables 8 and 9 in the QAPP for soil and water respectively.

If samples do not meet holding time, preservation and analysis recommendations, consider qualification with an "**h**".

If the sample was stored on ice upon collection and delivered to the laboratory the same day, the sample may exceed recommended temperature at the time of laboratory receipt. Professional judgment should be applied (considering temperature, matrix, magnitude of the exceedance, etc.) when evaluating the application of qualifiers when criteria are not met.

4.2 Blank Samples

Blank sample evaluation is conducted to determine the existence and magnitude of target analyte contamination as a result of activities in the field during collection and transport or from inter-laboratory sources.

- For each matrix, at least one method blank should be prepared and analyzed with each sample delivery group (SDG). Evaluation pertains to the batch of samples analyzed with the method blank.
- Field or equipment blank collection and analysis frequency is included in Table 5 in the QAPP. Evaluation pertains to the field samples associated with the field or equipment blank.
- Blank analyses may not have involved the same weights, volumes, or dilution factors as the associated samples. It may be easier to work with the raw data and/or convert the data to the same units for comparison purposes.

Table 1 – Guidelines for Blank Contamination

Sample Result	Recommended Action for Associated Data
Non-detect	No action required
< 5x blank concentration	Qualify with 'b'
≥ 5x blank concentration	Use professional judgment

b = Reported value may be a potential false positive based on blank data evaluation procedures

Note: Other multipliers of the blank contamination may be used based on professional judgment (common lab contaminant, etc.)

Professional judgment regarding the usability of the data should be used in cases where gross detections of target analytes are found in the blank sample. A number of factors may be considered including historical data, prior knowledge of the site conditions, target analytes involved, type of blank sample, etc. In such cases, it may be appropriate to qualify the affected data with '*****' (estimated value, QA/QC criteria not met) or '******' (unusable value, QA/QC criteria not met).

4.3 Deuterated Monitoring Compounds (DMC) and Surrogates

DMCs are isotopically labeled (deuterated) analogs of native target compounds. DMCs are only used for the SVOC GC/MS analysis. *Table 2* presents the recommended DMCs with their associated target compounds.

Table 2 – DMC and Associated Target Compounds

DMC (alphabetical)	Associated Target Compounds	
2,4-Dichlorophenol-d$_3$	2,4-Dichlorophenol Hexachlorobutadiene 4-Chloro-3-methylphenol 2,4,6-Trichlorophenol	2,4,5-Trichlorophenol 1,2,4,5-Tetrachlorobenzene Pentachlorophenol 2,3,4,6-Tetrachlorophenol
2-Chlorophenol-d$_4$	2-Chlorophenol	
2-Nitrophenol-d$_4$	Isophorone	2-Nitrophenol
4-6-Dinitro-2-methylphenol-d$_2$	4,6-Ditritro-2-methylphenol	
4-Chloroaniline-d$_4$	4-Chloroaniline Hexachlorocyclopentadiene	3,3'-Dichlorobenzidine
4-Methylphenol-d$_8$	2-Methylphenol 4-Methylphenol	2,4-Dimethylphenol
4-Nitrophenol-d$_4$	2-Nitroaniline 3-Nitroaniline 2,4-Dinitrophenol	4-Nitrophenol 4-Nitroaniline
Acenaphthylene-d$_8$	Naphthalene 2-Methylnaphthalene 2-Chloronapthalene	Acenaphthylene Acenaphthene
Anthracene-d$_{10}$	Hexachlorobenzene Atrazine	Phenanthrene Anthracene
Benzo(a)pyrene-d$_{12}$	Benzo(b)fluoranthene Benzo(k)fluoranthene Benzo(a)pyrene	Indeno(1,2,3-cd)pyrene Dibenzo(a,h)anthracene Benzo(g,h,i)perylene
Bis-(2-chloroethyl) ether-d$_8$	Bis-(2-chloroethyl) ether 2,2'-oxybis(1-chloropropane)*	bis(2-Choloethoxy) methane
Dimethylphthalate-d$_6$	Caprolactum 1,1'-Biphenyl	Di-n-butylphthalate Butylbenzylphthalate

Table 2 – DMC and Associated Target Compounds

DMC (alphabetical)	Associated Target Compounds	
	Dimethylphthalate Diethylphthalate	bis(2-ethylhexyl)phthalate Di-n-octylphthalate
Fluorene-d_{10}	Dibenzofuran Fluorene 4-Chlorophenyl-phenylether	4-Bromophenyl-phenylether Carbazole
Nitrobenzene-d_5	Acetophenone N-Nitroso-di-n-propylamine Hexachloroethane Nitrobenzene	2,6-Dinitrotoluene 2,4-Dinitrotoluene N-Nitrosdiphenylamine
Phenol-d_5	Benzaldehyde	Phenol
Pyrene-d_{10}	Fluoranthrene Pyrene	Benzo(a)anthracene Chrysene
SIM DMC and Associated Target Compounds		
Fluoranthene-d_{10}	Fluoranthene Pyrene Benzo(a)anthracene Chrysene Benzo(b)fluoranthene	Benzo(k)fluoranthene Benzo(a)pyrene Indeno(1,2,3-cd)pyrene Dibenzo(a,h)anthracene Benzo(g,h,i)perylene
2-Methylnaphthalene-d_{10}	Naphthalene 2-Methylnaphthalene Acenaphthylene Acenaphthene	Fluorene Pentachlorophenol Phenanthrene Anthracene

* = Bis(2-chloroisopropyl)ether

Surrogates are similar to analytes of interest in chemical composition, extraction, and chromatography but are not typically found in environmental samples. Other DMC or surrogates may be used by a laboratory based on their experience provided adequate chromatographic separations can be demonstrated. All samples (blanks, spiked samples, project samples, QC samples) should contain DMC or surrogates. Acceptable evaluation of DMC or surrogate spikes may not be applicable if dilution of the sample was required. Percent recoveries are calculated for each DMC or surrogate and these are evaluated based on the criteria within the laboratory report. Percent recoveries are calculated using the equation provided under accuracy in 'Definitions' from Barr's "Compendium of Data Quality Assessment Documentation" included in Appendix C of the QAPP.

Table 3 includes guidance to evaluate the surrogate recovery where a single surrogate is analyzed.

Table 3 – Guidelines for Single DMC or Surrogate		
Criteria	**Recommended Action for Associated Data**	
	Detect	**Non-Detect**
%R > Upper Limit	Qualify with '*'	No qualification
%R < Lower Limit	Qualify with '*' or '**', use professional judgment	
%R within Limits	No qualification	

'*' = reported value is estimated and QA/QA criteria were not met
'**' = reported value is unusable and QA/QC criteria were not met

Table 4 includes guidance where multiple surrogates are analyzed per analytical fraction.

Table 4 – Guidelines for Multiple DMC or Surrogates		
Criteria	**Recommended Action for Associated Data**	
	Detect	**Non-Detect**
One %R < Lower Limit	No qualification may be necessary, use professional judgment	
Two or more %R < Lower Limit	Qualify with '*' or '**', use professional judgment	
Two or more %R > Upper Limit	Qualify fraction with '*'	No qualification
One %R > Upper Limit	No qualification may be necessary, use professional judgment	No qualification
All %R within Limits	No qualification	

'*' = reported value is estimated and QA/QA criteria were not met
'**' = reported value is unusable and QA/QC criteria were not met

4.4 Laboratory Control Samples (LCS) and Laboratory Control Sample Duplicate Samples (LCSD)

The laboratory control sample is used to monitor the overall performance of each step during analysis, including sample preparation. The LCS should be analyzed:

- Once every preparation batch
- Once for each matrix.

Laboratory control samples may contain all target compounds or a subset (see *Table 5* for guidance) and the percent recoveries are evaluated based on the criteria listed in QAPP Tables 2 and 3 for soil and water respectively. Percent recoveries are calculated for accuracy and the relative percent difference (RPD) is calculated for precision (when an LCSD was analyzed). Accuracy and precision equations can be found in 'Definitions' from Barr's "Compendium of Data Quality Assessment Documentation" included in Appendix C of the QAPP.

Table 5 – Number of Suggested Target Compounds - LCS/LCSD and MS/MSD

Number of Target Parameters	Number of Spiked Compounds
1-10 analytes	Spike all compounds
11-20 analytes	At least 10 compounds or 80% of all analytes, whichever is greater
More than 20 analytes	Spike at least 16 compounds

Table 6 – Guidelines for Laboratory Control Samples

Criteria	Recommended Action for Associated Data	
	Detect	Non-Detect
%R and RPD > Upper Limit	Qualify with ‘*’	No qualification
%R < Lower Limit	Qualify with ‘*’ or ‘**’, use professional judgment	
%R and RPD within Limits	No qualification	

* = Reported value is estimated and QA/QC criteria were not met
** = Reported value is unusable and QA/QC criteria were not met

4.5 Laboratory Duplicate Samples

Laboratory duplicate samples are separate aliquots of field samples analyzed to demonstrate acceptable method precision by the laboratory at the time of analysis. Field blanks and proficiency testing (PT) samples should not be used for duplicate analysis. The RPDs are calculated using the equation as provided in ‘Definitions’ from Barr’s “Compendium of Data Quality Assessment Documentation” included in Appendix C of the QAPP and are not calculated where data are already qualified with b, U, <, or **. RPD results are dependent on the homogeneity of the samples.

Duplicates should be analyzed (whichever is more frequent):

- One from each matrix (soil or water)
- One from each SDG

The MS/MSD duplicate pairs may be substituted for laboratory duplicates.

Laboratory acceptance criteria listed in QAPP Tables 2 and 3 for soil and water respectively are used to evaluate RPDs.

Higher RPDs are expected when results are at or near the reporting limits and are not always indicative of poor precision. RPDs are typically only evaluated for samples where both the native and duplicate sample concentrations are greater than five times (>5x) the RL. In cases where either of the samples (native or duplicate) is non-detect for a parameter and the other corresponding sample has detectable

concentrations much greater than five times (>5x) the RL, professional judgment should be used to determine if qualification is appropriate.

Table 7 – Guidelines for Laboratory Duplicates	
% RPD	**Recommended Action for Associated Data**
RPD < Upper Limit	No action is required
RPD > Upper Limit	Both results are ≤ 5x RL, no action is required
RPD > Upper Limit	Both results are > 5x RL, consider qualifying with '*****'

* = Reported value is estimated and QA/QC criteria were not met

4.6 Field Duplicate Samples

Field duplicate samples (also known as "masked" or "blind" duplicate samples) are used to demonstrate acceptable precision and reproducibility of the field and laboratory procedures. Frequency of collection is included in Table 5 of the QAPP. The RPDs are calculated using the equation as provided under precision in 'Definitions' from Barr's "Compendium of Data Quality Assessment Documentation" included in Appendix C of the QAPP and are not calculated where data is already qualified with b, U, <, or **. RPD results are dependent on the homogeneity of the samples.

Acceptance criteria for field duplicate samples are ≤ 40% RPD for soil and sediment samples and ≤ 30% RPD for aqueous samples and are considered acceptable as included in QAPP Tables 2 and 3 respectively.

Higher RPDs are expected when results are at or near the reporting limits and are not always indicative of poor precision. RPDs are typically only evaluated for samples where both the native and duplicate sample concentrations are greater than five times (>5x) the RL. In cases where either of the samples (native or field duplicate) is non-detect for a parameter and the other corresponding sample has detectable concentrations much greater than five times (>5x) the RL, professional judgment should be used to determine if qualification is appropriate.

4.7 Matrix Spikes (MS) and Matrix Spike Duplicate (MSD) Samples

Matrix spike samples may contain all target compounds or a subset (see *Table 5*) and provide information about the effect of each samples' matrix on the sample preparation procedures and analytical results. Matrix spikes are typically analyzed at the following frequencies:

- 1 (MS/MSD pair) in every 20 samples
- 1 per preparation batch per matrix
- 1 per SDG

The percent recoveries are evaluated based on the criteria listed in QAPP Tables 2 and 3 for soil and water respectively. If a matrix spike recovery does not meet acceptance criteria and is not associated with a project sample, no further action is required unless other systematic evidence warrants qualification.

If the native concentration of a spiked sample is significantly greater than the spike added (>4x), spike recovery cannot be accurately evaluated, therefore the criteria do not apply. Professional judgment should be used for percent recoveries nominally outside laboratory acceptance criteria prior to qualifying data.

Solid samples may have highly variable concentrations of target analytes and percent recoveries (%R) may be influenced by the sampling precision and inherent sample homogeneity. Professional judgment should be used for difficult matrices and the acceptance criteria adjusted accordingly.

Table 8 – Guidelines for Matrix Spikes

Criteria	Recommended Action for Associated Data	
	Detect	Non-Detect
%R and RPD > Upper Limit	Qualify with '*'	No qualification
%R < Lower Limit	Qualify with '*' or '**', use professional judgment	
%R and RPD within Limits	No qualification	

* = Reported value is estimated and QA/QC criteria were not met
** = Reported value is unusable and QA/QC criteria were not met

While matrix spike duplicates are not required by all methods, if results for MSD analyses are reported, evaluate the RPD for MS and MSD pairs using the equation as provided under precision in 'Definitions' from Barr's "Compendium of Data Quality Assessment Documentation" included in Appendix C of the QAPP.

4.8 Overall Assessment

The chain-of-custody should be reviewed to determine if the laboratory report matches the requested analyses and that project specific parameters were analyzed as requested. The narrative and other supporting documentation should be evaluated to ensure that sample condition was appropriately documented by the laboratory upon receipt. If available, historical data should be used to assist with data evaluation. Any additional anomalies should be documented and evaluated, if necessary.

5.0 Quality Control and Quality Assurance (QA/QC)

The data review may include the completion of a Routine Level Quality Control Report (see Barr's "Compendium of Data Quality Assessment Documentation" included in Appendix C of the QAPP) as part of the evaluation process. Within each QC data section, the reviewer should include references to whether the QC data met or exceeded the acceptance criteria. The qualifiers, added, removed, or retained, should be documented also. Where multiple qualifiers may be applicable to a sample/analyte result, professional judgment should be used to determine if all qualifiers are necessary or if one qualifier would be sufficient to represent the deviations. A statement as to whether the data are acceptable as reported or acceptable with qualification(s) should also be included. If revised reports are required and the revision affects the sample results, notification should be given to the appropriate data management personnel and/or project team members.

The Data Quality Specialist will verify that the qualifiers associated with data tables match the Routine Level Quality Control Report.

6.0 Records

The Routine Level Quality Control Report should be saved to the appropriate internal Barr file and the link uploaded to the tracking system. Periodically, Data Quality staff should check for missing Routine Level Quality Control Reports in the tracking system to help maintain the most current information.

Documentation specific to this SOP are listed below and are available in Barr's "Compendium of Data Quality Assessment Documentation" included in Appendix C of the QAPP.

- Definitions
- Barr Qualifiers/Footnotes
- Routine Level Quality Control Report

Additional records information can be found in Barr's "Records Management System Manual".

7.0 References

Environmental Protection Agency, *National Functional Guidelines for Superfund Organic Methods Data Review*.

Analytical methods listed under the 'Scope and Applicability' section of this SOP.

BARR

Standard Operating Procedure – Yakima Mill Site

Routine Level Volatile Organic Compounds (VOC) and Gasoline Data Evaluation

August 30, 2018

Approved By:

Dana Pasi		Dana Pasi	08/28/18
Print	QA Manager	Signature	Date

Routine Level Volatile Organic Compounds (VOC) and Gasoline Data Evaluation

1.0 Scope and Applicability

This SOP is intended as a guidance SOP for the routine level evaluation of VOC and Gasoline data provided by laboratories to be used the Yakima Mill Site Project.

This SOP is based on quality assurance elements, not the specific criteria, of *USEPA Contract Laboratory Program National Functional Guidelines (NFG) for Organic Data* and applies to routine VOC and gasoline data evaluation for analyses by the following technologies:

- Gas Chromatography/Flame Ionization Detector (GC/FID) – Method: NWTPH-Gx
- Gas Chromatography/Mass Spectrometry (GC/MS) – Method: EPA 8260

The recommended procedures in this SOP should be followed unless conditions make it impractical or inappropriate to do so. Modifications should be noted in the applicable documentation and communicated to appropriate personnel. Significant changes may result in a revision or newly created SOP.

2.0 Limitations

- Level IV data evaluation is not covered in this SOP.

3.0 Responsibilities

The laboratory is responsible for generating data from the samples submitted for analysis. In instances where QC criteria are not met for the analysis of samples, the laboratory is responsible for reanalysis of the samples, provided reanalysis is possible (considering matrix interference, holding times and sample volume, etc.), or documenting the impact to the data.

The Data Quality Specialist is responsible for evaluating the data in accordance with this document, in addition to using professional judgment where necessary or appropriate. Also, project specific requirements, such as those specified in the Quality Assurance Project Plan (QAPP) and Sampling and Analysis Plan (SAP), should be applied before qualifying any data.

4.0 Procedure

The Quality Assurance/Quality Control (QA/QC) data detailed below are the most typical found in a routine level laboratory report. Other QA/QC data may be provided by the laboratory within the laboratory report case narrative, data qualifiers, or cover sheet and should be evaluated using professional judgment (e.g., initial calibration, calibration verification, internal standards).

Definitions to common QA/QC terms and terms used within this SOP along with a list of Barr 'Data Qualifiers/Footnotes' that may be applied during review can be found in Barr's "Compendium of Data Quality Assessment Documentation" included in Appendix C of the QAPP.

4.1 Holding Time and Preservation

The purpose of holding time and preservation evaluation is to ascertain the validity of the analytical results based on the sample condition, preservation, and time elapsed between the date of sample collection and date of analysis.

The recommended holding time and preservation acceptance criteria are listed in Tables 2 and 3 in the SAP and Tables 8 and 9 in the QAPP for soil and water respectively.

If samples do not meet holding time, preservation and analysis recommendations, consider qualification with an "**h**".

If the sample was stored on ice upon collection and delivered to the laboratory the same day, the sample may exceed recommended temperature at the time of laboratory receipt. Professional judgment should be applied (considering temperature, matrix, magnitude of the exceedance, etc.) when evaluating the application of qualifiers when criteria are not met.

4.2 Blank Samples

Blank sample evaluation is conducted to determine the existence and magnitude of target analyte contamination as a result of activities in the field during collection and transport or from inter-laboratory sources.

- For each matrix, at least one method blank should be prepared and analyzed with each sample delivery group (SDG) – laboratories should analyze a method blank at least once every 12 hours. Evaluation pertains to the batch of samples analyzed with the method blank.
- Field or equipment blank collection and analysis frequency is included in Table 5 in the QAPP. Evaluation pertains to the field samples associated with the field or equipment blank.
- Trip blanks should be placed in each transport cooler containing VOC sample containers prior to shipment into the field and remain with the associated VOC samples submitted to the laboratory for VOC analysis; including sample storage through analysis.
- Blank analyses may not have involved the same weights, volumes, or dilution factors as the associated samples. It may be easier to work with the raw data and/or convert the data to the same units for comparison purposes.

Table 1 – Guidelines for Blank Contamination

Sample Result	Recommended Action for Associated Data
Non-detect	No action required
< 5x blank concentration	Qualify with 'b'
≥ 5x blank concentration	Use professional judgment

b = Reported value may be a potential false positive based on blank data evaluation procedures

Note: Other multipliers of the blank contamination may be used based on professional judgment (common lab contaminant, etc.)

Professional judgment regarding the usability of the data should be used in cases where gross detections of target analytes are found in the blank sample. A number of factors may be considered including historical data, prior knowledge of the site conditions, target analytes involved, type of blank sample, etc. In such cases, it may be appropriate to qualify the affected data with '*****' (estimated value, QA/QC criteria not met) or '******' (unusable value, QA/QC criteria not met).

4.3 Deuterated Monitoring Compounds (DMC) and Surrogates

DMCs are isotopically labeled (deuterated) analogs of native target compounds. DMCs are only used for the VOC GC/MS analysis. *Table 2* presents the recommended DMCs with their associated target compounds.

Table 2 –DMC and Associated Target Compounds

DMC (alphabetical)	**Associated Target Compounds**	
1,1,2,2-Tetrachloroethane-d_2	1,1,2,2-Tetrachloroethane	1,2-Dibromo-3-chloropropane
1,1-Dichloroethane-d_2	trans-1,2-Dichloroethene	cis-1,2-Dichloroethene
	1,1-Dichloroethene	
1,2-Dichlorobenzene-d_4	Chlorobenzene	1,2-Dichlorobenzene
	1,3-Dichlorobenzene	1,2,4-Trichlorobenzene
	1,4-Dichlorobenzene	1,2,3-Trichlorobenzene
1,2-Dichloroethane-d_4	Trichlorofluoromethane	1,1,1-Trichloroethane
	1,1,2-Trichloro-1,2,2-trifluoroethane	Carbon tetrachloride
	Methyl acetate	1,2-Dibromoethane
	Methylene chloride	1,2-Dichloroethane
	Methyl-tert-butyl ether	
1,2-Dicloropropane-d_6	Cyclohexane	1,2-Dichloropropane
	Methylcyclohexane	Bromodichloromethane
1,4-Dioxane-d_8	1,4-Dioxane	
2-Butanone-d_5	Acetone	2-Butanone
2-Hexanon-d_5	4-Methyl-2-pentanone	2-Hexanone
Benzene-d_6	Benzene	
Chloroethane-d_5	Dichlorodifluoromethane	Chloroethane
	Chloromethane	Carbon disulfide
	Bromomethane	
Chloroform-d	1,1-Dichloroethane	Dibromochloromethane
	Bromochloromethane	Bromoform
	Chloroform	
Toluene-d_8	Trichloroethene	o-Xylene
	Toluene	m,p-Xylene
	Tetrachloroethene	Styrene
	Ethylbenzene	Isopropylbenzene
trans-1,3-Dichloropropene-d_4	cis-1,3-Dichloropropene	1,1,2-Trichloroethane
	trans-1,3-Dichloropropene	
Vinyl Chloride-d_3	Vinyl chloride	

Surrogates are similar to analytes of interest in chemical composition, extraction, and chromatography but are not typically found in environmental samples. Other DMCs or surrogates may be used by a laboratory based on their experience provided adequate chromatographic separations can be demonstrated. All samples (blanks, spiked samples, project samples, QC samples) should contain DMCs or surrogates. Acceptable evaluation of the DMC or surrogate spikes may not be applicable if dilution of the sample was required. Percent recoveries are calculated for each DMC or surrogate and these are evaluated based on the criteria within the laboratory report. Percent recoveries are calculated using the equation provided under accuracy in ‘Definitions’ from Barr’s “Compendium of Data Quality Assessment Documentation” included in Appendix C of the QAPP.

Table 3 includes guidance to evaluate the surrogate recovery where a single surrogate is analyzed.

Table 3 – Guidelines for Single DMC or Surrogate

Criteria	**Recommended Action for Associated Data**	
	Detect	**Non-Detect**
%R > Upper Limit	Qualify with ‘*’	No qualification
%R < Lower Limit	Qualify with ‘*’ or ‘**’, use professional judgment	
%R within Limits	No qualification	

‘*’ = reported value is estimated and QA/QA criteria were not met
‘**’ = reported value is unusable and QA/QC criteria were not met

Table 4 includes guidance where multiple surrogates are analyzed per analytical fraction.

Table 4 – Guidelines for Multiple DMC or Surrogates

Criteria	**Recommended Action for Associated Data**	
	Detect	**Non-Detect**
One %R < Lower Limit	No qualification may be necessary, use professional judgment	
Two or more %R < Lower Limit	Qualify with ‘*’ or ‘**’, use professional judgment	
Two or more %R > Upper Limit	Qualify fraction with ‘*’	No qualification
One %R > Upper Limit	No qualification may be necessary, use professional judgment	No qualification
All %R within Limits	No qualification	

‘*’ = reported value is estimated and QA/QA criteria were not met
‘**’ = reported value is unusable and QA/QC criteria were not met

4.4 Laboratory Control Samples (LCS) and Laboratory Control Sample Duplicate Samples (LCSD)

The laboratory control sample is used to monitor the overall performance of each step during analysis, including sample preparation. The LCS should be analyzed:

- Once every preparation batch

- Once for each matrix.

Laboratory control samples may contain all target compounds or a subset (see *Table 5* for guidance) and the percent recoveries are evaluated based on the criteria listed in QAPP Tables 2 and 3 for soil and water respectively. Percent recoveries are calculated for accuracy and the relative percent difference (RPD) is calculated for precision (when an LCSD was analyzed). Accuracy and precision equations can be found in 'Definitions' from Barr's "Compendium of Data Quality Assessment Documentation" included in Appendix C of the QAPP.

Table 5 – Number of Suggested Target Compounds - LCS/LCSD and MS/MSD

Number of Target Parameters	Number of Spiked Compounds
1-10 analytes	Spike all compounds
11-20 analytes	At least 10 compounds or 80% of all analytes, whichever is greater
More than 20 analytes	Spike at least 16 compounds

Table 6 – Guidelines for Laboratory Control Samples

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	Detect	Non-Detect
%R and RPD > Upper Limit	Qualify with '*'	No qualification
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** = Reported value is unusable and QA/QC criteria were not met

4.5 Laboratory Duplicate Samples

Laboratory duplicate samples are separate aliquots of field samples analyzed to demonstrate acceptable method precision by the laboratory at the time of analysis. Field blanks and proficiency testing (PT) samples should not be used for duplicate analysis. The RPDs are calculated using the equation as provided in 'Definitions' from Barr's "Compendium of Data Quality Assessment Documentation" included in Appendix C of the QAPP and are not calculated where data are already qualified with b, U, <, or **. RPD results are dependent on the homogeneity of the samples.

Duplicates should be analyzed (whichever is more frequent):

- One from each matrix (soil or water)
- One from each SDG

The MS/MSD duplicate pairs may be substituted for laboratory duplicates.

Laboratory acceptance criteria listed in QAPP Tables 2 and 3 for soil and water respectively are used to evaluate RPDs.

Higher RPDs are expected when results are at or near the reporting limits and are not always indicative of poor precision. RPDs are typically only evaluated for samples where both the native and duplicate sample concentrations are greater than five times (>5x) the RL. In cases where either of the samples (native or duplicate) is non-detect for a parameter and the other corresponding sample has detectable concentrations much greater than five times (>5x) the RL, professional judgment should be used to determine if qualification is appropriate.

Table 7 – Guidelines for Laboratory Duplicates

% RPD	Recommended Action for Associated Data
RPD < Upper Limit	No action is required
RPD > Upper Limit	Both results are ≤ 5x RL, no action is required
RPD > Upper Limit	Both results are > 5x RL, consider qualifying with '*****'

* = Reported value is estimated and QA/QC criteria were not met

4.6 Field Duplicate Samples

Field duplicate samples (also known as "masked" or "blind" duplicate samples) are used to demonstrate acceptable precision and reproducibility of the field and laboratory procedures. Frequency of collection is included in Table 5 of the QAP. The RPDs are calculated using the equation as provided under precision in 'Definitions' from Barr's "Compendium of Data Quality Assessment Documentation" included in Appendix C of the QAPP and are not calculated where data is already qualified with b, U, <, or **. RPD results are dependent on the homogeneity of the samples.

Acceptance criteria for field duplicate samples are ≤ 40% RPD for soil and sediment samples and ≤ 30% RPD for aqueous samples and are considered acceptable as included in QAPP Tables 2 and 3 respectively.

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4.7 Matrix Spikes (MS) and Matrix Spike Duplicate (MSD) Samples

Matrix spike samples may contain all target compounds or a subset (see *Table 5*) and provide information about the effect of each samples' matrix on the sample preparation procedures and analytical results. Matrix spikes are typically analyzed at the following frequencies:

- 1 (MS/MSD pair) in every 20 samples

- 1 per preparation batch per matrix
- 1 per SDG

The percent recoveries are evaluated based on the criteria listed in QAPP Tables 2 and 3 for soil and water respectively. If a matrix spike recovery does not meet acceptance criteria and is not associated with a project sample, no further action is required unless other systematic evidence warrants qualification.

If the native concentration of a spiked sample is significantly greater than the spike added (>4x), spike recovery cannot be accurately evaluated, therefore the criteria do not apply. Professional judgment should be used for percent recoveries nominally outside laboratory acceptance criteria prior to qualifying data.

Solid samples may have highly variable concentrations of target analytes and percent recoveries (%R) may be influenced by the sampling precision and inherent sample homogeneity. Professional judgment should be used for difficult matrices and the acceptance criteria adjusted accordingly.

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Criteria	**Recommended Action for Associated Data**	
	Detect	**Non-Detect**
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* = Reported value is estimated and QA/QC criteria were not met
** = Reported value is unusable and QA/QC criteria were not met

While matrix spike duplicates are not required by all methods, if results for MSD analyses are reported, evaluate the RPD for MS and MSD pairs using the equation as provided under precision in 'Definitions' from Barr's "Compendium of Data Quality Assessment Documentation" included in Appendix C of the QAPP.

4.8 Overall Assessment

The chain-of-custody should be reviewed to determine if the laboratory report matches the requested analyses and that project specific parameters were analyzed as requested. The narrative and other supporting documentation should be evaluated to ensure that sample condition was appropriately documented by the laboratory upon receipt. If available, historical data should be used to assist with data evaluation. Any additional anomalies should be documented and evaluated, if necessary.

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Documentation specific to this SOP are listed below and are available in Barr's "Compendium of Data Quality Assessment Documentation" included in Appendix C of the QAPP.

- Definitions
- Barr Qualifiers/Footnotes
- Routine Level Quality Control Report

Additional records information can be found in Barr's "Records Management System Manual".

7.0 References

Environmental Protection Agency, *National Functional Guidelines for Superfund Organic Methods Data Review*.

Analytical methods listed under the 'Scope and Applicability' section of this SOP.

Exhibit C

Health and Safety Plan (PHASP)

(No changes from December 2017 Final RI Work Plan submittal)

Barr Engineering Co.

Fulcrum Environmental Consulting, Inc.

Final Project Health and Safety Plan

Remedial Investigation – Yakima Mill Site

805 North 7th Street
Yakima, WA 98901

Preparation Date: December 20, 2017

Date to Review: December 20, 2018

Project Number: 47 / 39 – 1001

Allan Gebhard
Principal-in-Charge

Alec Danielson
Project Manager

Tom Mattison
Health & Safety Coordinator

Project Health and Safety Plan
Remedial Investigation – Yakima Mill Site
December 2017

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Health and Safety Program Manual

(Updated August 2015)

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Section D	Safety Training Program
Section E	Construction Safety
Section F	Personal Protective Equipment (PPE) Program
Section G	Respirator Protection Program
Section H	Hearing Conservation Program
Section I	Confined Space Entry Procedures
Section J	Lockout/Tagout Program
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Section AE	Subcontractor Environmental, Health and Safety Program
Section AF	MSHA Safety Program
Section AG	Aerial Lift Safety Program

1.0 Overview

The OSHA Federal Regulations, including 29CFR 1910.120 and 29 CFR 1926.65 Hazardous Waste Operations and Emergency Response and Washington State Department of Labor and Industries, Washington Administrative Code (WAC) 296-843, Hazardous Waste Operations, provide the basis for this Project Health and Safety Plan (PHASP). Barr Engineering Co. (Barr) and Fulcrum Environmental Consulting, Inc. (Fulcrum) have prepared this PHASP to address the potential health and safety hazards that may exist at the Site.

The PHASP appendix provides additional details for standard operating procedures, safety training, medical surveillance, hazard evaluations, excavation safety, confined space entry, material safety data sheets, and OSHA posters applicable to work at the Site. This PHASP and its appendix will be kept onsite during work.

All Site personnel covered by this PHASP are required, prior to working onsite, to complete training sessions in accordance with 29 CFR 1926 Hazardous Waste Operations. This training will consist of a minimum of 40 hours of classroom instruction, and 24 hours of actual field experience under the direct supervision of a trained, experienced supervisor in addition to the one-time 8-hour hazardous waste operations supervisor training. Other training, specific to Site hazards will be provided as appropriate.

All Site personnel covered by this PHASP participate in a medical surveillance program and have access to medical providers in the event of an overexposure to hazardous substances.

All Site personnel and visitors covered by this PHASP are required to sign the PHASP acknowledgement sheet (Form 1). A Barr or Fulcrum employee onsite will be designated as Project Health and Safety Team Leader (PHSTL) during field activities. Section 2 of this PHASP explains the PHSTL responsibilities.

The safety and health of onsite personnel covered by this PHASP will take precedence over cost and schedule considerations for all project work.

1.1 Site Background Information

The Site is located in Yakima, Washington, west of Interstate 82 in Range 19 Township 13 Sections 7 and 18 (Figure 1). The Site is approximately 171 acres in size. The Site operated as a sawmill and lumber manufacturing facility from the early 1900s until approximately 2006. The Site is currently used for covered storage, vehicle and equipment maintenance, and log yard material recovery. The Site has been the subject of numerous investigations that have involved assessments and environmental sampling and analyses. Previous investigation results indicate petroleum impacts in soil and groundwater; fill containing log yard materials, debris, rock and soil; and elevated metal concentrations in groundwater. There is potential for methane generation from the City of Yakima Landfill (Landfill Site), located to the southern adjacent to the Site, and potentially from log yard materials on the Site. The Site is divided into Areas of Concern (AOCs) based on historical operations and known or suspected releases. In addition to Site-wide petroleum use and placement of fill materials, minor amounts of chemicals have been previously handled at the Site. Health and safety protocols should be modified based on the AOC and type of work being conducted. The generalized Site layout and AOCs are provided on Figure 12.

Most of the Site is currently owned by LeeLynn, Inc. & Wiley Mt., Inc., Yakima Resources, LLC, and Dunollie Enterprises, LLC (Owners). The Site was previously operated by Boise Cascade Corporation, a predecessor of OfficeMax Incorporated (OfficeMax), and is currently operated by the Owners. OfficeMax still owns a portion of the Site which is leased to the Owners. The Site is identified by the Washington State Department of Ecology (Ecology) as Facility Site ID 450 and Cleanup Site ID 12059. Investigation and remediation are being conducted in accordance with the terms of Agreed Order No. DE 13959 between OfficeMax/Owners and Ecology.

Log yard materials recovery and recycling activities are being conducted at the Site. Workers must sign in at the main office and attend site specific safety training prior to beginning work. Workers must sign out prior to leaving the Site. At a minimum, Level D Personal Protective Equipment (PPE) is required to be warn at all times while on the Site.

1.2 Emergency Contacts and Emergency Plan Overview

The Hospital Location Map (Figure 3) provides a direct route to the nearest hospital. Site personnel will review and become familiar with the Hospital Location Map prior to the start of Site operations. Refer to Section 6 for additional information on the Emergency Action Plan.

The PHSTL will designate an emergency signal and evacuation point during the pre-work safety meeting (Form 2) and will update this information as necessary on the Daily Safety Form (Form 3). In case of emergency, contact numbers are provided in the table below. Incidents, accidents, close calls and good calls should be reported using Forms 4 and 5.

Emergency Situation:

- Call 911 or otherwise seek immediate treatment
- Notify Project Manager as soon as possible

Non-Emergency Situation

- Conduct first-aid as appropriate (See Table 3)
- Call Project Manager to notify (PM should notify Project Coordinator and Health and Safety Coordinator)
- Seek medical treatment if necessary

Emergency Contacts

Agency/Firm	Telephone Number
Fire Department/Police/Ambulance:	911
National Poison Center	(800) 222-1222
National Response Center	(800) 424-8802

Agency/Firm	Telephone Number
Project Coordinator: Allan Gebhard	952-832-2725 (Work) 612-723-7373 (Cell)
Project Manager: Alec Danielson	952-832-2837 (Work) 612-708-9883 (Cell)
Field Manager: Kevin McGilp	952-832-2856 (Work) 612-708-9882 (Cell)
Fulcrum Project Manager: Ryan Mathews	509-574-0839 (Work) 709-728-2424 (Cell)
Site Office	509-453-3131
OfficeMax Representative: Noelle Wooten	704-338-5010
Owners Representative: Matt Wells	206-407-0502
BU Health and Safety Coordinator (HSC): Tom Mattison	952-832-2876 (Work) 952-807-5199 (Cell)

Incident Type	PHASP Reference
Chemical Exposure	Table 1, Section 6, Appendix Section Y MSDS
Injury	Table 3 First Aid

1.3 Site Activities and Personal Protective Equipment (PPE)

Refer to Table 2 to identify task-specific hazards, and Section F for additional information on PPE.

The following tasks are expected to be conducted on this Site and the required level of PPE is summarized in the tables below:

- **Chemical resistant disposable coveralls** (e.g., Kleengard™, Tyvek™, PolyTyvek™) for work that may contaminate clothing.
- **Hard hats** are required when working on- Site. Hard hat liners are recommended during colder months.
- **Hearing protection** is required during soil boring, monitoring well installation, and test trenching activities involving heavy equipment when personnel may be exposed to high noise levels (for example, cannot hear normal conversation or have to raise voice to be understood).
- **High visibility vests** are required when working on-Site and adjacent to roadways, or when working on active construction sites or around earth moving equipment (e.g. backhoes, drill rigs).

- **Eye protection** is required when working on-Site.

Task	*PPE Level*	*Forms Required*	*Training*	*Appendix Section*
Reconnaissance Activities (non-intrusive activities)	Basic Level D (see table below) plus: - High-visibility Vest	Forms 2, 3	Field Activities & Safety Practices	Section R
Water, Soil and/or Air Sampling	Basic Level D plus: - Chemical resistant gloves (2 pr) - High-visibility vest	Forms 2, 3	Field Activities & Safety Practices	Section R
Surface Water and Pond Bottom Sampling	Basic Level D plus: - Personal flotation device - High-visibility vest	Forms 2, 3	Water and Boat Safety	Section L & M
Drilling	Basic Level D plus: - Chemical resistant gloves (2 pr) - High-visibility vest - Hearing protection	Forms 2, 3	Field Activities & Safety Practices	--
Test Trenching/ Excavation	Basic Level D plus: - High-visibility vest - Hearing protection (as needed)	Forms 2, 3, 4, 5	Excavation Training	Section K
Construction Activities	Basic Level D plus: - High-visibility Vest - Hearing protection (as needed)	Forms 2, 3	Field Activities & Safety Practices	Section E

Basic Level D PPE

Type	*Item*
Foot protection	Safety-toe boots
Head protection	Hard hat
Hand protection	Leather/cotton gloves (optional)
Eye protection	Safety Glasses with side shields

1. Protective gloves may be worn over nitrile gloves by site personnel covered by this PHASP involved in any activities where the nitrile gloves may be damaged during project work.

2. All PPE worn onsite will be decontaminated or discarded at the end of each work day.

3. No watches or other jewelry will be permitted during operation of hand held powered equipment.

1.4 Site-Specific Hazards

Prior to commencing on-Site activities, a pre-work safety meeting will be conducted (Form 2). Topics covered during the pre-work safety meeting are included on Form 2.

Site personnel will hold/attend regular daily safety (“toolbox”) meetings that will cover identified hazards, work area activities and changes in work area conditions. Meeting topics and personnel will be documented on the Daily Safety Form (Form 3) or in the field book.

1.5 Site Control and Work Zones

The work area during intrusive activities (drilling, trenching, excavation) will include the zones described below and will be recorded on Form 3 or in the field book.

> **Exclusion Zone** – This zone will include all areas where potentially contaminated soils or materials are to be handled and all areas where contaminated equipment or personnel travel. The exclusion zone will be delineated by traffic cones during intrusive activities. Refer to Figures 4 and 5 for typical exclusion zones during drilling and test trenching.
>
> **Decontamination Zone** – This zone will occur at the exit from the Exclusion Zone. The Decontamination Zone will include the following items: soap, water, eyewash, trash disposal, paper towels.
>
> **Support Zone** – This area is defined as the area of the Site outside the zone of significant air and soil contamination. Support vehicles and equipment will be located in the Support Zone.

Section 4 provides additional information regarding work zones and decontamination procedures.

Site Communications: staff on site will communicate with direct verbal communication, or cell phones if direct verbal communication is not applicable.

1.6 Site Chemical Hazards

The following selected hazardous substances are known or suspected to be onsite based on Site history or analytical laboratory samples collected during previous investigations:

Gasoline (including fuel additives)	Polycyclic Aromatic Hydrocarbons
Diesel	Methane
Hydraulic Oil	PCBs
Lubricating Oil	
Metals	
Volatile Organic Compounds	

See Table 1 for health effects, exposure limits, and guidelines for the above hazardous substances as well as their physical and chemical properties. Material Safety Data Sheets (MSDS) are in Section Y.

1.6.1 Air Monitoring

A summary of air monitoring duration, frequency and the action levels for these chemical hazards are provided in the table below:

Hazard	Monitor When:	Monitoring Instrument[1]	Action Levels (Above background for 10 minutes)	Action
Organic Vapors/ Gases	Anytime you are in the exclusion zone on a site with organic contaminants. Periodically when: - Unidentified odors are encountered - Discolored soils are encountered	Organic Vapor Monitor (PID/FID)	≥2.5 ppm	Use benzene detector tubes. If no benzene vapors, may increase action level to 10 ppm
			>10 ppm	- Level C (Half mask/full face respirator with organic vapor cartridge) - Leave area and reassess
Benzene Vapors	When action limit exceeded on PID/FID for 10-minute duration with uncharacterized odors	Benzene Monitor (Dräger detector tubes)	>2.5 ppm	Leave area and reassess
Explosive Atmosphere	- Organic Vapor Monitor readings above action level - Combustible atmosphere could develop	Combustible Gas Indicator (4-gas meter)	>5% LEL	Alarm will sound, leave area and reassess
Hydrogen Sulfide	H_2S gases could accumulate	Hydrogen Sulfide (H_2S) (4-gas meter or H_2S meter)	≥5 ppm	Alarm will sound, leave area and reassess
Oxygen Deficiency	When oxygen levels could be outside of the acceptable range	Oxygen Monitor (4-gas meter)	< 19.5% > 23%	Alarm will sound, leave area and reassess
Asphyxiant Gas (CO)	When carbon monoxide could accumulate	Carbon Monoxide Monitor (4-gas meter; detector tube)	≥15 ppm	Alarm will sound, leave area and reassess
Explosive/ Asphyxiant (Methane)	When methane could accumulate, such as near the Landfill Site.	Methane Monitor (Landfill Gas meter; detector tube, or 4-gas monitor)	≥5% LEL	Leave area and reassess
Hazardous Dust	- Intrusive activity creating hazardous dust - Hazardous soil may become airborne	Particulate (aerosol) Monitoring	>5 mg/m^3	Leave area and refer to Section S section 9.3 to assess hazard

[1] APPENDIX SECTION S: AIR MONITORING PROGRAM describes equipment, operating, and calibration procedures, and action level determination.

LEL= Lower Explosive Limit

PID= Photoionization Detector

FID= Flame Ionization Detector

Identification of air monitoring results in excess of the action levels cited in the table above will be reported to the PHSTL. The PHSTL will immediately evacuate personnel from unsafe areas and will then report to the Project Manager and the Field Manager. The PHSTL, in consultation with the Project Manager and Field Manager, will determine when PPE should be upgraded or operations shut down and restarted. If work is stopped because action levels have been exceeded, air monitoring will continue from a safe distance until it is determined that it is safe to continue Site operations

1.6.2 Chemical Spills

The following materials have the potential to be released at the Site from equipment being used in the investigation or by encountering unexpected underground tanks, containers, or pipes:

1. Fuel Petroleum Products (e.g., gasoline, diesel fuel).
2. Oil-Based Petroleum Products (e.g., hydraulic fluid, motor oil).

Onsite workers have not received appropriate training to provide emergency response at the Site. Section 6 provides details about spill containment procedures. In the event of a release, the Project Manager or Project Coordinator will notify the Owners and OfficeMax and appropriate regulatory agencies.

1.6.3 Encountering Unknown Chemicals or Unexpected Conditions

The following course of action should be taken if unknown or unexpected conditions (drums, tanks, pipes, etc.) are encountered:

1. Evacuate as necessary and stay upwind of the area, if possible. Maintain site security and control as described in Sections 1.5 and 3.0 of this PHASP. Conduct air monitoring as described in Section 1.6.1 and adjust work zones as necessary.
2. Contact the Barr or Fulcrum Project Manager or Project Coordinator to inform them of the incident as soon as possible. The Barr or Fulcrum Project Manager or Project Coordinator should notify the appropriate parties including Owners and OfficeMax and the Barr Health and Safety Coordinator.
3. Notify any other affected personnel at the Site.
4. Notify proper emergency services (fire, ambulance, police, etc.) for assistance if necessary. See Section 1.2 for emergency contacts. Inform emergency services personnel of the type of work being performed so that the need for equipment and decontamination can be assessed by them.
5. Prepare a summary report of the incident as soon as possible after the incident which should be kept on file.

2.0 Responsibilities and Administration

The organizational structure for the Site is as follows:

- The Project Coordinator, primary responsibility for project, directs all project work.
- The Barr Project Manager and Fulcrum Project Manager, manages operations for consistency with work plans, conducts pre-work safety meetings.
- The Field Manager, coordinates and directs field staff for consistency with work plans and PHASP.
- The Health and Safety Coordinator, reviewed this PHASP.
- Project Health and Safety Team Leader (PHSTL), oversees onsite safety activities (see details below).
- Field staff, follows safety procedures, stops unsafe actions.

An onsite employee will be designated as the PHSTL each day and will be identified on the Daily Safety Form (Form 3).

The responsibilities of the PHSTL are as follows:

1. Implements the PHASP during Site work.
2. Conducts the pre-work safety briefing for all onsite personnel and other safety.
3. Holds daily safety (“toolbox”) meetings to discuss health and safety issues (Form 3).
4. Reviews and modifies the PHASP as needed.
5. Suspends work activity if unsafe working conditions develop.
6. Coordinates the Emergency Action Plan (Section 6.0).
7. Provides, maintains and makes safety equipment accessible to site personnel covered by this PHASP.
8. Verifies that site personnel are performing and documenting daily equipment operational checks.
9. Tracks and monitors delineation of work zones and documents the locations of new work areas.
10. Confirms use of the “buddy system” when applicable.
11. Assists in the investigation of accidents, injuries, illnesses, spills, fires, incidents, and near misses. Investigations will be documented on the Incident/Accident Report Form (Form 7).
12. Ensures that a copy of this PHASP, Site maps delineating work zones, Safety Data Sheets (SDS) for all hazardous substances known onsite, appropriate OSHA postings, first-aid kit, eyewash station, and potable water are onsite.

13. Reviews work area safety audits and corrects deficiencies as necessary and communicates results to the Site personnel.

3.0 Work Zones and Decontamination Procedures

Specific work zones will be delineated by temporary fencing, a flagged line, traffic cones, or other items appropriate to specific Site needs and activities and will be noted on Daily Safety Form (Form 3) or in the field book. Refer to Figures 4 and 5 for depictions of typical work zones.

a. **Exclusion Zone** – This zone will include all areas where potentially contaminated soils or materials are to be handled and all areas where contaminated equipment or personnel travel. Access to the Exclusion zone will be limited to personnel who have received training in accordance with 29 CFR 1926 Hazardous Waste Operations (40-Hr HAZWOPER).

b. **Decontamination Zone** – This zone is located at the interface of the Exclusion Zone and Support Zone and provides access for the transfer of construction materials and Site equipment to the Exclusion Zone, the decontamination of vehicles prior to leaving the Exclusion Zone, the decontamination of personnel and clothing prior to entering the Support Zone, and for the physical segregation of the Support Zone and Exclusion Zone. Section R of the Appendix provides detail on decontamination standard operating procedure. Access to the Decontamination zone will be limited to personnel who have received training in accordance with 29 CFR 1926 Hazardous Waste Operations (40-Hr HAZWOPER).

c. **Support Zone** – This area is outside the zone of significant air and soil contamination. The Support Zone will be clearly delineated and procedures implemented to prevent active or passive migration of contamination from the work Project Site.

If present, the project field office will be the central location for potable water supply, eye wash (as applicable) and first-aid kit, communications, safety records, and lunch/break areas. The location of the lunch/break area will be determined by the PHSTL and communicated to Site personnel.

The general work areas and controlled access points will be detailed on work area location maps at each work area or in the field notebook with changes documented. It is understood that the Exclusion Zone concept will change when working with mobile equipment and the location of the equipment moves to a new location.

The use of the "buddy system" is required for all site personnel covered by this PHASP when working in the Exclusion Zone and Decon Zones. Names of "buddies" will be documented daily on Form 3 or in the field notebook.

3.1 Exclusion Zone

The following regulations for personnel actively participating in the field sampling program shall be enforced:

1. Onsite personnel will wear required PPE when in the Exclusion Zone.
2. Used disposable outerwear will not be reused if deemed unsuitable, and when removed, will be placed inside disposal containers provided for that purpose.

3. Smoking, chewing tobacco, eating and drinking are prohibited within the Exclusion and Decontamination Zones. These activities will be permitted only within designated lunch/break areas and documented on Form 3 or in field notebook.

3.2 Decontamination Zone

Upon leaving the Exclusion Zone, personnel will thoroughly clean exposed skin before smoking, using chewing tobacco, eating or drinking. The following equipment/facilities will be made available as needed:

1. Disposable PPE (nitrile gloves, coveralls, boot covers, etc.)
2. Disposal containers for used PPE
3. Soap, water or cleansing wipes

All vehicles and equipment used within the Exclusion Zone will be decontaminated on the Site as needed prior to leaving the Site. Decontamination will consist of the thorough cleaning of those parts of the equipment which come in contact with potentially contaminated material. The PHSTL will monitor that equipment is clean or has been decontaminated prior to removal from the Site.

4.0 Personal Protective Equipment

Engineering controls and work practices designed to reduce and maintain employee exposure at or below the permissible exposure limits (PELs) for the hazardous substances of concern will be implemented where feasible. Whenever engineering controls and work practices are not feasible, a reasonable combination of engineering controls, work practices and personal protective equipment (PPE) will be used to reduce and maintain employee exposure at or below the PELs for the hazardous substances of concern.

All onsite personnel covered by this PHASP will be equipped with PPE appropriate for the nature of the work being completed as discussed in Section 1.3. All safety equipment and protective clothing will be kept clean, well-maintained, and intact.

All Site activities within the Exclusion Zone will require Level D personal protection (defined in Section 1.3) at a minimum, unless it is determined through the hazard analyses process that a less restrictive level of protection is required and the PHASP is amended. Any deviations from this level of required protection will be documented on Form 3 as described in Section 1.3.

In the event that air monitoring, as described in Section 1.3, indicates that respiratory protection is necessary, Level C PPE will consist of Level D or modified Level D PPE with a half-mask, air-purifying respirator with organic vapor and P100 particulate filtration. Prior to arriving at the Project Site, all onsite personnel involved in intrusive investigation or activities where overexposure to airborne particulates may occur, will have received medical surveillance, respirator use training, and have been fit tested for a half-mask respirator. Barr has developed a written respirator program that complies with the applicable standards and can be referenced in the PHASP Appendix, Section G.

5.0 Air Monitoring

During the progress of intrusive work, air quality measurements will be collected to monitor exposure levels of organic vapors, combustibles, benzene, oxygen, carbon monoxide, hydrogen sulfide, and/or methane in the breathing zone (see table in Section 1.6). Background air monitoring for organic vapors and airborne dust particles may be conducted prior to commencement of activities. Refer to Section S of the Appendix for details on air monitoring.

The air monitoring program may consist of monitoring with an organic vapor monitor, combustible gas monitor, and/or hydrogen sulfide monitor in the breathing space. Operation and calibration procedures will be according to manufacturers' instructions using a specified calibration gas. During periods when monitoring is necessary (i.e., during initial monitoring and subsequent monitoring when conditions change), daily calibration and maintenance records will be kept by the PHSTL and filed in the project field office on Daily Safety Form (Form 3) or documented in the field notebook.

Full shift exposure monitoring of individuals with the highest potential for exposure will be conducted during investigation activities and sample parameters will be determined for each type of work.

6.0 Emergency Action Plan (EAP)

This plan is intended to provide immediate response to a serious Site occurrence such as injury, explosion, spill, or fire. This plan is intended to be compatible with and to integrate the emergency response plan of local emergency service providers, and to satisfy the requirements of 29 CFR 1910.120 (l) (1) and 29 CFR 1926.65 (1) (1) (Emergency Response Plan). Personnel roles and lines of authority are discussed in Section 2.0 and a table of emergency contact numbers is included in Section 1.2. A hospital route map is provided on Figure 3. The details of this EAP will be communicated in the pre-work safety meeting and specific scenarios will be reviewed for clarity on response activities.

Site personnel should not attempt any emergency service procedures, except those necessary to render first-aid and for the safe evacuation of others.

6.1 Emergency Notification Procedures

The PHSTL will take the initiative for project emergency notification procedures. The PHSTL will immediately be notified of any onsite emergencies, and is responsible for making sure that appropriate evacuation procedures are followed and conducted in a safe and orderly manner.

The Project Manager has overall responsibility for this EAP and should be notified whenever this plan is utilized or whenever there is a question on proper implementation to allow for critique of the emergency response and subsequent follow-up.

The following course of action should be taken by the PHSTL if an emergency situation develops:

1. Evacuate as necessary.
2. Notify proper emergency services (fire, ambulance, police, etc.) for assistance. Inform emergency services personnel of the type of work being performed and potential chemical or other hazards.
3. Notify any other potentially affected personnel at the Site.
4. Secure the Site from entry by non-authorized personnel.
5. Contact the Project Manager or Project Coordinator to inform them of the incident as soon as possible. The Project Manager should notify the appropriate parties including OfficeMax/Owners and the Health and Safety Coordinator.
6. Prepare a summary report of the incident for the Project Manager as soon as possible after the incident which should be submitted to the Health and Safety Manager.

6.2 Pre-emergency Planning

The PHSTL will contact local emergency response providers regarding Site activities and Site hazards prior to any major construction/excavation activities or any activities that may require specialized rescue equipment. Documentation of this contact and any future contacts will be maintained in the field notebook.

6.3 Emergency Prevention and Recognition

All Site personnel are expected to conduct their work in a manner that does not contribute to emergency conditions (i.e., preventing fire, a spill of hazardous substances, etc.). Furthermore, all Site personnel performing intrusive activities (e.g., drilling, excavation activities) are required to clear utilities prior to the start of intrusive activities.

Site personnel are expected to be alert for any conditions that may lead to an emergency condition and to notify the PHSTL immediately if such a condition develops.

6.4 Medical Services and First Aid

Medical transport will be made by onsite personnel in the event of minor injuries or through contacting the local ambulance service (in the event of a major injury). Cellular telephones and/or radios will be onsite for daily and emergency contact purposes. Always call for medical transport in emergencies.

General emergency procedures for responding to potential exposures to hazardous substances are described below and Table 3 provides an overview of common first-aid incidents. Follow directions of emergency service providers, if available, in lieu of these instructions. Provide emergency service providers with background information regarding chemical/physical exposure.

General Emergency Procedures to Potential Exposures

Hazardous Substance Exposure Route	Emergency Procedure
Eye Contact:	Flush eyes with eyewash and saline solution and follow with an eye flush for at least 15 minutes with clean water, if available while awaiting emergency medical services. Seek emergency medical attention.
Skin Contact:	Flush skin with clean water, for at least 15 minutes, if possible. Remove contaminated clothing while flushing skin. Seek emergency medical attention as needed.
Inhalation:	Remove person to fresh air, away from active work area. Seek emergency medical attention. If breathing has stopped, a qualified individual should provide artificial respiration, while awaiting emergency medical services.
Ingestion:	Do not induce vomiting. Immediately seek emergency medical attention.

6.5 Evacuation Procedure and Emergency Alarm

In the event of an emergency necessitating evacuation (such as fire, explosion, or significant release of a flammable hazardous substance (i.e., oil, gasoline), three long blasts are to be sounded with an air horn or vehicle horn and/or verbal warnings will be sounded. Operations should be shut down and all Site personnel should evacuate to the evacuation point. This safe area should be in the predominantly upwind direction of the Exclusion Zone. The signal method and possible safe area location(s) may vary depending on the type of emergency, size of Site, and number of employees. This signal and location(s) to be used as the evacuation point will be discussed at the pre-work safety meeting, and any changes should be noted at daily "tool-box" meetings.

The PHSTL will account for Site personnel covered by this PHASP after emergency evacuation has been completed.

6.6 Spill Containment Plan

6.6.1 Notification and Initial Assessment

In the event a spill occurs at the Site, the emergency or spill discoverer will immediately notify the PHSTL. The following information, to the extent available will be provided to the Project Manager or Project Coordinator for recommendation to OfficeMax/Owners for notification of local, state, and federal governmental agencies.

- Name of individual reporting spill
- Location of spill
- Number of injured personnel and nature of injuries (if applicable)
- Substance spilled
- Amount spilled (estimated)
- Rate material currently spilling (estimated)
- Time spill occurred (estimated)
- Extent which spill has traveled
- If the spill entered any sewers or water bodies
- Any additional, pertinent information (i.e., other potential hazards)
- If the spill is contained
- If an emergency spill responder is required

The PHSTL or specific designated person will assume the duty of Emergency Coordinator until an appropriate alternate Emergency Coordinator arrives. The Emergency Coordinator will serve as chief of the emergency response crew which has been trained in: spill clean-up procedures, emergency equipment operation, proper use of respiratory and other personal protective equipment.

The Emergency Coordinator will employ any or all of the following measures to ensure maximum protection of the safety and health of Site personnel and the public:

- Use of PPE.
- Dismissal of all non-essential personnel.

- Advisement of local emergency response providers regarding the incident.
- Involvement of outside contractors to provide assistance.

6.6.2 Containment, Clean-up and Disposal

Specific procedures for handling, transporting, labeling, and disposing of hazardous substances spilled or generated by work activities are covered in the subcontractor contract(s) for this project, as appropriate. The following generally describes the procedures for containing spills at the Site.

a. All sources of ignition must be removed to prevent fire.

b. Refer to attached material safety data sheets for particular hazards and precautionary measures for specific petroleum product.

c. Use berms, sorbent pads, booms and/or other barriers for spill containment and clean-up and to prevent migration of petroleum product into storm drain or surface water bodies.

d. Should a spill occur near a water body, a sorbent boom will be placed in the water adjacent to the spill as soon as possible.

e. If greater than 10 gallons of fuel petroleum product is spilled, a vacuum system may be employed as appropriate.

f. Should a spill occur that has the potential of entering a catch basin or storm sewer, a sorbent boom should be placed at the outfall of said sewer as quickly as possible.

g. All personnel involved in the clean-up are to be equipped with gloves, and appropriate PPE.

h. Caution will be utilized and only non-sparking tools or equipment will be employed on the cleanup.

i. Apply safety clay based adsorbent to the spill in sufficient quantity to adsorb all the liquid.

j. Mix the adsorbent with the spilled petroleum product until no liquid or clumping remains.

k. Place the material into drums or appropriate roll-off boxes labeled with the following information:

    i. Date

    ii. Material spilled

l. Fill out a hazardous waste label with the proper information.

6.7 Decontamination Procedures

Injured person(s) should be decontaminated as much as possible prior to transport to a medical facility. Where hazardous substances cannot be removed at the Site, consider use of clean Tyvek to line the stretcher under the injured.

6.8 PPE and Emergency Equipment

In the event emergency service providers are needed, those providers should provide their own personal protective equipment and emergency equipment. Protective equipment used for any evacuation should be consistent with levels of protection and action levels as determined in this PHASP.

Tables

Table 1: Toxicity Profile for Selected Hazardous Substances (dust/fibers/particulates)

Chemical Name and CAS Number	NIOSH-Immediately Dangerous to Life and Health (IDLH) Level	Occupational Exposure Limits (8 hour time weighted averages) [1]	Short Term Exposure Limits (STELs) and/or Ceiling Values (C)[2]	Ionization .Potential (I.P.) in electron volts. (eV)	Acute Effects (potential effects from short-term high level exposure)	Chronic Effects (potential effects from long term low level exposures)	Flamm. Range		Carcino-genicity Class [3]	Other
							LEL%	UEL%		
Dust/Fibers/Particulates										
Particulates not otherwise regulated or specified	None	15 mg/m^3 total dust (OSHA-PEL, NIOSH-REL, MN OSHA) 10 mg/m^3 inhalable particulates (ACGIH-TLV) 5 mg/m^3 respirable fraction (OSHA-PEL, NIOSH-REL, MN OSHA) 3 mg/m^3 respirable particulates (ACGIH-TLV)	NA	NA	Depends on particulate matter composition	Depends on particulate matter composition	NA	NA	Varies with particulate	Physical chemical properties vary with particulate

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[1] Occupational Health and Safety Administration (OSHA) Permissible Exposure Limits (PELs) as 8-hour Time Weighted Averages (TWAs), American Conference of Governmental Industrial Hygienist (ACGIH) Threshold Limit Values (TLVs) as 8 hour TWAs, and/or NIOSH Recommended Exposure Limits (RELs) as up to 10 hour TWAs.

[2] Short Term Exposure Limits (STELs) include 15 minute TWAs that should not be exceeded any time during the work day and/or ceilings (C) limits which should not be exceeded for any length of time during work exposure.

[3] Substance identified by OSHA, the International Agency for Research on Cancer (IARC), the National Toxicology Program (NTP), US EPA and/or ACGIHas a suspected or confirmed human carcinogen.

Table 1: Toxicity Profile for Selected Hazardous Substances (gases/fumes/mists)

Chemical Name and CAS Number	NIOSH-Immediately Dangerous to Life and Health (IDLH) Level	Occupational Exposure Limits (8 hour time weighted averages) [1]	Short Term Exposure Limits (STELs) and/or Ceiling Values (C)[2]	Ionization .Potential (I.P.) in electron volts. (eV)	Acute Effects (potential effects from short-term high level exposure)	Chronic Effects (potential effects from long term low level exposures)	Flamm. Range		Carcino-genicity Class [3]	Other
							LEL%	UEL%		
Gases/Fumes/Mists										
Carbon Monoxide (CO) (630-08-0)	1,200 ppm	50 ppm (55 mg/m^3) (OSHA-PEL) 25 ppm (ACGIG-TLV) 35 ppm (40 mg/m^3) (NIOSH-REL, MN OSHA)	C: 200 ppm (229 mg/m^3) (NIOSH, MN OSHA)	14.01	Exposure to CO can cause headache, dizziness, lightheadedness, nausea, vomiting, unconsciousness, and suffocation. Lower levels can effect concentration, memory, and vision, and loss of muscle coordination. Extremely high exposure levels can decrease the ability of the blood to carry oxygen. Skin contact with liquid CO can cause frostbite.	Chronic exposure may cause central nervous system (CNS) damage.	12.5	74	OSHA: No IARC: No NTP: No US EPA: No ACGIH: No	OT: 100,000 ppm VP: >35 atm BP: -313°F Fl P: NA (Gas) Sol: Slight (2%) Color/Odor: colorless, odorless gas
Hydrogen Sulfide (H_2S) (7783-06-4)	100 ppm	10 ppm (14 mg/m3) (MN OSHA)	C: 20 ppm (OSHA) STEL:15 ppm (21 mg/m3) (MN OSHA)	10.46	H_2S is an irritant of the eyes and respiratory system at low concentrations (50 ppm); inhalation exposure to higher concentrations may cause respiratory paralysis; symptoms of short-term overexposure to low levels are nervousness, headaches, fatigue, weakness, spasms, convulsions, and delirium.	Inhalation exposure to 250 ppm over a period of time has led to lung problems, nausea, cramps, diarrhea.	4.0	44	OSHA: No IARC: No NTP: No US EPA: No ACGIH: No	OT: 0.005 ppm (rotten eggs; olfactory fatigue occurs at 150 ppm) VP: >760 mm Hg BP: -77ºF Sol: Insoluble Fl P: NA

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[2] Short Term Exposure Limits (STELs) include 15 minute TWAs that should not be exceeded any time during the work day and/or ceilings (C) limits which should not be exceeded for any length of time during work exposure.

[3] Substance identified by OSHA, the International Agency for Research on Cancer (IARC), the National Toxicology Program (NTP), US EPA and/or ACGIHas a suspected or confirmed human carcinogen.

Table 1: Toxicity Profile for Selected Hazardous Substances (gases/fumes/mists)

Chemical Name and CAS Number	NIOSH-Immediately Dangerous to Life and Health (IDLH) Level	Occupational Exposure Limits (8 hour time weighted averages) [1]	Short Term Exposure Limits (STELs) and/or Ceiling Values (C)[2]	Ionization .Potential (I.P.) in electron volts. (eV)	Acute Effects (potential effects from short-term high level exposure)	Chronic Effects (potential effects from long term low level exposures)	Flamm. Range		Carcino-genicity Class [3]	Other
							LEL%	UEL%		
Oil mist, mineral (8012-95-1)	2500 mg/m^3	5 mg/m^3 (OSHA-PEL, NIOSH-REL)	STEL: 10 mg/m^3 (NIOSH)	NA	May cause respiratory tract irritation. Skin or respiratory tract irritation has not been reported at concentrations below the OSHA PEL.	Lipoid pneumonia has been reported with exposure to high concentrations of oil mist in the absence of adequate ventilation.	NA	NA	OSHA:No IARC: 1 (untreated or mildly treated) IARC: 3 (highly refined) NTP: US EPA: ACGIH:	BP: 680ºF Fl. P. 380 ºF VP:<0.5 mm Hg Sol. Insol Colorless oily liquid dispersed in air, has odor of lubricating oil

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[3] Substance identified by OSHA, the International Agency for Research on Cancer (IARC), the National Toxicology Program (NTP), US EPA and/or ACGIHas a suspected or confirmed human carcinogen.

Table 1: Toxicity Profile for Selected Hazardous Substances
(metals and inorganic compounds)

Chemical Name and CAS Number	NIOSH-Immediately Dangerous to Life and Health (IDLH) Level	Occupational Exposure Limits (8 hour time weighted averages) [1]	Short Term Exposure Limits (STELs) and/or Ceiling Values (C)[2]	Ionization .Potential (I.P.) in electron volts. (eV)	Acute Effects (potential effects from short-term high level exposure)	Chronic Effects (potential effects from long term low level exposures)	Flamm. Range		Carcino-genicity Class [3]	Other
							LEL%	UEL%		
Metals and Inorganic Compounds										
Arsenic (7440-38-2) For inorganic compounds see 29 CFR 1910.1018	Ca 5 mg/m^3 (as As) Inorganic compounds	10 µg/m^3 for inorganic compounds (OSHA-PEL) 0.5 mg/m^3 for organic compounds (OSHA-PEL) 0.01 mg/m^3 for inorganic compounds (ACGIH –TLV 0.5 mg/m^3 for organic compounds (as As) (MN OSHA)	NA	NA	Inhalation can cause severe respiratory irritation; oral exposure may cause cramps, gastrointestinal (G.I.) damage, swelling and death.	Skin changes may be produced (including pigmentation changes) upon oral or inhalation exposure; vascular, nervous system and liver injury may result if inhaled or ingested.	NA	NA	OSHA: Yes IARC: 1 NTP: known human carcinogen US EPA: A ACGIH: A1	Properties vary depending on specific compound; essential element Odor: inorganic-odorless; organic-odor may vary
Cadmium (7440-43-9) (See 29 CFR 1910.1027)	Ca 9 mg/m^3 (as Cd dust or fume)	0.005 mg/m^3 (OSHA-PEL) 0.01 mg/m^3 0.002 mg/m^3 respirable fraction (ACGIH-TLVs)	NA	NA	Ingestion may lead to nausea, diarrhea, muscle cramps; high doses may lead to unconsciousness.	Chronic oral exposure may produce bone and kidney damage.	NA	NA	OSHA: Yes IARC:1 NTP: Known human carcinogen US EPA: B1 ACGIH: A2	Cadmium dust properties vary depending on specific compound Odor: odorless

[1] Occupational Health and Safety Administration (OSHA) Permissible Exposure Limits (PELs) as 8-hour Time Weighted Averages (TWAs), American Conference of Governmental Industrial Hygienist (ACGIH) Threshold Limit Values (TLVs) as 8 hour TWAs, and/or NIOSH Recommended Exposure Limits (RELs) as up to 10 hour TWAs.

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Table 1: Toxicity Profile for Selected Hazardous Substances (metals and inorganic compounds)

Chemical Name and CAS Number	NIOSH-Immediately Dangerous to Life and Health (IDLH) Level	Occupational Exposure Limits (8 hour time weighted averages) [1]	Short Term Exposure Limits (STELs) and/or Ceiling Values (C)[2]	Ionization .Potential (I.P.) in electron volts. (eV)	Acute Effects (potential effects from short-term high level exposure)	Chronic Effects (potential effects from long term low level exposures)	Flamm. Range		Carcino-genicity Class [3]	Other
							LEL%	UEL%		
Chromium (VI) (hexavalent) (18540-29-9) See 29 CFR 1910.1026	Ca	0.05 mg/m^3 (OSHA-PEL, Water soluble Cr VI compounds for ACGIH-TLV) 0.01 mg/m^3 insoluble Cr VI compounds (ACGIH-TLV)	(this is from Cal/OSHA- but double check)	NA	Hexavalent forms are more toxic than trivalent; Inhalation of salts may produce severe nasal irritation/damage; skin ulcers and dermatitis result from contact with salts or chromic acid.	Hexavalent forms are more toxic than trivalent; liver, kidney and lung damage may result from inhalation exposure; dermatitis may result from skin contact.	NA	NA	OSHA: No IARC: 1 NTP: Known human carcinogen US EPA: A ACGIH: A1	Properties vary depending on specific compound; essential element Odor: Odorless
Chromium II and III (divalent and trivalent) (7440-47-3)	25 mg/m^3	0.5 mg/m^3 (OSHA-PEL, ACGIH-TLV, NIOSH-REL)	NA	NA	Can cause eye and skin irritation. Hexavalent forms are more toxic than trivalent.	Hexavalent forms are more toxic than trivalent.	NA	NA	OSHA:No IARC: 3 NTP: No US EPA: D ACGIH: A4	Properties vary depending on specific compound; essential element Odor: Odorless
Chromium metal and insoluble salts (as Cr) (7440-47-3)	250 mg/m^3	1 mg/m^3 (OSHA-PEL) 0.5 mg/m^3 (NIOSH-REL)	NA	NA	NA	NA	NA	NA	OSHA: No IARC: 3 NTP: No US EPA: D ACGIH: A4	Properties vary depending on specific compound; essential element Odor: Odorless

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[3] Substance identified by OSHA, the International Agency for Research on Cancer (IARC), the National Toxicology Program (NTP), US EPA and/or ACGIHas a suspected or confirmed human carcinogen.

Table 1: Toxicity Profile for Selected Hazardous Substances
(metals and inorganic compounds)

Chemical Name and CAS Number	NIOSH-Immediately Dangerous to Life and Health (IDLH) Level	Occupational Exposure Limits (8 hour time weighted averages) [1]	Short Term Exposure Limits (STELs) and/or Ceiling Values (C)[2]	Ionization .Potential (I.P.) in electron volts. (eV)	Acute Effects (potential effects from short-term high level exposure)	Chronic Effects (potential effects from long term low level exposures)	Flamm. Range		Carcino-genicity Class [3]	Other
							LEL%	UEL%		
Lead (inorganic) (7439-92-1) (29 CFR 1910.1025)	100 mg/m^3	0.05 mg/m^3 (OSHA-PEL, ACGIH-TLV, NIOSH-REL)	NA	NA	Early signs of acute inhalation exposure are fatigue, metallic taste in mouth, and sleep disturbance.	Inhalation and ingestion may produce abdominal pain, weakness, muscle cramps. Effects of chronic exposure to low lead levels are subtle (blood lead of 40-60 µg/L); chronic intoxication is thought to produce anemia and have an adverse effect on nervous system development.	NA	NA	OSHA: No IARC: 2B NTP: Reasonably anticipated human carcingoen US EPA: B2 ACGIH: No[3]	Properties vary depending on compound. Pregnant women and children are especially sensitive to low level effects.
Sulfuric Acid (7664-93-9)	15 mg/m^3	1 mg/m^3 (OSHA-PEL, NIOSH-REL, MN OSHA) 0.2 mg/m^3 (ACGIH-TLV-thoracic fraction)	3 mg/m^3	NA	Corrosive; may cause burns to eyes and skin. May cause severe irritation or burns to respiratory system. Severe inhalation exposure may cause a chemical pneumonitis (an inflammation of the lung).	Repeated contact with dilute solutions may cause a dermatitis. Repeated or pronounced inhalation of the mist may cause inflammation of the upper respiratory tract leading to chronic bronchitis.	NA	NA	OSHA: No IARC: 1 (strong inorganic acid as mist) NTP: No USEPA: No ACGIH: No	OT: 1 mg/m^3 VP: 0.0001 mm BP: 554ºF Sol: Miscible Fl.P: NA Odor: Odorless
Tetraethyl lead (skin) (78-00-2)	40 mg/m^3 as Pb	0.075 mg/m^3, as Pb (OSHA-PEL, NIOSH-REL, MN OSHA) 0.1 mg/m^3 (ACGIH-TLV)	NA	11.10	TEL is absorbed through the skin from gasoline when in concentrations greater than 0.1%. Symptoms of over-exposure include weakness, fatigue, headache, nausea, insomnia and nightmares. Nervous system involvement may be seen by incoordination and tremors through all routes of exposure.	Nervous system effects; blood changes have been noted in rats administered TEL through oral, inhalation and dermal routes.	1.8	NA	OSHA: No IARC: No NTP: No US EPA: No ACGIH: No	VP: 0.2 mm Hg BP: 228ºF Fl P: 200ºF Sol: Insoluble Odor: Pleasant, sweet odor

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[3] Substance identified by OSHA, the International Agency for Research on Cancer (IARC), the National Toxicology Program (NTP), US EPA and/or ACGIHas a suspected or confirmed human carcinogen.

Table 1: Toxicity Profile for Selected Hazardous Substances (organic compounds)

Chemical Name and CAS Number	NIOSH-Immediately Dangerous to Life and Health (IDLH) Level	Occupational Exposure Limits (8 hour time weighted averages) [1]	Short Term Exposure Limits (STELs) and/or Ceiling Values (C)[2]	Ionization .Potential (I.P.) in electron volts. (eV)	Acute Effects (potential effects from short-term high level exposure)	Chronic Effects (potential effects from long term low level exposures)	Flamm. Range		Carcino-genicity Class [3]	Other
							LEL%	UEL%		
Organic Compounds										
Acetone (67-64-1)	2,500 ppm (10% LEL)	1000 ppm (2400 mg/m$^{3)}$ (OSHA-PEL) 500 ppm (ACGIH-TLV) 250 ppm (590 mg/m^3) (NIOSH-REL) 750 ppm (1800 mg/m^3) (MN OSHA)	STEL: 750 ppm (ACGIH) STEL: 1,000 ppm (2400 mg/m^3) (MN OSHA)	9.69	Respiratory, eye, skin irritant; inhalation to high concentrations may result in central nervous system (CNS) depression (nausea, dizziness, headache, fatigue); vomiting; abdominal pain.	Skin contact may cause dermatitis; inhalation exposure may cause bronchitis. May cause kidney damage by the oral route of exposure.	2.5	13	OSHA: No IARC: No NTP: No US EPA: No ACGIH: No	OT: 100 ppm VP: 180 mm Hg BP: 133ºF Sol: Miscible Fl P: 0ºF Odor: Fragrant, mint-like odor
Benzene (skin) (71-43-2) (See 29 CFR 1910.1028)	Ca 500 ppm	1 ppm (OSHA-PEL) 0.5 ppm (ACGIH-TLV) 0.1 ppm (NIOSH-REL)	STEL: 5 ppm (OSHA) STEL: 2.5 ppm (ACGIH) STEL: 1ppm (NIOSH)	9.24	Eye, skin, respiratory irritant. Inhalation can cause central nervous system (CNS) depression (headache, fatigue, dizziness, nausea).	Toxic to bone marrow cells, leading to anemia (fatigue, headache, nausea, anorexia) upon repeated inhalation exposure; continued exposure may result in leukemia.	1.3	7.9	OSHA: Yes IARC: 1 NTP: Known human carcinogen US EPA: A ACGIH: A1	OT: 4.68 ppm VP: 75 mm Hg BP: 176ºF Sol: Slightly sol. In water very sol. In organic solvents and oils Fl P: 12ºF Odor: aromatic

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[3] Substance identified by OSHA, the International Agency for Research on Cancer (IARC), the National Toxicology Program (NTP), US EPA and/or ACGIHas a suspected or confirmed human carcinogen.

Table 1: Toxicity Profile for Selected Hazardous Substances
(organic compounds)

Chemical Name and CAS Number	NIOSH-Immediately Dangerous to Life and Health (IDLH) Level	Occupational Exposure Limits (8 hour time weighted averages) [1]	Short Term Exposure Limits (STELs) and/or Ceiling Values (C)[2]	Ionization .Potential (I.P.) in electron volts. (eV)	Acute Effects (potential effects from short-term high level exposure)	Chronic Effects (potential effects from long term low level exposures)	Flamm. Range		Carcino-genicity Class [3]	Other
							LEL%	UEL%		
Diesel Fuel (68334-30-5)	NA	100 mg/m^3 inhalable fraction and vapor (ACGIH-TLV)	NA	NA	Skin and respiratory irritant. Inhalation of high concentrations may cause CNS depression (headache, confusion, drowsiness, nausea). Ingestion may cause gastrointestinal irritation, nausea, and vomiting.	Repeated skin contact may cause dermatitis.	0.6 (Diesel Fuel Oil No.2-D)	7.5 (Diesel Fuel Oil No. 2-D)	OSHA: No IARC: 2B (engine exhaust) NTP: No (diesel engine exhaust is reasonably anticipated to be a carcinogen) US EPA: No ACGIH: No	VP: 2.12-26.4 mm Hg @ 70ºF BP: 304->1090ºF FP: 100ºF min. will vary depending on type
Ethyl Benzene (100-41-4)	800 ppm (10% LEL)	100 ppm (435 mg/m^3) (OSHA-PEL, NIOSH-REL, MN OSHA) 20 ppm (ACGIH-TLV)	STEL: 125 ppm (545 mg/m^3) (MN OSHA)	8.76	Respiratory, eye, skin irritant; inhalation or ingestion overexposure may result in CNS depression (nausea, dizziness, headache, fatigue); vomiting; abdominal pain.	Repeated skin contact may cause dermatitis; inhalation exposure may cause bronchitis.	0.8	6.7	OSHA: No IARC: 2B NTP: No US EPA: No ACGIH: No	OT: 0.092-0.6 ppm VP: 7 mm Hg BP: 277ºF Sol: 0.01% Fl P: 55ºF Odor: Aromatic odor
Fuel Oil	NA	NA	NA	NA	Inhalation or ingestion exposure may cause headache, nausea, confusion, drowsiness, convulsions, and coma. No. 2 Fuel Oil: Mild eye and moderate skin irritation, practically nontoxic.	May produce kidney damage.	0.6	7.5	Some fuel oils may be carcino-genic IARC:3 (distillate) 2B residual NTP: No	VP: 2-26 mm Hg at 21ºC BP: 304-1090ºF Fl P: 100-336ºF Sol: ~5 mg/L

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Table 1: Toxicity Profile for Selected Hazardous Substances
(organic compounds)

Chemical Name and CAS Number	NIOSH-Immediately Dangerous to Life and Health (IDLH) Level	Occupational Exposure Limits (8 hour time weighted averages) [1]	Short Term Exposure Limits (STELs) and/or Ceiling Values (C)[2]	Ionization .Potential (I.P.) in electron volts. (eV)	Acute Effects (potential effects from short-term high level exposure)	Chronic Effects (potential effects from long term low level exposures)	Flamm. Range		Carcino-genicity Class [3]	Other
							LEL%	UEL%		
Gasoline (8006-61-9)	Ca	300 ppm (900 mg/m^3) (ACGIH-TLV, MN OSHA)	STEL: 500 ppm (1500 mg/m^3) (ACGIH, MN OSHA)	NA	Inhalation overexposure to vapors can cause bronchopneumonia, pulmonary edema, inebriation, and vomiting. Ingestion can cause aspiration pneumonitis.	Dermatitis and blistering of the skin may occur from repeated dermal contact.	1.4	7.6	OSHA: No IARC: 2B NTP: No US EPA: No ACGIH: No[3]	OT: 0.25 ppm VP: 263 mm Hg BP: 102ºF Sol: Insoluble Fl.P: -45ºF
Hydraulic Fluid	NA	NA	NA	NA	Skin or eye contact may produce slight irritation. Ingestion may result in gastrointestinal irritation.	No chronic effects found in the literature.	NA	NA	OSHA: No IARC: No NTP: No US EPA: No ACGIH: No	BP: 375-550ºF FP: Varies w/ particular blend and product
Kerosene (Fuel Oil No. 1) (8008-20-6)	NA	200 mg/m^3 (ACGIH-TLV) 100 mg/m^3 (NIOSH-REL)	NA	NA	Inhalation exposure to the vapor is not expected since kerosene has a low vapor pressure. Potential respiratory irritant and CNS depressant (headache, nausea, dizziness, lightheadedness, and vomiting if heated or misted. Skin irritant and possible eye irritant. Aspiration hazard. Kerosene can enter lungs during swallowing or vomiting and cause lung inflammation, lung damage, and, in some cases, death.	Long-term dermal exposure to kerosene may produce dermatitis. Limited data regarding other chronic effects.	0.7	5	OSHA: No IARC: No NTP: No US EPA: No ACGIH: No	BP: 347-617ºF Sol: Insoluble Fl.P: 100-162ºF VP: 5mm (100ºF) OT: 0.55 Predominantly C_9 -C_{16} Odor: Characteristic, mild petroleum

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Table 1: Toxicity Profile for Selected Hazardous Substances (organic compounds)

Chemical Name and CAS Number	NIOSH-Immediately Dangerous to Life and Health (IDLH) Level	Occupational Exposure Limits (8 hour time weighted averages) [1]	Short Term Exposure Limits (STELs) and/or Ceiling Values (C)[2]	Ionization .Potential (I.P.) in electron volts. (eV)	Acute Effects (potential effects from short-term high level exposure)	Chronic Effects (potential effects from long term low level exposures)	Flamm. Range		Carcino-genicity Class [3]	Other
							LEL%	UEL%		
Methane (74-82-8)	NA	See ACGIH Appendix F: Minimal Oxygen Content	NA	12.98	No physiological effects below the flammability limits; simple asphyxiant at high concentrations if inhaled. Generally, flammability and explosive hazards outweigh biologic effects.	No adverse health effects are reported.	5.3	15.0	OSHA: No IARC: No NTP: No US EPA: No ACGIH: No	OT: 200 ppm Fl P: -386.6ºF Odor: Odorless
Methyl Alcohol (skin) (Methanol) (67-56-1)	6,000 ppm	200 ppm (260 mg/m^3) (OSHA-PEL, ACGIH-TLV, NIOSH-REL, MN OSHA)	250 ppm (325 mg/m^3) (ACGIH, NIOSH, MN OSHA)	10.84	Eye, skin and respiratory irritant. Inhalation of high concentrations may cause CNS depression, visual impairment (optic nerve neuropathy or visual field changes) or complete and possibly permanent blindness. Can absorb through skin and may cause headache, fatigue and visual disturbances.	Repeated inhalation exposure or skin absorption may produce temporary or permanent visual disturbances and possibly blindness.	6	36.5	OSHA: No IARC: No NTP: No US EPA: No ACGIH: No	OT: 4.2-5,960 ppm VP: 99 mm BP: 148ºF Fl P: 54ºF Sol: Miscible Odor: Characteristic pungent odor
Methyl Tert-Butyl Ether (MTBE) (1634-04-04)	NA	50 ppm (ACGIH-TLV)	NA	NA	Causes eye, skin and respiratory tract irritation. Aspiration hazard if swallowed. Can enter lungs and cause damage. May cause central nervous system depression.	Repeated inhalation may cause nasal and tracheal inflammation. Chronic exposure may cause liver damage. Adverse reproductive effects have been reported in animals.	1.6	15.1	OSHA: No IARC: 3 NTP: No US EPA: No ACGIH: A3	FL P: -18 ºF BP: 131ºF Odor: Turpentine-like, pungent

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Table 1: Toxicity Profile for Selected Hazardous Substances
(organic compounds)

Chemical Name and CAS Number	**NIOSH-Immediately Dangerous to Life and Health (IDLH) Level**	**Occupational Exposure Limits (8 hour time weighted averages) [1]**	**Short Term Exposure Limits (STELs) and/or Ceiling Values (C)[2]**	**Ionization .Potential (I.P.) in electron volts. (eV)**	**Acute Effects (potential effects from short-term high level exposure)**	**Chronic Effects (potential effects from long term low level exposures)**	**Flamm. Range**		**Carcino-genicity Class [3]**	**Other**
							LEL%	**UEL%**		
Naphthalene (skin) (91-20-3)	250 ppm	10 ppm (50 mg/m^3) (OSHA-PEL, ACGIH-TLV,MN OSHA)	STEL 15 ppm (75 mg/m^3) (ACGIH, MN OSHA)	8.12	Oral exposure may produce abdominal pain, nausea, vomiting. Skin/eye contact can lead to systemic effects, conjunctivitis (pink eye), dermatitis.	Inhalation of vapors and ingestion of dusts may lead to cataracts and retinal degeneration. Dermatitis may result from skin contact.	0.9	5.9	OSHA: No IARC: 2B NTP: Reasonably anticipated human carcinogen US EPA: No ACGIH: No	OT: 0.08 ppm VP: 0.08 mm Hg Fl P: 174ºF BP: 424ºF Sol: 0.003% Odor: Mothballs or coal tar odor
Carcinogenic Polynuclear Aromatic Hydrocarbons (cPAHs)	Ca	NA	NA	NA	Acute toxicity appears low in lab animals, although occupational exposure has caused skin reactions and eye irritation. Acute and chronic effects of cPAHs and nPAHS are similar.	Dermatitis may result from skin exposure; animal studies show oral administration may lead to blood disorders and liver, kidney, and ocular effects. cPAHs may produce immuno-suppressive effects in humans.	NA	NA	OSHA: Yes IARC: 1 for Benzo(a)pyrene, otherwise varies per compound NTP: Reasonably anticipated human carcinogens US EPA: B2 (benzo(a) pyrene) ACGIH: A1 (coal tar pitch volatiles) A2 (benzo(a) pyrene)	Properties vary; Low VP

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[1] Occupational Health and Safety Administration (OSHA) Permissible Exposure Limits (PELs) as 8-hour Time Weighted Averages (TWAs), American Conference of Governmental Industrial Hygienist (ACGIH) Threshold Limit Values (TLVs) as 8 hour TWAs, and/or NIOSH Recommended Exposure Limits (RELs) as up to 10 hour TWAs.

[2] Short Term Exposure Limits (STELs) include 15 minute TWAs that should not be exceeded any time during the work day and/or ceilings (C) limits which should not be exceeded for any length of time during work exposure.

[3] Substance identified by OSHA, the International Agency for Research on Cancer (IARC), the National Toxicology Program (NTP), US EPA and/or ACGIHas a suspected or confirmed human carcinogen.

Table 1: Toxicity Profile for Selected Hazardous Substances (organic compounds)

Chemical Name and CAS Number	NIOSH-Immediately Dangerous to Life and Health (IDLH) Level	Occupational Exposure Limits (8 hour time weighted averages) [1]	Short Term Exposure Limits (STELs) and/or Ceiling Values (C)[2]	Ionization .Potential (I.P.) in electron volts. (eV)	Acute Effects (potential effects from short-term high level exposure)	Chronic Effects (potential effects from long term low level exposures)	Flamm. Range		Carcino-genicity Class [3]	Other
							LEL%	UEL%		
Noncarcinogenic Polynuclear Aromatic Hydrocarbons (nPAHs)	NA	NA	NA	NA	Acute toxicity appears low in lab animals, although occupational exposure has caused skin reactions and eye irritation. Acute and chronic effects of cPAHs and nPAHS are similar.	Dermatitis may result from skin exposure; animal studies show oral administration may lead to blood disorders, and liver, kidney, and ocular effects.	NA	NA	OSHA: No IARC: Varies per compound NTP: No US EPA: No ACGIH: No	Properties vary; Low VP
Stoddard Solvent (mineral spirits) (8052-41-3)	20,000 mg/m^3	500 ppm (2900 mg/m^3) (OSHA-PEL) 100 ppm (525 mg/m^3) (ACGIH-TLV, MN OSHA) 350 mg/m^3 (NIOSH-REL)	C: 1800 mg/m^3 (15 minutes) (NIOSH)	10.2	In humans, acute inhalation exposure may produce eye, nose, and throat irritation. CNS depression (headaches, nausea, vomiting, diarrhea, and fatigue) may also occur. Ingestion may cause similar effects along with abdominal pain.	Prolonged or repeated direct skin contact may cause defatting, drying, scaling, and possible development of dermatitis. Long-term inhalation exposure has resulted in kidney damage in animal studies (particularly in male rats).	0.8-1.1	6.0	OSHA: No IARC: No NTP: No US EPA: No ACGIH: No	OT: 1-30 ppm VP: 3 mm Hg BP: 309-396ºF FP: >100ºF Sol: Insoluble Odor: Kerosene-like odor
Toluene (skin) (108-88-3)	500 ppm	200 ppm (OSHA-PEL) 20 ppm (ACGIH-TLV) 100 ppm (376 mg/m^3) (NIOSH-REL, MN OSHA)	C: 300 ppm (OSHA) 500 ppm (10 minute maximum peak) (OSHA) 150 ppm (560 mg/m^3) (MN OSHA)	8.82	Respiratory, eye, skin irritant; inhalation exposure may cause CNS depression (nausea, dizziness, headache, fatigue); vomiting; abdominal pain.	Repeated or prolonged skin contact may cause dermatitis; inhalation exposure may cause bronchitis.	1.1	7.1	OSHA: No IARC: 3 NTP: No US EPA: No ACGIH: No	OT: 0.17 ppm VP: 21 mm Hg BP: 232ºF Fl P: 40ºF Sol: 0.07% Odor: Sweet, pungent, benzene-like odor

[1] Occupational Health and Safety Administration (OSHA) Permissible Exposure Limits (PELs) as 8-hour Time Weighted Averages (TWAs), American Conference of Governmental Industrial Hygienist (ACGIH) Threshold Limit Values (TLVs) as 8 hour TWAs, and/or NIOSH Recommended Exposure Limits (RELs) as up to 10 hour TWAs.

[2] Short Term Exposure Limits (STELs) include 15 minute TWAs that should not be exceeded any time during the work day and/or ceilings (C) limits which should not be exceeded for any length of time during work exposure.

[3] Substance identified by OSHA, the International Agency for Research on Cancer (IARC), the National Toxicology Program (NTP), US EPA and/or ACGIHas a suspected or confirmed human carcinogen.

Table 1: Toxicity Profile for Selected Hazardous Substances
(organic compounds)

Chemical Name and CAS Number	NIOSH-Immediately Dangerous to Life and Health (IDLH) Level	Occupational Exposure Limits (8 hour time weighted averages) [1]	Short Term Exposure Limits (STELs) and/or Ceiling Values (C)[2]	Ionization .Potential (I.P.) in electron volts. (eV)	Acute Effects (potential effects from short-term high level exposure)	Chronic Effects (potential effects from long term low level exposures)	Flamm. Range		Carcino-genicity Class [3]	Other
							LEL%	UEL%		
1,2,4-Trimethylbenzene (95-63-6)	NA	25 ppm (125 mg/m^3) (mixed isomers) (ACGIH-TLV, NIOSH-REL, MN OSHA) NIOSH-REL is only for 1,2,4-trimethylbenzene	NA	8.27	Irritating to eyes, respiratory system and skin; inhalation of high concentrations may cause CNS depression (drowsiness, fatigue, dizziness, nausea)	Prolonged or repeated skin contact may cause dermatitis. Repeated inhalation may cause chronic bronchitis. May cause anemia and other blood cell abnormalities. Prolonged exposure may produce a narcotic effect. Prolonged or repeated exposure may cause nausea, dizziness, and headache.	0.9	6.4	OSHA: No IARC: No NTP: No US EPA: No ACGIH: No	OT: 2.4 ppm VP: 1 mm BP: 337ºF Fl P: 112ºF Sol: Insoluble Sp.Gr.: 0.88 Odor: Distinctive, aromatic odor
1,3,5-Trimethylbenzene (108-67-8)	NA	25 (125 mg/m^3) (mixed isomers) (ACGIH-TLV, NIOSH-REL, MN OSHA) NIOSH-REL is only for 1,3,5-trimethylbenzene	NA	8.39	Irritating to eyes, respiratory system and skin; inhalation of high concentrations may cause CNS depression (drowsiness, fatigue, dizziness, nausea)	Prolonged or repeated skin contact may cause dermatitis. Repeated inhalation may cause chronic bronchitis. May cause anemia and other blood cell abnormalities. Prolonged exposure may produce a narcotic effect. Prolonged or repeated exposure may cause nausea, dizziness, and headache.	NA	NA	OSHA: No IARC: No NTP: No US EPA: No ACGIH: No	OT: 2.4 ppm VP: 2 mm BP: 329ºF Fl P: 122ºF Sol: Insoluble Sp.Gr.: 0.86 Odor: Distinctive, aromatic odor

[1] Occupational Health and Safety Administration (OSHA) Permissible Exposure Limits (PELs) as 8-hour Time Weighted Averages (TWAs), American Conference of Governmental Industrial Hygienist (ACGIH) Threshold Limit Values (TLVs) as 8 hour TWAs, and/or NIOSH Recommended Exposure Limits (RELs) as up to 10 hour TWAs.

[2] Short Term Exposure Limits (STELs) include 15 minute TWAs that should not be exceeded any time during the work day and/or ceilings (C) limits which should not be exceeded for any length of time during work exposure.

[3] Substance identified by OSHA, the International Agency for Research on Cancer (IARC), the National Toxicology Program (NTP), US EPA and/or ACGIHas a suspected or confirmed human carcinogen.

Table 1: Toxicity Profile for Selected Hazardous Substances (organic compounds)

Chemical Name and CAS Number	NIOSH-Immediately Dangerous to Life and Health (IDLH) Level	Occupational Exposure Limits (8 hour time weighted averages) [1]	Short Term Exposure Limits (STELs) and/or Ceiling Values (C)[2]	Ionization .Potential (I.P.) in electron volts. (eV)	Acute Effects (potential effects from short-term high level exposure)	Chronic Effects (potential effects from long term low level exposures)	Flamm. Range		Carcino-genicity Class [3]	Other
							LEL%	UEL%		
Vinyl Chloride (75-01-4) (See 29 CFR 1910.1017)	Ca	1ppm (OSHA-PEL, ACGIH-TLV)	C: 5 ppm (15-minute) (OSHA)	9.99	Inhalation to high concentrations may cause CNS depression (dizziness, light headaches, nausea, dulling of vision and hearing); liver function impaired upon inhalation exposure to 300-500 ppm.	Repeated exposure may cause bone degeneration, malignant tumors (affected organ systems include CNS, respiratory, liver and blood) have resulted in vinyl chloride workers; additional effects in workers include liver and kidney damage, decreased pulmonary function, gastro-intestinal toxicity, and enlarged spleens.	3.6	33	OSHA: Yes IARC: 1 NTP: Known human carcinogen US EPA: A ACGIH: A1	OT: 260 ppm VP: 3.3 atm BP: 7ºF Fl P: NA(gas) Sol: 0.1% (77ºF) Odor: Pleasant odor at high conc.
Xylene (o,m,p-isomers) (1330-20-7)	900 ppm	100 ppm (435 mg/m3) (OSHA-PEL, NIOSH-REL, MN OSHA) 0.5 ppm (ACGIH-TLV-inhalable vapor fraction)	STEL: 150 ppm (655 mg/m^3) (MN OSHA)	8.56	Respiratory, eye, skin irritant; CNS depression (nausea, dizziness, headache, fatigue) at high concentrations by the inhalation route of exposure; vomiting; abdominal pain may also occur.	Skin contact may cause dermatitis; inhalation exposure may cause bronchitis.	1	7	OSHA: No IARC: 3 NTP: No US EPA: No ACGIH: No	OT: 0.05 ppm VP: 9 mm Hg Fl P: 63ºF (ortho) Sol: Insoluble Odor: Aromatic odor

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[1] Occupational Health and Safety Administration (OSHA) Permissible Exposure Limits (PELs) as 8-hour Time Weighted Averages (TWAs), American Conference of Governmental Industrial Hygienist (ACGIH) Threshold Limit Values (TLVs) as 8 hour TWAs, and/or NIOSH Recommended Exposure Limits (RELs) as up to 10 hour TWAs.

[2] Short Term Exposure Limits (STELs) include 15 minute TWAs that should not be exceeded any time during the work day and/or ceilings (C) limits which should not be exceeded for any length of time during work exposure.

[3] Substance identified by OSHA, the International Agency for Research on Cancer (IARC), the National Toxicology Program (NTP), US EPA and/or ACGIHas a suspected or confirmed human carcinogen.

Table 1: Toxicity Profile for Selected Hazardous Substances (pesticides/PCBs)

Chemical Name and CAS Number	NIOSH-Immediately Dangerous to Life and Health (IDLH) Level	Occupational Exposure Limits (8 hour time weighted averages) [1]	Short Term Exposure Limits (STELs) and/or Ceiling Values (C)[2]	Ionization .Potential (I.P.) in electron volts. (eV)	Acute Effects (potential effects from short-term high level exposure)	Chronic Effects (potential effects from long term low level exposures)	Flamm. Range		Carcino-genicity Class [3]	Other
							LEL%	UEL%		
Pesticides/PCBs										
Polychlorinated Biphenyls, 54% chlorine (PCBs, chlorodiphenyl) (skin) (11097-69-1)	Ca 5 mg/m^3	0.5 mg/m^3 (OSHA-PEL, ACGIH-TLV) 0.001 mg/m^3 (NIOSH-REL)	NA	NA	Oral ingestion of PCBs has produced liver damage, general fatigue, and weight loss in rats; nausea, swelling of the hands and face may occur upon acute exposure.	Chronic human exposure to PCBs has led to headaches, fever, vomiting, diarrhea and chloracne (a skin disease).	NA	NA	OSHA: No IARC: 1 NTP: Reasonably anticipated human carcinogen US EPA: B2 ACGIH: No[3]	VP: 0.0004 mm Hg BP: 617-734ºF Fl P: Relatively nonflammable Sol: Insoluble Odor: Mild hydrocarbon odor

[1] Occupational Health and Safety Administration (OSHA) Permissible Exposure Limits (PELs) as 8-hour Time Weighted Averages (TWAs), American Conference of Governmental Industrial Hygienist (ACGIH) Threshold Limit Values (TLVs) as 8 hour TWAs, and/or NIOSH Recommended Exposure Limits (RELs) as up to 10 hour TWAs.

[2] Short Term Exposure Limits (STELs) include 15 minute TWAs that should not be exceeded any time during the work day and/or ceilings (C) limits which should not be exceeded for any length of time during work exposure.

[3] Substance identified by OSHA, the International Agency for Research on Cancer (IARC), the National Toxicology Program (NTP), US EPA and/or ACGIHas a suspected or confirmed human carcinogen.

Terminology (and its abbreviations) for
Table 1: Toxicity Profile for Selected Hazardous Substances on Site

TLV (Threshold Limit Value):	The ACGIH time-weighted average airborne concentration, to be used as a guideline for a normal 8-hour workday and a 40-hour work week, to which nearly all workers may be repeatedly exposed, day after day, without adverse effect.
PEL (Permissible Exposure Limit):	OSHA-regulated time-weighted average airborne concentration for a normal 8-hour workday and a 40-hour work week, to which nearly all workers may be repeatedly exposed, day after day, without adverse effect.
():	IDLHs that were originally in the Standards Completion Program that did not take into consideration carcinogenic effects.
BP:	Boiling point
C (Ceiling):	The concentration that should not be exceeded during any part of the working exposure.
Ca:	Potential occupational carcinogen (NIOSH – National Institute for Occupational Safety and Health)
CNS:	Central nervous system
Fl P:	Flash point
Flamm. Range:	Flammability Range
GI:	Gastrointestinal
I.P.:	Ionization potential
IDLH:	Immediately dangerous to life and health
LEL:	Lower explosive limit in air, % by volume
MLT:	Melting Point
MN RAL:	Minnesota Recommended Allowable Limit for drinking water contaminants
NA:	Not available
NOC:	Not otherwise classified
OT:	Odor threshold
PAHs:	Polynuclear aromatic hydrocarbons
PCBs:	Polychlorinated biphenyls
ppm:	Parts per million
Skin:	Indicates skin absorption as an additional exposure route
Sol:	Solubility in water
Sp.Gr.:	Specific gravity
STEL (Short-term exposure limits):	15-minute TWA Concentration, which should not be exceeded at any time during a workday. The duration of a STEL exposure should not be repeated more than four times per day.
TWA:	Time weighted average
UEL:	Upper explosive limit in air, % by volume
VP:	Vapor pressure in mm of Mercury

Toxicity Profile Reference

Carcinogen Categories

Group	Category
U.S. EPA Classification of Overall Weight-of-Evidence for Human Carcinogenicity	
A	Human carcinogen—sufficient evidence from epidemiological studies.
B1	Probable human carcinogen—limited human evidence.
B2	Probable human carcinogen—inadequate human data but sufficient evidence in animals.
C	Possible human carcinogen—limited animal evidence and no human data.
D	Not classifiable as to human carcinogenicity—inadequate animal evidence.
ACGIH Carcinogen Categories	
A1	Confirmed human carcinogens—recognized to have carcinogenic potential.
A2	Suspected human carcinogens—suspected of inducing cancer, based on limited epidemiological evidence or animal studies.
A3	Confirmed animal carcinogen with unknown relevance to humans---the agent is not likely to cause cancer in humans except under uncommon or unlikely routes or levels of exposure.

References for
Table 1: Toxicity Profile for Selected Hazardous Substances on Site

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Table 2

Task Hazard Analysis

Task	Tasks include:	Potential Chemical Hazards	Potential Biological Hazards[1]	Potential Physical Hazards
Reconnaissance Activities	-Site walks -Mapping and surveying -Geophysical surveying (surface)	-Inhalation -Dermal Contact -Potential for contact with unidentified chemicals	-Poisonous plants -Poisonous animals -Insect bites/sting -Aggressive animals -Plants with thorns	-Balance/traction/grip -Vehicle traffic -Extreme weather -Water bodies -Ergonomics (repetitive tasks, lifting, etc.) -Working alone -Fire hazards -Energized equipment
Sampling Activities	-Groundwater sampling -Soil sampling -Soil gas sampling -Aquifer testing -Waste characterization sampling -Product Recovery -Installation of downhole data loggers -Sediment sampling -Headspace screening -Sewer sampling/opening	-Inhalation -Dermal contact -Potential for contact with unidentified chemicals.	-Poisonous plants -Poisonous animals -Insect bites/sting -aggressive animals -Water-borne pathogens	-Balance/traction/grip -Vehicle traffic -Extreme weather -Water bodies -Ergonomics (repetitive tasks, lifting, etc.) -Working alone -Fire Hazards -Energized equipment -Explosive atmospheres
Intrusive Activities	-Drilling -Excavation/test trenching -Construction	-Inhalation -Dermal contact -Potential airborne dust particles	-Poisonous plants -Poisonous animals -Insect bites/sting -Aggressive animals -Water-borne pathogens	-Balance/traction/grip -Vehicle traffic -Heavy Equipment -Extreme weather -Water bodies -Ergonomics (repetitive tasks, lifting, etc.) -Working alone -Fire Hazards -Energized equipment -Explosive atmospheres -High noise levels -Utilities -Collapsing soils

Refer to Forms 2 and 3 for mitigation measures

[1]Biological Hazards

Potential biological hazards include plants, snakes, and various stinging insects. Some of the most common biological hazards can be prevented or the effects reduced by over the counter medications. Workers who know they are sensitized to any biological hazard should not perform any task that would increase their risk for anaphylactic shock.

Poisonous Plants

Common poisonous plants onsite may include plants from the poison ivy group, including poison oak and sumac. The most distinctive features of poison ivy and oak are that their leaves are composed of three leaflets. Both of these plants have greenish-white flowers and berries that grow in clusters. These plants can produce a severe rash characterized by redness, blisters, swelling, and intense burning and itching. The victim may also develop a headache, high fever and feel very ill. The rash will usually begin to appear within a few hours but may be delayed for 24 to 48 hours.

If contact occurs with a poisonous plant, remove all contaminated clothing and wash the exposed areas thoroughly with soap and water, followed by rubbing alcohol. Apply calamine lotion if rash is mild. Seek medical advice if a severe reaction occurs or if there is a known history of previous sensitivity. If a poisonous plant is found in the work area, the PHSTL should be notified so that it can be removed. All personnel entering an area with poison ivy should wear a Tyvek suit, at a minimum, to avoid skin contact.

Snakes

They are most commonly found in wood piles, in abandoned buildings, and under rocks. Don't reach into these places without first inspecting them carefully. Always watch out for snakes and keep a respectful distance if you see one.

If snakebite occurs, remain calm. Since swelling may occur, any jewelry such as rings, watches or bracelets around the affected area should be removed. The wound should be immobilized and held below the level of the heart. The victim (and snake if possible) must be immediately taken to the nearest hospital. Identification of the snake is helpful, but no time should be wasted or safety compromised since the symptoms will give medical personnel an accurate diagnosis.

Insect Stings

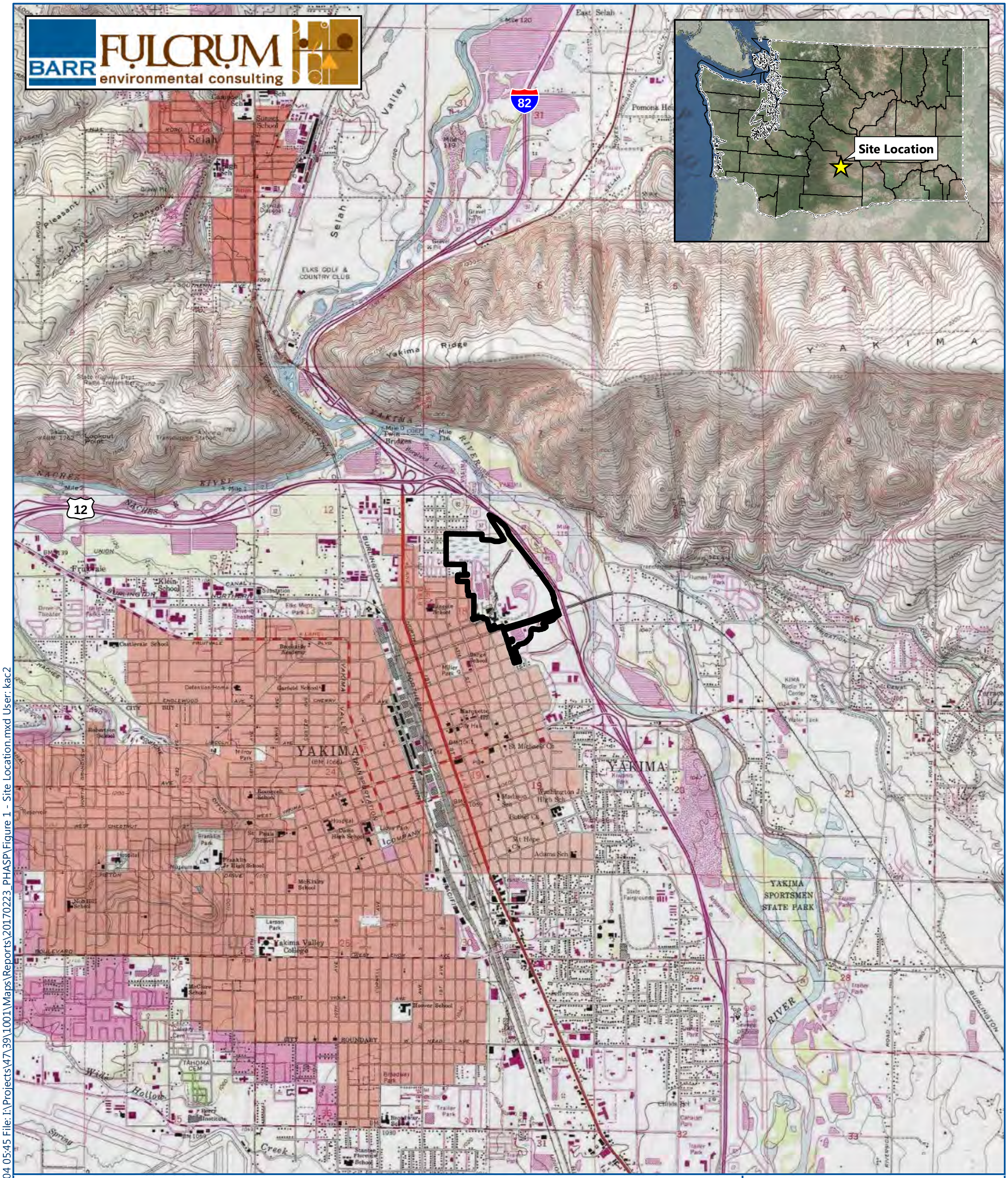
Stings from insects are often painful, cause swelling and can be fatal if a severe allergic reaction such as anaphylactic shock occurs. If a sting occurs, the stinger should be scraped out of the skin, opposite of the sting direction. Never use tweezers to remove the stinger as it will force additional venom into the victim. The area should be washed with soap and water followed by an ice pack.

If the victim has a history of allergic reaction, he should be taken to the nearest medical facility. If the victim has medication to reverse the effects of the sting, it should be taken quickly.
If the victim experiences a severe reaction, a constricting band should be placed between the sting and the heart. The bitten area should be kept below the heart if possible. A physician should be contacted immediately for further instructions.

Table 3
First Aid Reference Guide

WHOA!	Wounds & Bleeding	Amputated Parts
Safety First! What happened? What do you observe? ☐ # of victims ☐ # of witnesses ☐ Mechanism of Injury ☐ Nature of Illness Are there any hazards? ABCs/AVTPU	Remember PIE, children love it! ☐ Direct pressure to control bleeding ☐ Ice or cold application. In a pinch? Look in the fridge (ice, frozen veggies, pop, frozen juice, frozen rice, etc.) ☐ Elevate extremity ☐ Clean with soap & water, then bandage	☐ Remember PIE! ☐ Treat for shock: Calm & reassure, monitor ABCs, elevate legs, maintain normal body temperature ☐ Place amputated tissue in clean or sterile dressing that is dampened but not wet. Wrap the tissue in plastic or foil and cool with ice. Avoid freezing the tissue.
Nosebleed	**Avulsed Tooth**	**Serious Burns**
☐ Squeeze one or both nostrils ☐ Apply cold directly to the nose ☐ Patient should lean forward with heat tilted down	☐ Do not place in milk, mouthwash or alcohol. Milk contains sugar which can destroy tooth tissue ☐ Do place in saline solution, water, or in patient's saliva ☐ Time is crucial. See the dentist immediately!	☐ Stop the burning by using profuse water or ☐ Stop, drop, and roll ☐ Ensure ABCs ☐ Treat for shock ☐ Place dry dressing on burn ☐ Call 9-1-1
Minor Burn	**Sunburns**	**Heat Illness**
☐ Cool with water until pain stops ☐ Cover with dressing to prevent contamination ☐ DO NOT use ointments, creams, lotions, or butter. This will trap heat and increase tissue damage ☐ Some over-the-counter remedies such as aloe should not be used until the burn has been cooled and clean **Insect Bites & Stings** Don't slap at an insect when it is on you. It is better to blow or brush off ☐ If stinger is left in, it should be scraped off ☐ Apply ice or cold application ☐ If itching, pain, hives, & difficulty breathing occur, call 9-1-1	Prevention is the best cure! ☐ Limit exposure to sun between 11 AM – 2 PM ☐ Apply sunscreen with a sun protection factor of 15 SPF. This should be done 30 minutes before going outside If sunburn occurs: ☐ Remove patient from direct exposure to sun ☐ Cool by taking a cool shower or bath ☐ DO NOT use ointments, creams, lotions, or butter ☐ Check with your physician before using pain medications or other over-the-counter remedies ☐ If sunburn is serious, see your physician immediately	The best treatment is prevention! ☐ Keep hydrated! Drink lots of water ☐ Avoid sugar treats, pop, & caffeine. These make it difficult for a person to absorb fluid ☐ Avoid nicotine Symptoms of heat exhaustion are pale, cool, clammy/sweaty skin, nausea, dizziness, weakness, fatigue. This progresses to heat stroke when the level of consciousness changes ☐ Remove to a cool place ☐ Cool rapidly ☐ Give fluids if tolerated ☐ Monitor patient's mental status ☐ Treat for shock ☐ Call 9-1-1 if necessary
Frostbite	**Head & Neck Injuries**	**Seizures**
This is preventable. Avoid tobacco use, caffeine, and alcohol. The three stages of frostbite is incipient, superficial, & deep frostbite. Signs & symptoms are tingling and numbness in cold, white or gray skin, & pain. General treatment is: ☐ Remove from cold environment ☐ Warm in water 104-108 degree F ☐ Once rewarmed, elevate part ☐ If you can't go indoors, place hands under armpit (if hands are affected) ☐ Do not rub, this may cause tissue damage ☐ Avoid rewarming & refreezing cycle	S&S-Altered mental status, any significant mechanism of injury, unconsciousness, unequal pupils, clear fluid or blood coming from ears, unusual sleepiness, confusion, dizziness, severe headache, difficulty with speech or vision, vomiting, difficulty walking, pale, sweaty. General treatment is: ☐ Call 9-1-1 ☐ Stabilize head ☐ Check for consciousness ☐ Do not move an unconscious person ☐ Keep in position found ☐ Treat for shock	General treatment for tonic-clonic seizures are: ☐ Protect the head ☐ Do not place anything in the mouth ☐ Do not restrain the person ☐ If possible, time the seizure When seizure stops, place in recovery position
Diabetic Emergencies/Hypoglycemia	**Diabetic Emergencies/Hyperglycemia**	**Fractures, Sprains, & Dislocations**
Hypoglycemia is low blood sugar and is the most common of diabetic emergencies. S&S is: altered mental status (giddy, sleepy, aggressive, or cranky). The skin will appear pale, cool & clammy ☐ When in doubt, and as long as the patient remains conscious, give sugar in the form of juices, honey, sugar, candy, or soda pop ☐ Do not give diet products such as nutrasweet ☐ Follow up with a sandwich or more substantial meal ☐ Call 9-1-1	Hyperglycemia is high blood sugar. Most often this is an undiagnosed diabetic or a diabetic who is not taking proper care of themselves. This is not the emergency that hypoglycemia is. However, if left untreated, this can progress to diabetic coma: ☐ S&S are excessive thirst, excessive urination, fruity breath odor, flushed and dry skin ☐ If in doubt, give sugar. This will not hurt the patient ☐ Call 9-1-1	It is not necessary to know the difference between these three conditions. An x-ray is the only definitive diagnosis. S&S are similar and first aid is the same. Some general S&S are: pain, tenderness, swelling, deformity, and loss of mobility. Some general treatment guidelines are: ☐ Stabilize or immobilize the injury site ☐ Apply cold application ☐ Rest ☐ Elevate extremity, if possible ☐ Call 9-1-1 if needed or see your physician

Figures



▭ Yakima Mill Site Boundary

N

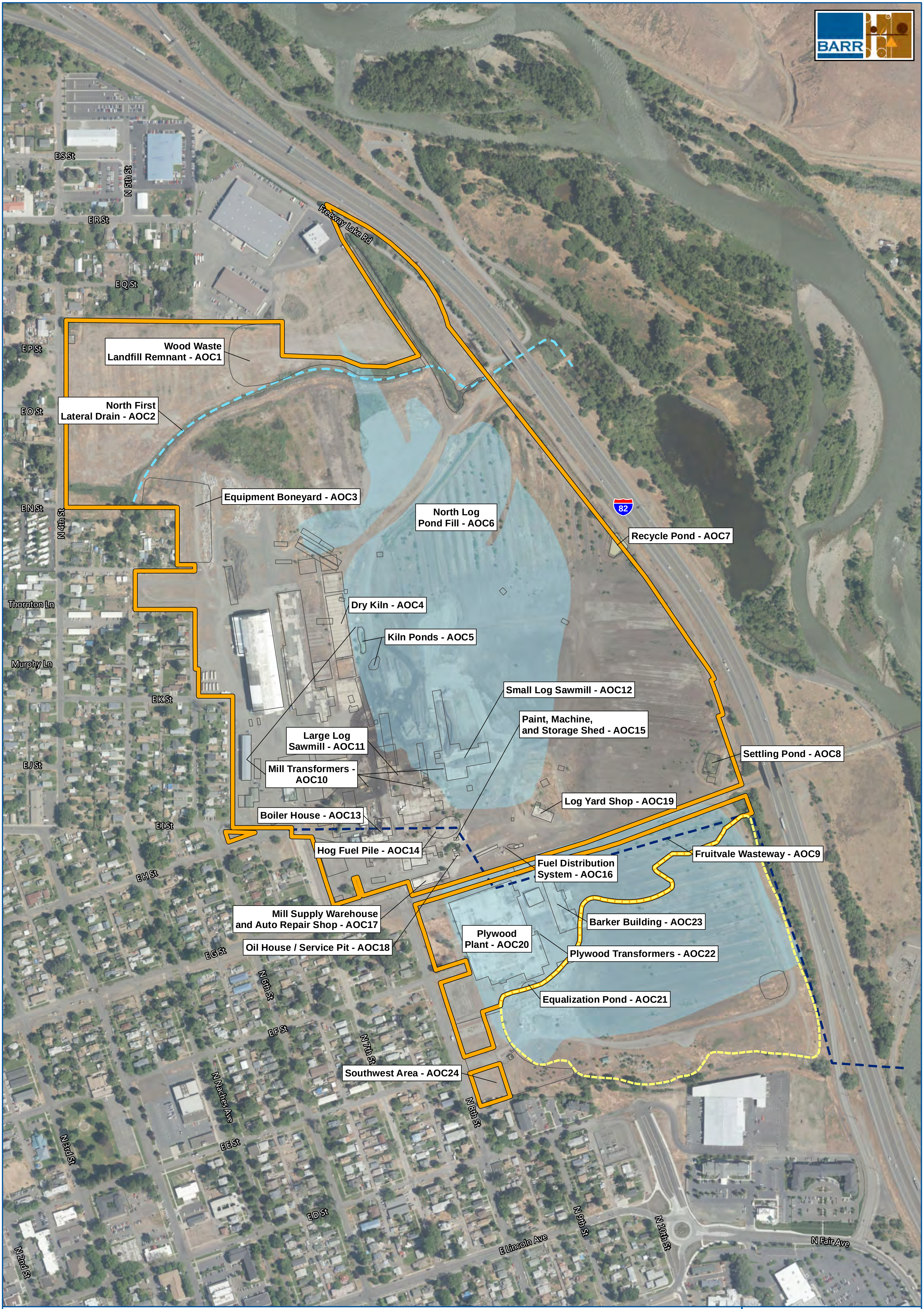
0 4,000 8,000
Feet

Background Data: USGS 24k Quad (Copyright:© 2013 National Geographic Society, i-cubed); Aerial Imagery (Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community)

SITE LOCATION
Final Project Health and
Safety Plan - Dec 2017
Yakima Mill Site
Yakima, WA

FIGURE 1

Barr Footer: ArcGIS 10.4, 2017-12-18 14:44 File: I:\Projects\47\39\1001\Maps\Reports\20170223_PHASP\Figure 2 - Site Layout.mxd User: kac2



Approximate Extent of Municipal Solid Waste (Landfill Site)

Yakima Mill Site Boundary

Historical Log Pond Extent

Historical Site Feature

Fruitvale Wasteway

North First Lateral Drain

N

0 450 900

Feet

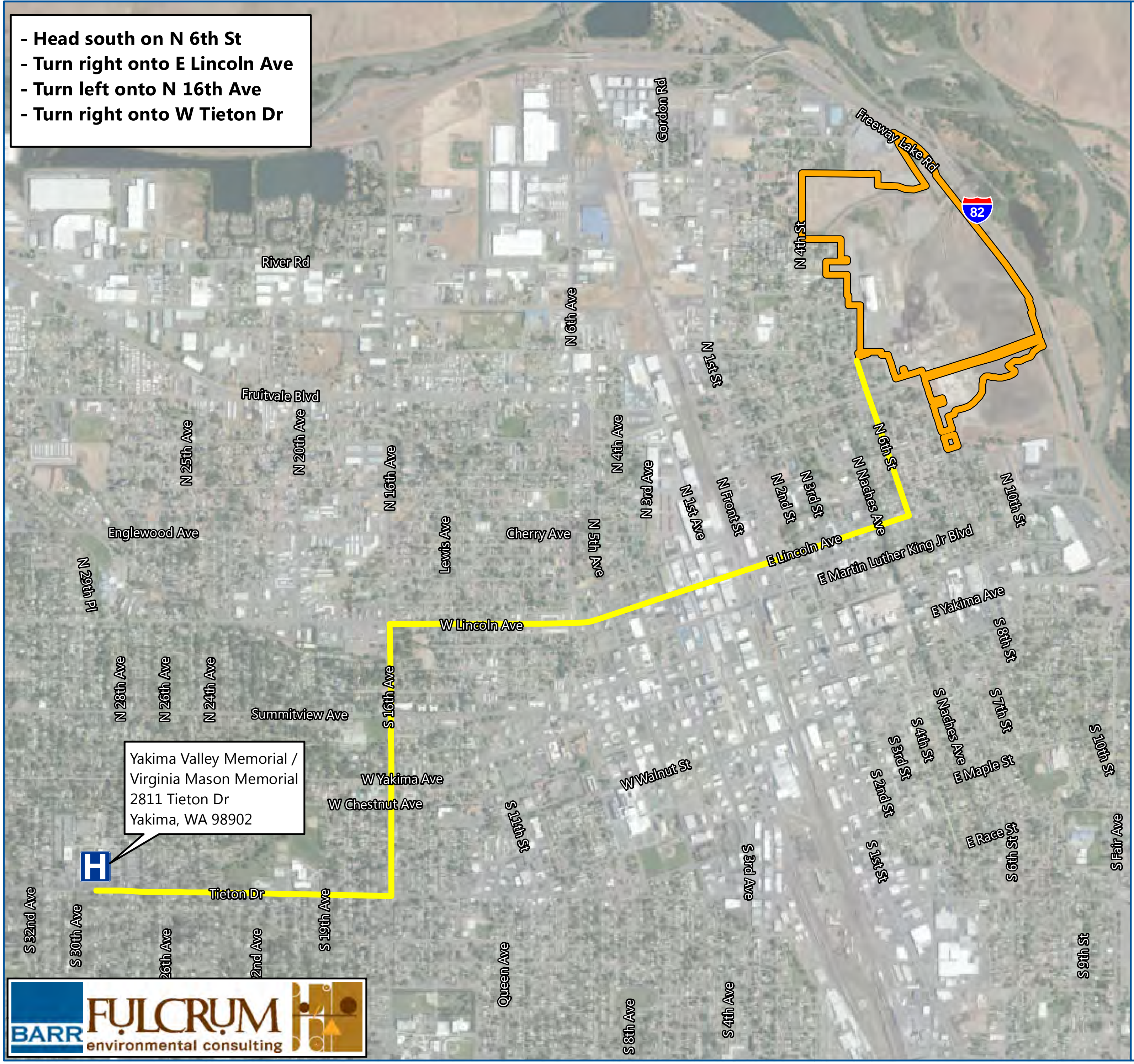
Background Aerial Imagery Source:
City of Yakima (June 2017)

SITE LAYOUT
Final Project Health and Safety Plan - Dec 2017
Yakima Mill Site
Yakima, WA

FIGURE 2

Barr Footer: ArcGIS 10.4, 2017-12-18 14:31 File: I:\Projects\47\39\1001\Maps\Reports\20170223_PHASP\Figure 3 - Hospital Location Map.mxd User: kac2

- **Head south on N 6th St**
- **Turn right onto E Lincoln Ave**
- **Turn left onto N 16th Ave**
- **Turn right onto W Tieton Dr**



Yakima Valley Memorial /
Virginia Mason Memorial
2811 Tieton Dr
Yakima, WA 98902

▭	Yakima Mill Site Boundary
H	Hospital Location

N

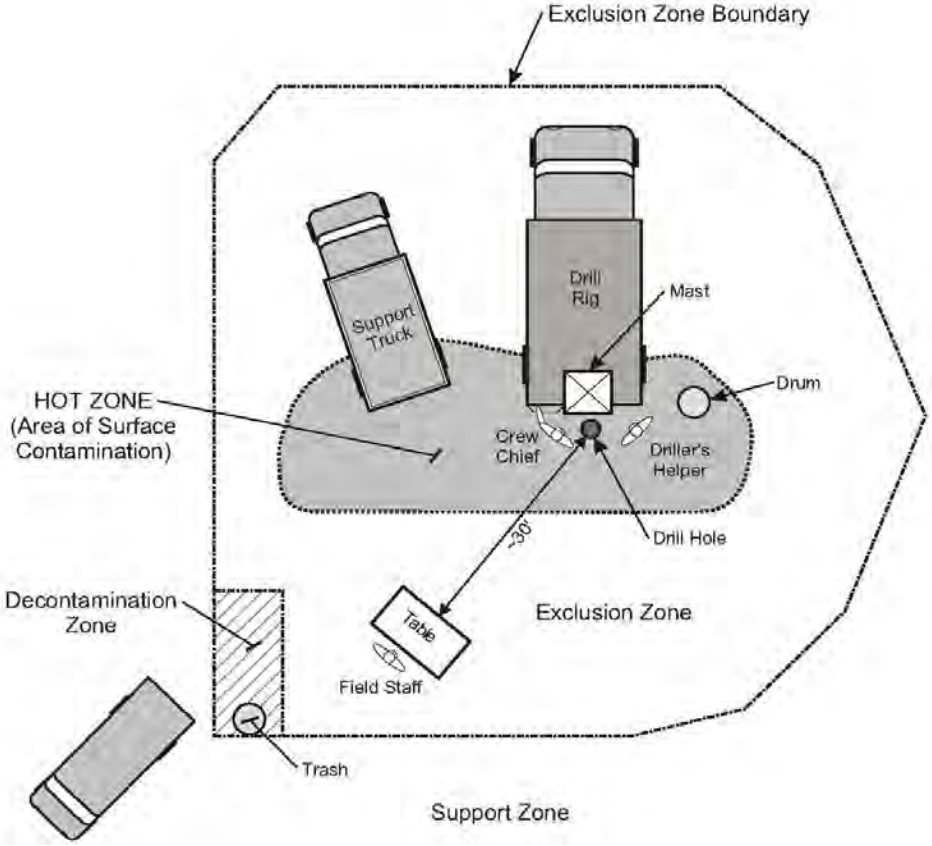
0 2,000 4,000

Feet

Background Aerial Imagery Source:
City of Yakima (June 2017)

HOSPITAL LOCATION MAP
Final Project Health and
Safety Plan - Dec 2017
Yakima Mill Site
Yakima, WA

FIGURE 3



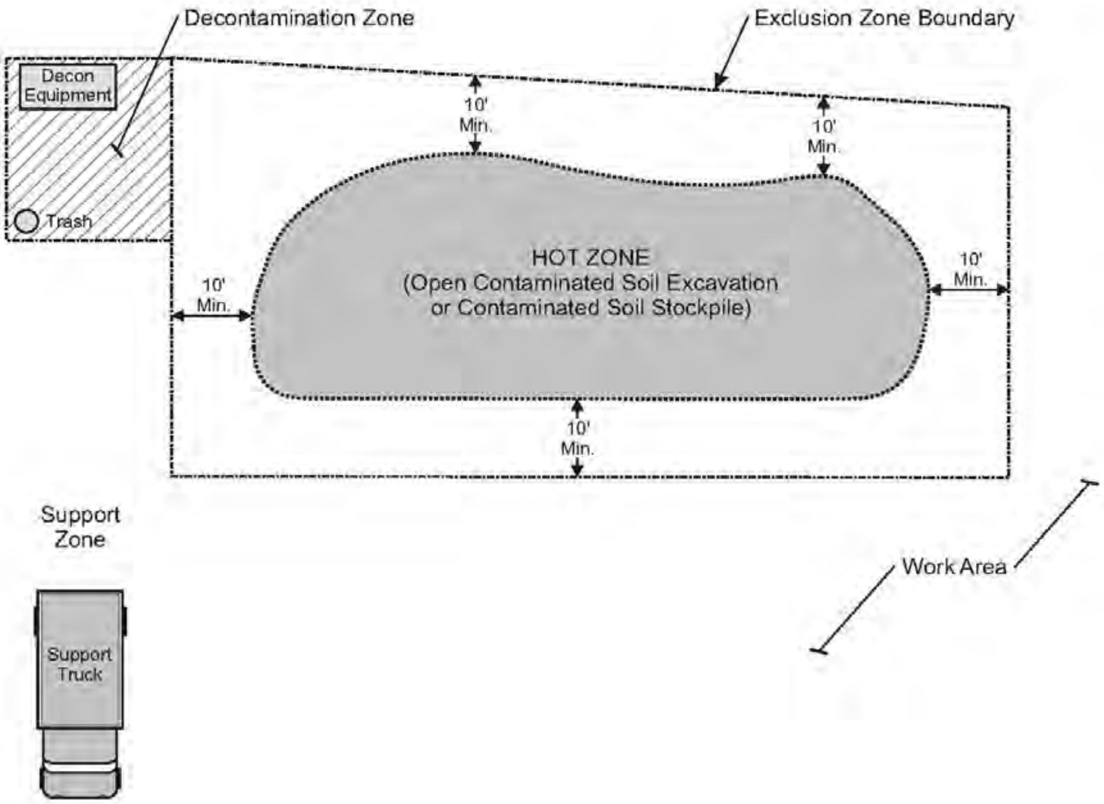
GENERAL GUIDELINES:

1. Enter and exit Exclusion Zone only through Decontamination Zone.
2. Radius of Exclusion Zone equals Mast height plus 20 feet.
3. Check for site specific requirements.

Figure 4

EXAMPLE OF WORK AND EXCLUSION ZONES FOR DRILLING ACTIVITIES

W:\Corporate\Operations\Human Resources\Safety Program\PHASP\2012 Update\Figures\Work Zones for Drilling Investigations CDR RLG 02-06-12



GENERAL GUIDELINES:

1. Enter and exit Exclusion Zone only through Decontamination Zone.
2. Radius of Exclusion Zone equals Mast height plus 20 feet.
3. Check for site specific requirements.
4. Place Stockpiles more than two feet from open excavation.

Figure 5

EXAMPLE OF WORK AND EXCLUSION ZONES FOR EXCAVATION/TRENCHING ACTIVITIES

W:\Corporate\Operation(s)\Human Resources\Safety Program\PHASP\2012 Update\Figures\Work Zones for Excavation Trenching Activities CDR RLG 02-06-12

Forms

Form 1
Project Health and Safety Acknowledgement and Visitor Sign-In Sheet

By signing your name, you acknowledge that you have attended a pre-work safety meeting for work at ____________________ project site and that you have read the PHASP and agree to abide by the requirements of this plan.

No.	Date	Name	Signature	Affiliation	Date of Pre-Work Safety Meeting
1)					
2)					
3)					
4)					
5)					
6)					
7)					
8)					
9)					
10)					
11)					
12)					
13)					
14)					
15)					
16)					
17)					
18)					
19)					
20)					
21)					
22)					
23)					
24)					
25)					

Form 2

Pre-Work Safety Checklist

SAFESTART®

These four states...

- ☐ **Rushing**
- ☐ **Frustration**
- ☐ **Fatigue**
- ☐ **Complacency**

can cause or contribute to these critical errors...

- ☐ **Eyes not on Task**
- ☐ **Mind not on Task**
- ☐ **Line-of-Fire**
- ☐ **Balance/Traction/Grip**

...which increase the risk of injury.

Date:______________________________

Project: ______________________________

Team Members Attending:____

Task:____

____

The following PPE should always be worn onsite:

☐ Safety Glasses ☐ Hard-Hat ☐ Steel-Toe Boots ☐ High Visibility Vest

☐ Flame Retardant Clothing ☐ Protective Gloves ☐ Hearing Protection

☐ Other:

Training Required:

☐ Hazardous Waste Site (40-Hr HAZWOPER) ☐ Lead site (Lead Safety Awareness)

☐ Mine Site (24-Hr MSHA training needed if un-escorted) ☐ Industrial Site (Industrial Site Training) ☐ Site/Client Specific Training:

Potential Hazard	Mitigation Measures	Training
☐ Weather ☐ Heat/Cold Stress ☐ Thunderstorms/Winter storms ☐ Tornadoes, Flooding, High Winds	☐ rest breaks ☐ shelter ☐ hydration ☐ weather alert radio ☐ review heat/cold stress guidelines ☐ stop work ☐ gear:	
☐ Balance/Traction/Grip	☐ identify hazards:	
☐ Water/Ice	☐ PFD ☐ rescue boat ☐ ring buoy ☐ stay clear ☐ buddy ☐ safety equipment::	Water Safety/ Ice Safety
☐ Biological Hazards ☐ Poisonous Plants ☐ Poisonous/Aggressive Animals ☐ Insect Bites/Stings ☐ Water-Borne Pathogens	☐ tick/insect repellant clothing ☐ tick/insect repellant ☐ bear spray ☐ snake boot/chaps ☐ other:	
☐ Smoke/Dust Inhalation	☐ aerosol monitor ☐ particulate respirator	Respirator/ Fitness
☐ Heights/Drop-Offs > 6 feet	☐ be aware ☐ fall protection equipment: ☐ anchor:	Fall Protection, Scaffolding
☐ Falling Objects/Overhead Hazards	☐ hard hat ☐ be aware ☐ avoid line-of-fire	
☐ Fire/Explosive Hazard ☐ Combustible Materials ☐ Seasonal Fire Risk ☐ Catalytic Converter/hot engines ☐ Potential Explosive Atmosphere	☐ fire extinguisher ☐ other: ☐ non-sparking equipment ☐ combustible gas monitoring ☐ emergency signal ☐ flame retardant clothing (FR Clothing)	Fire Extinguisher

☐ Utilities	☐ one-call clearance ☐ private clearance ☐ mark or flag utilities ☐ other:	
☐ Excavation >4 ft *	☐ competent person ☐ exclusion zone ☐ pre-entry inspection	Excavation Safety
☐ Confined Space * ☐ Excavation Entry ☐ Sewer ☐ Tanks/Enclosed Spaces	☐ organic vapor monitoring ☐ O_2/combustible gas monitoring ☐ stand-by person ☐ confined space permit completed ☐ rescue equipment:	Confined Space
☐ Vehicular Traffic	☐ high visibility vest ☐ traffic barricades ☐ traffic control person ☐ lane closure ☐ cones ☐ traffic spotter	
☐ Heavy Equipment	☐ spotter ☐ hand signals ☐ emergency signal ☐ hearing protection ☐ avoid line-of-fire ☐ high visibility vest	Field Activities
☐ Operator Qualifications (off-road, trailer, ATV, snowmobile, boat)*	☐ inspection checklist ☐ operator qualified/experienced	DOT, Boat Safety, ATV
☐ Energized Equipment	☐ lockout/tagout * ☐ equipment inspections	Lockout/Tagout, Electrical
☐ Sustained Noise > 85dB	☐ hearing protection	
☐ Chemical Exposure ☐ Inhalation ☐ Ingestion ☐ Dermal Contact	☐ lead/asbestos awareness ☐ air monitoring: ☐ glove type: ☐ additional PPE: ☐ respirator:	Respirator/ Fitness, PPE, lead/asbestos awareness
☐ Ergonomic - Repetitive Tasks, Heavy Lifting	☐ stretching/moving ☐ review lifting techniques ☐ use appropriate equipment:	
☐ Limited/Remote Medical Services	☐ cell phone ☐ satellite phone ☐ 911 available	First aid/CPR, Wilderness Survival
☐ Fatigue	☐ rest breaks ☐ stay overnight ☐ work in shifts	
☐ Working Alone	☐ remote buddy ☐ emergency plan ☐ schedule check-ins : ☐ cell phone coverage	

*Obtain additional permits, checklists and forms from the portal

Additional Discussion Questions	**Comments**
What conditions might warrant work stoppage or postponement?	
Are there concerns about personal safety (unrestricted public access, police protection, hunting season etc.)?	
What should happen is there is a spill or if something unexpected is encountered?	
What should be covered during onsite safety meetings? (Use PHASP Form 3)	
What signal will be used onsite in an emergency? Where is the evacuation point?	
How will the exclusion zone be delineated?	
Where will the first aid kit/eyewash/ fire extinguisher be located?	

Is there a source of potable water for decontamination procedures? What are the decon procedures?	
Will there be off-road driving conditions or other vehicle/driving requirements?	
Will field staff be transporting or shipping hazardous materials? (check with Pete Lawless for shipping requirements)	
Any pre-existing medical conditions or allergies the team should be aware of?	
Discuss driving safety (stopping if fatigued/ill, limit or ban use of cell phones).	
Any neighboring facilities or conditions that might affect safety?	
Additional hazards or safety concerns identified by team	
Have local emergency responders been contacted?	

Notes:

Form 3
Daily Safety Form

Project Name:		Project Number:
PHSTL:	Buddy:	Date:
Meeting Attendees:		

ADMINISTRATIVE	YES	NO	N/A		YES	NO	N/A
PHASP, PHASP Appendices and MSDS onsite?	☐	☐	☐	Fire Extinguisher/First Aid Kit/Eye Wash onsite?	☐	☐	☐
PHASP Acknowledgment and Visitor Sign-In Sheet signed?	☐	☐	☐	Weekly check of First Aid Kit conducted (by PHSTL)?	☐	☐	☐
Work zone (exclusion, decon, support zones) physically defined and documented?	☐	☐	☐	PPE:	☐ Level D ☐ FR Clothing	☐ Modified Level D ☐ High visibility vest	☐ Level C ☐ Other

SAFESTART®

These four states...
- ☐ **Rushing**
- ☐ **Frustration**
- ☐ **Fatigue**
- ☐ **Complacency**

can cause or contribute to these critical errors...
- ☐ **Eyes not on Task**
- ☐ **Mind not on Task**
- ☐ **Line-of-Fire**
- ☐ **Balance/Traction/Grip**

...which increase the risk of injury.

DAILY "TOOL-BOX" MEETING TOPICS (select topics prior to meeting)

Hazard	***Discussion Topic/Mitigation Measure***
☐ Weather	☐ Potential for heat/cold stress ☐ Warm-up/Cool-down periods ☐ Shelter/hydration ☐ Proper clothing ☐ Adverse weather (tornadoes, thunder/lightning, winter storms) ☐ Review symptoms of heat/cold stress ☐ Other:
☐ Balance/Traction/Grip	☐ Identify potential hazards ☐
☐ Water/Ice	☐ Personal Flotation Device (PFD) ☐ Ring buoy ☐ Rescue Boat ☐ Buddy system ☐ Check ice thickness
☐ Biological Hazards ☐ Poisonous plants ☐ Poisonous/aggressive animals ☐ Insect bites/stings ☐ Water-borne pathogens	☐ Repellant clothing/spray ☐ Locations to avoid
☐ Smoke/Dust Inhalation	☐ Aerosol monitor ☐ Particulate respirator
☐ Fall Protection (> 6 ft)	☐ Describe fall protection:
☐ Overhead Hazards	☐ Hard hat ☐ Avoid line-of-fire ☐ Flag overhead hazards
☐ Fire/Explosion ☐ Combustible materials ☐ Seasonal fire risk ☐ Catalytic converter/hot engines ☐ Potential explosive atmosphere	☐ Non-sparking equipment ☐ Combustible gas monitoring ☐ Flame retardant clothing (FR Clothing) ☐ Protective gloves when handling hot equipment
☐ Utilities	☐ Utility clearance completed ☐ Locations clearly marked ☐ Awareness of utilities when work area changes ☐ Other:
☐ Excavation (> 4 ft, working near or entering excavation)	☐ Excavation Safety Checklist completed ☐ Exclusion Zone delineation ☐ Soil Type:____________ ☐ Other:
☐ Confined Space	☐ Confined space permit ☐ Air monitoring ☐ Training up-to-date ☐ Stand-by person ☐ Rescue equipment:
☐ Vehicular Traffic or Heavy Equipment	☐ Traffic barricades ☐ Cones ☐ Lane Closure ☐ Traffic Spotter ☐ High visibility vest ☐ Operator communication ☐ Emergency signal ☐ Avoid line-of-fire
☐ Energized Equipment	☐ Lockout/Tagout ☐ Equipment inspections
☐ Sustained noise > 85 dB	☐ Use hearing protection ☐ Other:
☐ Chemical Hazards (working in the exclusion zone)	☐ Lunch/Break Area ☐ No smoking/eating/drinking ☐ Evacuation route/emergency signal ☐ Spill response procedure ☐ Decon procedure ☐ Symptoms of overexposure ☐ Air Monitoring & PPE
☐ Ergonomics/Heavy Lifting	☐ Review proper lifting techniques ☐ Identify materials requiring lifting equipment ☐ Stretching/moving breaks ☐ Other:
☐ Emergency Action Plan	☐ Emergency signal ☐ Evacuation point ☐ Equipment shut-offs ☐ Hospital location map ☐ First Aid kit location ☐ Potable water location
☐ ***Additional spaces for project specific tasks***	
☐	
☐	

Additional Comments (Field Tasks, Field Deviations, Incidents, Visitors etc.):

Work Zones ***(Consider Including a map of the Project Area (screenshot of location map) and note exclusion zone, decontamination zone, support zone and air monitoring locations)***

AIR MONITORING

Type of Monitoring	*Instrument Name and Serial Number*	*Date/Time of Calibration Check?*	*Air Monitoring Frequency*
Combustible Gas Monitoring (% LEL)			
Organic Vapor Monitoring (ppm)			

AIR MONITORING DATA

Time	Air Monitoring Reading ***(Modify for site-specific air monitoring parameters)***				
	Organic Vapors (ppm)	**Oxygen (%)**	Combustible Gas Monitoring (% LEL)	**CO (ppm)**	**H_2S (ppm)**

BARR

Form 4

Close Call / Good Call Report

Please complete this form after the occurrence of a Close Call (incident causing injury or property damage that almost happened, or could have been worse) or a Good Call (implemented action to prevent a Close Call or incident).

Reporting and follow up related to this Close Call / Good Call Report should be billed to AC040700.12 COR 500. Return completed form to a HSC.

Description of Close Call/Good Call (who, what, where, when, how):

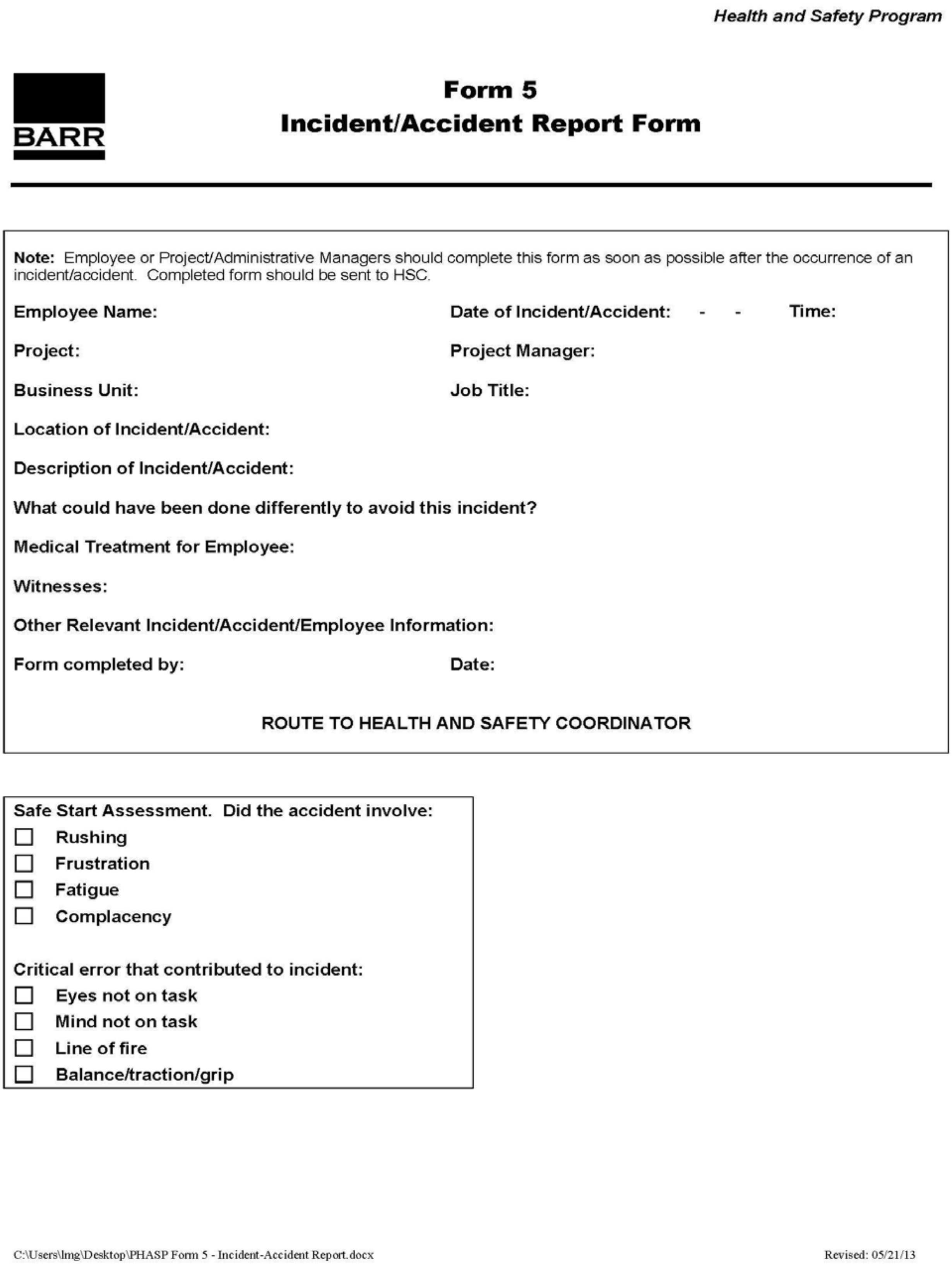
What went right? What could've been done differently?

Reported by (optional):

Today's Date:

Project (optional):

Project Manager (optional):



Health and Safety Program

BARR

Form 5
Incident/Accident Report Form

Note: Employee or Project/Administrative Managers should complete this form as soon as possible after the occurrence of an incident/accident. Completed form should be sent to HSC.

Employee Name: **Date of Incident/Accident:** - - **Time:**

Project: **Project Manager:**

Business Unit: **Job Title:**

Location of Incident/Accident:

Description of Incident/Accident:

What could have been done differently to avoid this incident?

Medical Treatment for Employee:

Witnesses:

Other Relevant Incident/Accident/Employee Information:

Form completed by: **Date:**

ROUTE TO HEALTH AND SAFETY COORDINATOR

Safe Start Assessment. Did the accident involve:

- ☐ **Rushing**
- ☐ **Frustration**
- ☐ **Fatigue**
- ☐ **Complacency**

Critical error that contributed to incident:

- ☐ **Eyes not on task**
- ☐ **Mind not on task**
- ☐ **Line of fire**
- ☐ **Balance/traction/grip**

C:\Users\lmg\Desktop\PHASP Form 5 - Incident-Accident Report.docx

Revised: 05/21/13

Form 6
Daily Excavation Safety Checklist

*** To be completed by Competent Person or Excavation Safety Trained Employee ***

Project Name:		Project Number:
Site Location:		Barr Competent Person/Checklist Completed by:
Date:	Time:	Competent Person Onsite:
Control of Site: (check one)	Barr________	Others ________
Soil Classification (attach form):		Protective System Used:
Excavation Depth:		Excavation Width:

A) Site Control, Will Excavation Entry	**Yes**	**No**
1. Is Barr in Control of the Site? If *YES*: go to line A2. If *NO*: go to line A3.		
2. Are you Barr's Competent Person for this project? If *YES*: go to line A8. If *NO*: have Barr's Competent Person complete this checklist.		
3. Have you conferred with the Competent Person for the site? If *YES*: go to line A4. If *NO*: confer with Competent Person before completing checklist.		
4. Have you completed inspection of the excavation and surrounding area? If *YES*: go to line A5. If *NO*: complete an inspection of the excavation before completing checklist.		
5. Does the Competent Person have the authority to take prompt corrective measures (remove employees from the excavation immediately if needed)? If *YES*: go to line A6. If *NO*: go to line D2.		
6. Has Competent Person conducted daily inspections of excavations, adjacent areas, and protective systems? If *YES*: go to line A7. If *NO*: Competent Person should conduct inspection before completing checklist.		
7. Does the Competent Person confirm that, in their opinion, the excavation complies with the OSHA Standard? If *YES*: go to line A8. If *NO*: go to line D2.		
8. Will a Barr Employee or Barr Subcontractor enter the excavation? If *YES*: go to line B1. If *NO*, checklist complete: • Employees *CANNOT ENTER* excavation without completing the rest of the checklist. • Always work with caution around excavations. • Utilities must be located for excavation work, call before you dig. • Work conducted around excavations without entry may require consideration of: - Soil type - Protection from falling hazards - Sloping - Inspection for tension cracks - Encumbrances - Consideration of the effects water on the stability of the excavation		

B) General Inspection of Jobsite	**Yes**	**No**
1. Are side slopes 4H:1V or flatter and is the excavation less than 20 feet deep? If *YES*: go to line C1. If *NO*: go to line B2.		
2. Is the excavation less than 4-feet deep and has the surrounding area been inspected for potential cave-ins (tension cracking, etc.)? If *YES*: go to line C1. If *NO*: go to line B3.		
3. Is there a known hazardous atmosphere or potential to create a hazardous atmosphere? • Confined space entry procedures must be conducted to protect employees entering excavations where there is a reasonable possibility that the atmosphere contains: - Less than 19.5% oxygen - Greater than 20% of the LEL - and/or other hazardous atmospheres. • Ventilation may have to be provided to prevent employee exposure. • Employees must be trained in confined space entry and the use of personal protective equipment and other rescue equipment. If *YES*: complete confined space entry permit and go to line B4. If *NO*: go to line B4.		
4. If used, obtain drawings of shielding, shoring and benching.		

Form 6
Daily Excavation Safety Checklist

*** To be completed by Competent Person or Excavation Safety Trained Employee ***

5. Is the excavation greater than 20 feet deep? If *YES*: go to line B6. If *NO*: go to line B7.		
6. Has a Professional Engineer designed the excavation? If *YES*: go to line B9. If *NO*: go to line D2.		
7. Are the side slopes 1.5H:1V or flatter? If *YES*: go to line B9. If *NO*: go to line B8.		
B) General Inspection of Jobsite (continued)	**Yes**	**No**
8. Have the soils been classified and has the allowable slope been determined in accordance with the OSHA Excavation Standard and documented? If *YES*: go to line B9. If *NO*: Classify soil to determine type and slope, document findings, go to line B9.		
9. Inspect sloping, shielding, shoring and/or benching. Have these protective systems been found to be in good state of repair and, if applicable, been found to conform to the certified design drawings? If *YES*: go to line B10. If *NO*: go to line D2.		
10. Have surface encumbrances been removed, protected, or stabilized? Note: surface encumbrances are any surface or subsurface obstruction that may create a hazard to employees. If *YES*: go to line B11. If *NO*: go to line D2.		
11. Inspect access and egress. Is there good access and egress? This would include: • A stairway, ladder, ramp or other safe means of egress located every 25 lateral feet in trench excavations. • *Secured* ladders that extend 3 feet above the edge of the trench. • Structural ramps used by employees that are designed by a Competent Person and structural ramps used for equipment that are designed by a Registered Professional Engineer. • Protection from cave-ins when entering or exiting the excavation. • Walkways and bridges over excavations that are equipped with standard guardrails and toeboards. If *YES*: go to line B12. If *NO*: go to line D2.		
12. Have protective measures from falling hazards been adopted or implemented? Employees may not: • Go under suspended loads and equipment. • Work on the faces of sloped or benched excavations above other employees. If *YES*: go to line B13. If *NO*: go to line D2.		
13. If there is accumulating water in the excavation and have precautions been taken to protect employees? • Surface water runoff should be diverted or controlled to prevent accumulation in the excavation. • Excavation inspections should be made after rainstorms or other hazard-increasing occurrences. If *YES*: go to line B14. If *NO*: go to line D2.		
14. Is there protection from loose rock or soil or other material or equipment that may fall or roll from the face or edge of the excavation? If *YES*: go to line B15. If *NO*: go to line D2.		
15. Have utility companies been contacted and have utilities been located? • Location of utilities must be marked. • Underground installations must be protected, supported, or removed when excavation is open. If *YES*: go to line C1. If *NO*: go to line D2.		
C) Barr PM/PIC Approval	**Yes**	**No**
1. Can it be concluded that the excavation complied with the requirements of the OSHA Excavation Standard? If there are any questions about conditions, call Barr geotechnical expert before continuing. If *YES*: go to line C2. If *NO*: go to line D2.		
2. Has Barr's Competent Person onsite given approval for the excavation entry? If *YES*: go to line C3. If *NO*: go to line D2.		
3. Have you conferred with Barr's PM or the PIC regarding your observations and conclusions and the need to enter excavation? If *YES*: go to line C4. If *NO*: go to line D2.		

Form 6
Daily Excavation Safety Checklist

*** To be completed by Competent Person or Excavation Safety Trained Employee ***

4.	Has Barr's PM or the PIC given their approval for the excavation entry? If *YES*: go to line C5. If *NO*: go to line D2.		
5.	Have you documented the procedures followed, the conditions observed, and the specific authorization for the excavation entry? If *YES*: go to line D1. If *NO*: go to line D2.		
D)	**Excavation Approval**		
	1. Excavation entry is **APPROVED** consistent with proper personal protection equipment.		
	2. Excavation entry is **NOT APPROVED** and under no circumstances shall the excavation be entered by: • Any Barr employee, employee of Barr's subcontractor(s), or other such as representatives of owner or regulatory agency where the site is controlled by Barr. • Any Barr employee where the site is controlled by others.		

Form 7
Soils Classification Checklist

This checklist must be completed when soil analysis is made to determine the soil type(s) present in the excavation. A separate analysis must be performed if the excavation (trench) is stretched over a distance where soil type changes.

Site Location:		
Date:	**Time:**	**Competent Person:**
Where was the sample taken from:		
Excavation Depth:	**Excavation Width:**	**Excavation Length:**

Visual Test

Particle type: Fine grained (cohesive) ____________________ Granular (sand/silt or gravel) ________________

Water conditions: Wet __________ Dry __________ Seeping water _______
Surface water present _______ Submerged __________

Previously disturbed soils: Yes __________ No ___________

Underground utilities: Yes __________ No ___________
If yes, what type?

Layered soils? **Note:** *The less stable layer controls soil type.* Yes __________ No ___________

Layered soils dipping into excavation: Yes __________ No ___________
Unknown ____________

Excavation exposed to vibrations: Yes __________ No ___________
If yes, from what?

Crack like openings or spalling observed: Yes __________ No ___________

Conditions that may create a hazardous atmosphere: Yes __________ No ___________
If yes, identify condition and source:

Surface encumbrances: Yes __________ No ___________
If yes, what type?

Work to be performed near public vehicular traffic: Yes __________ No ___________

Possible confined space exposure: Yes __________ No ___________

Manual Test

Plasticity: Cohesive ____________ Non-cohesive ______________

Dry strength: Granular (crumbles easily) ___________ Cohesive (broken with difficulty)_____________

Wet shake: Water comes to surface (granular material) _______
Surface remains dry (clay material) _______

Note: The following unconfined compressive strength tests should be performed on undisturbed soils.

This checklist must be completed when soil analysis is made to determine the soil type(s) present in the excavation. A separate analysis must be performed if the excavation (trench) is stretched over a distance where soil type changes.

Thumb Test used to estimate unconfined compressive strength of cohesive soil:

Test performed:	Yes ________	No ______	
______	Type A – soil indented by thumb with very great effort.		
______	Type B – soil indented by thumb with some effort.		
______	Type C – soil easily penetrated several inches by thumb with little or no effort. If soil is submerged, seeping water, subjected to surface water, runoff, exposed to wetting.		

Penetrometer or Shearvane used to estimate unconfined compressive strength of cohesive soils:			
Test performed:	Yes___	No____	Device used:
______	Type A – soil with unconfined compressive strength of 1.5 tsf or greater.		
______	Type B – soil with unconfined compressive strength greater than 0.5 tsf and less than 1.5 tsf.		
______	Type C – soil with unconfined compressive strength of 0.5 tsf or less. If soil is submerged, seeping water, subjected to surface water, runoff, exposed to wetting.		

Note: Type A – no soil is type A if soil is fissured, subject to vibration, previously disturbed, layered dipping into excavation on a slope of 4H:1V.

Soil Classification			
Stable Rock___	Type A ______	Type B ______	Type C ______

Selection of Protective System (29 CFR 1926, Subpart P, Appendix F)		
Protective System: Specify angle:	______ ______	Sloping (29 CFR 1926, Subpart P, Appendix B)
	______	Timber shoring (29 CFR 1926, Subpart P, Appendix C)
	______	Aluminum hydraulic shoring (29 CFR 1926, Subpart P, Appendix D)
	______	Trench shield Maximum depth in this soil ______

Form 8
Project Health and Safety Plan Amendment

Amendment #:

Date:

Amendment Section:

Amendment:

Reason For Amendment:

__ Amendment discussed with Project Manager on ____________ and approved.
__ Amendment discussed with Project Health and Safety Team Leader on __________ and approved.

Attachments

Attachment A
Heat Stress and Cold Stress Guidelines

The purpose of this guideline is to outline procedures and practices designed to help prevent disorders that occur from working in hot work environments. This guideline also is designed to prepare personnel to recognize signs and symptoms of heat related illnesses and provide for prompt and adequate treatment.

Definitions

Acclimatization: The process the body goes through to enable it to function properly in a particular environment. Acclimatization to the environment in this standard refers to high heat conditions.

Heat Cramps: Painful muscle cramps caused by exposure to excessive heat when workers may or may not drink large quantities of water, but fail to replace their body's salt loss.

Heat Exhaustion: Extreme weakness or fatigue, giddiness, nausea, or headache resulting from loss of fluid and/or salt through sweating.

Heat Rash: Red and inflamed bumps on the skin, usually accompanied by a prickly sensation, caused by a combination of excessive sweating and blocked sweat pores.

Heat Stress: The stress experienced by the body from heat and humidity, and complicated by personal characteristics such as age, weight, fitness, medical condition and lack of acclimatization to heat.

Heat Stroke: The failure of the body's internal mechanism to regulate its core temperature, resulting in the body becoming overheated to a dangerous degree.

Maximum Internal Body Temperature: It is recommended that the employee's deep body (core) temperature not exceed 100.4 degrees F (38 degrees C). This temperature is to be used as an overall gauge to determine if a worker is in any danger of having a heat related illness. This deep body temperature is based on the assumption that the employee is nearly acclimatized, fully clothed and is consuming adequate water and salts. On jobs where deep body temperature monitoring is required or being conducted, this temperature, when exceeded, must trigger the removal of the employee from the source of heat. (A reevaluation of the heat stress prevention procedures must be conducted along with an accident investigation to determine why the protective measures did not work or if another unseen factor contributed to the over exposure.)

Procedure Overview

Four environmental factors affect the amount of stress a worker faces in a hot working environment. These factors are temperature, humidity, radiant heat (such as from the sun), and air velocity.

Personal factors affect the ability of the body to resist heat stress illnesses. They include characteristics such as age, weight, fitness, medical condition and acclimatization to the heat. Short-term personal factors include alcohol, medication (prescription and non-prescription), diet, water and salt intake, sleep, and caffeine consumption.

The body reacts to high external temperature by circulating blood to the skin, which increases skin temperature and allows the body to release excess heat through the skin. However, if the muscles are being used for physical labor, less blood is available to flow to the skin and release the heat.

Sweating is another means the body uses to maintain a stable internal body temperature. However, sweating is effective only if the humidity level is low enough to permit evaporation and if the fluids and salts lost are adequately replaced.

If the body cannot dispose of excess heat, it will store it. When this happens, the body's core temperature rises, and the heart rate increases. As the body continues to store heat, the individual begins to lose concentration and has difficulty focusing on a task, may become irritable or sick, and often loses the desire to drink and eat. The next stage is most often fainting, and death is possible if the person is not removed from the heat.

A time of the year when heat stress should not be ignored is during spring and fall. During these times of year, the temperatures often range from below freezing to cool in the same day. The employee's susceptibility to heat stress occurs when he/she fails to wear sufficient layers of warm clothing. As the day grows warmer, the employee starts to sweat under his shirt and heavy jacket or insulated coveralls. At this point the employee takes off his jacket or coveralls and realizes that it still is too cold without it, so they put their jacket or coveralls back on. With this thick insulation around the body, the body's sweating mechanism will not work. The body will sweat, but little heat will dissipate. This stored heat can eventually lead to heat stress.

The key to protecting the employee is multi-layered clothing underneath the heavy jacket or coveralls. As it gets warmer, remove a layer of clothing. At some point, the jacket or coveralls get too warm and will need to be removed and replaced with some of the removed layers of clothing.

Heat Stroke Identification and Treatment

Heat Stroke: This is the most serious health problem for workers in hot environments and is caused by the failure of the body's internal mechanism to regulate its core temperature. Sweating stops and the body can no longer rid itself of excess heat. Signs may include:

- mental confusion, delirium, loss of consciousness, convulsions or coma
- a body temperature of 106 degrees F (41 degrees C) or higher
- loss of consciousness
- hot dry skin which may be red, mottled, or bluish
- victims of heat stroke may die unless treated promptly

Heat Stroke First Aid: Get the employee suffering from heat stroke to a Doctor/Hospital immediately. While awaiting medical help, the employee must be moved to a cool area and his or her clothing soaked with cool water. Place the injured in a comfortable position and fan them vigorously to increase cooling. Prompt first aid can prevent permanent injury to the brain and other vital organs. Water may be given to a conscious person. Don’t let the employee drink too quickly. Give the employee 4 ounces of water every 15 minutes. If the employee begins to vomit, stop giving water and place employee on their side.

Heat Exhaustion Identification and Treatment

Heat Exhaustion: Results from the loss of fluid through sweating and when a worker has failed to drink enough fluids or take in enough salt, or both. The employee with heat exhaustion still sweats but experiences extreme weakness or fatigue, giddiness, nausea, or headache. The skin is clammy and moist, the complexion pales or flushed, and the body temperature is normal or slightly higher.

Heat Exhaustion First Aid: The person should rest in a cool place and drink water or can be given an electrolyte solution (a beverage used by athletes to quickly restore potassium, calcium, and magnesium salts). These fluids should be given in 4-ounce portions, every 15 minutes. For severe cases involving victims who vomit or lose consciousness, medical attention is strongly recommended.

Heat Cramp Identification and Treatment

Heat Cramps: Painful muscle spasms are caused when workers are exposed to high heat and may or may not drink large quantities of water but fail to replace their bodies’ salt loss. Tired muscles, those used for performing the work, are usually the ones most susceptible to cramps.

Heat Cramp First Aid: Cramps may occur during or after working hours and may be relieved by taking liquids by mouth or saline solutions intravenously for quicker relief if medically determined to be required.

Heat Rash Identification and Treatment

Heat Rash: Also known as prickly heat may occur in hot and humid environments where sweat is not easily evaporated from the surface of the skin. When extensive or complicated by infection, heat rash can be so uncomfortable that it inhibits sleep, impedes a worker's performance or even results in temporary total disability. It can be prevented by periodically resting in a cool place and allowing the skin to dry.

Heat Rash First Aid: Antibiotic ointment can help prevent the rash from getting infected. Keep the rash as dry as possible.

Heat Stress Prevention

Heat-related health problems can be prevented or the risk of developing them reduced. Listed below are a few basic precautions which will help prevent heat stress.

Engineering controls including general ventilation (this can actually create a problem, ventilation with hot air affects the ability of the body to deal with the heat) and spot cooling by local exhaust ventilation at points of high heat production may be helpful. Evaporative cooling and mechanical refrigeration are other ways to reduce heat. Cooling fans can also reduce heat. Personal cooling devices using compressed air, ice packs, special fabrics that cool when wetted or reflective protective clothing are other ways to reduce the hazards of heat exposure for workers.

Recommended Practices

Increased air velocity. Fans are simple way to increase the body's ability to cool off. Fans become less effective at around 95 degrees F. (35 degrees C.) especially when the humidity is > 70%. A good rule of thumb is that fans don't cool you off above 98 degrees F. (37 degrees C.) and if air temperature is above body temperature it will increase the heat stress.

Cooling PPE. Ice vest or bandannas, wristlets, and head bands which have crystals contained in fabric which, when soaked for 30 minutes in water, will keep the fabric well below body temperature all day. These products can be reused.

Monitor core temperature of at risk workers with baby ear thermometer. If temperature above 100.4 degrees stop work.

Schedule rest breaks in a cool area when feasible.

Work practices such as providing plenty of drinking water, as much as a quart per worker per hour, at the workplace can help reduce the risk of heat stress. Workers should be encouraged to frequently drink small amounts, one cup every 15-20 minutes, of water. The water should be kept reasonable cool, 50 to 60 degrees F (10 to 15 degrees C) and should be kept near the workplace so the worker can reach it without abandoning the work area. In addition to water the use of electrolyte replacement drinks are recommended, but shall not replace water.

Alternating work and rest periods are required where high heat conditions exist. Scheduled rest periods in a cool area can help workers avoid heat stress. . If possible, heavy work should be scheduled during the cooler parts of the day and appropriate protective clothing provided, such as bandannas, or ice vest. Extra heavy clothing such as coveralls over street clothes must be avoided.

Training

Training all employees to recognize and treat heat stress disorders is essential to heat stress prevention.

Employee education is vital for all workers to ensure they are aware of the need to replace fluids and salt lost through sweating. Training should include the ability to recognize dehydration, heat cramps, salt deficiency, heat exhaustion, and heat stroke as heat disorders. Training should also include how to avoid heat related disorders and advice to stop work when they appear and seek treatment. Training should be conducted at the beginning of a project, initiated in the hot season and once a month until seasonal conditions change. Training shall be conducted for new employees during the pre-entry safety briefing.

The PHSTL will be trained to detect early signs of heat stress and will permit workers to interrupt their work if they are extremely uncomfortable.

Cold Stress

Fatal exposures to cold have been reported when persons fail to escape from low environmental air temperatures or from immersion in low temperature water. Hypothermia, a condition in which the body's deep core temperature falls significantly below 98.6EF, can be life-threatening. A drop in core temperature to 95EF or lower must be prevented.

Air temperature is not sufficient to determine the cold hazard of the work environment. The windchill must be considered as it contributes to the effective temperature. The body's physiologic defense against cold includes constriction of the blood vessels, inhibition of the sweat glands to prevent loss of heat via evaporation, glucose (fuel) production, and involuntary shivering to produce heat by rapid muscle contraction.

The frequency of accidents increases with cold exposures as the body's nerve impulses slow down, individuals react sluggishly and numb extremities make for increased clumsiness. Additional safety hazards include ice, snow blindness, reflections from the snow, and possible skin burns from contact with cold metal.

There are certain predisposing factors that make an individual more susceptible to cold stress. It is the responsibility of the project team members to inform the PHSTL if any of the predisposing factors listed below apply to that individual. This enables the PHSTL to monitor the individual if necessary, or use other means of preventing/reducing the individual's likelihood of experiencing a cold-related illness/disorder.

Predisposing Factors

Predisposing factors that will increase an individual's susceptibility to cold stress are listed below.

- Dehydration – The use of diuretics and alcohol, and diarrhea can cause dehydration. Dehydration reduces blood circulation to the extremities.
- Fatigue during physical activity – Exhaustion reduces the body’s ability to contract blood vessels. This results in the blood circulation occurring closer to the surface of the skin and the rapid loss of body heat.
- Age – Some elderly and very young individuals may have an impaired ability to sense cold.
- Alcohol consumption – Alcohol dilates the blood vessels near the skin surface resulting in body heat loss.
- Sedative drugs – Sedatives may interfere with the transmission of impulses to the brain thereby interfering with the body’s physiological defense against cold.
- Poor circulation – Vasoconstriction of peripheral vessels reduces blood flow to skin surface.
- Heavy workload – Heavy workloads generate metabolic heat and make an individual perspire. If perspiration is absorbed by the individual’s clothing and is in contact with skin, cooling of the body will occur.

- The use of PPE – PPE usage which traps sweat inside the PPE may increase an individual's susceptibility to cold stress.

- Lack of acclimatization – Acclimatization, the gradual introduction of workers into a cold environment allows the body to physiologically adjust to cold working conditions.

- History of cold injury – Previous injury due to cold exposures may result in increased cold sensitivity.

Preventing Cold Stress

There are a variety of measures that can be implemented to prevent or reduce the likelihood of employees developing cold related illness/disorders. These include acclimatization, fluid and electrolyte replenishment, eating a well-balanced diet, wearing warm clothing, the provision of shelter from the cold, thermal insulation of metal surfaces, adjusting work schedules, and employee education.

- **Acclimatization:** Acclimatization is the gradual introduction of workers into a cold environment to allow their body to physiologically adjust to cold working conditions. However, the physiologic changes are usually minor and require repeated uncomfortably cold exposures to induce them.

- **Fluid and Electrolyte Replenishment:** Cold, dry air can cause employees to lose significant amounts of water through the skin and lungs. Dehydration affects the flow of blood to the extremities and increases the risk of cold injury. Warm, sweet, caffeine-free, nonalcoholic drinks and soup are good sources to replenish body fluids.

- **Eating a Well-Balanced Diet:** Restricted diets including low-salt diets can deprive the body of elements needed to withstand cold stress. Eat high-energy food throughout the day.

- **Warm Clothing:** It is beneficial to maintain air space between the body and outer layers of clothing in order to retain body heat. However, the insulating effect provided by such air spaces is lost when the skin or clothing is wet.

- **Work Schedule Adjustment:** Schedule work during the warmest part of the day if possible; rotate personnel; and, adjust the work schedule to enable employees to recover from the effects of cold stress.

The parts of the body most important to keep warm are the feet, hands, head and face. As much as 40% of body heat can be lost when the head is exposed.

- **Recommended Clothing includes:**
  - Inner layers (t-shirt, shorts, socks) should be of thin, thermal insulating, nonmoisture absorbent material, moisture wicking, such as polypropylene.
  - Wool or thermal trousers. Denim is not a good protective fabric since it absorbs moisture very well.
  - Felt-lined, rubber-bottomed, leather-topped boots with a removable felt insole is preferred. Wool socks with polypropylene inner socks. Consider winter boots one half size larger than regular size to accommodate thick socks.
  - Wool or thermal shirts/sweaters should be worn over inner layer.
  - A wool cap is good head protection. Use a liner under a hard hat.
  - Mittens are better insulators than gloves. Wool liners for either mittens or gloves.
  - Face masks or scarves are good protection against wind.
  - Tyvek/polycoated tyvek provide good wind protection.
  - Wear loose fitting clothing, especially footwear. Consider winter boots a half size larger than regular shoes to accommodate thick socks.
  - Carry extra clothing in vehicle. Change out of wet clothes or socks.
- **Provision of Shelter from the Cold:** Shelters with heaters should be provided for the employees rest periods if possible. Sitting in a heated vehicle is a viable option. Care should be taken that the exhaust is not blocked and that windows are partially open to provide ventilation.
- **Thermal Insulation of Metal Surfaces:** At temperatures of 30 degrees F or lower, cover metal tool handles with thermal insulating material if possible.
- **Employee Education:** Employees have already been trained to recognize and treat the effects of cold stress during their 40-hour training. Signs, symptoms and treatment of cold stress should be reviewed in project safety meetings where applicable. The Buddy System will help in preventing cold stress once the employees are trained to recognize the signs and symptoms of cold stress.

Suggested Cold Stress Prevention Guidelines

It may not be practically or economically feasible to implement all the above prevention measures. Follow the guidelines given below when the **ambient air temperature is -5 degrees F or lower:**

- Contact the PHSTL to determine if the Site worker should continue working in such temperatures.
- Dress warm.
- Replenish fluids and electrolytes at regular intervals.
- Provide shelter from the cold.
- Adjusting work-rest schedules.

Cold Stress First-Aid Treatment Guidelines

TABLE A-1: COLD STRESS FIRST-AID TREATMENT GUIDELINES describes symptoms of different stages in cold stress and first aid treatment guidelines.

Table A-1. Cold Stress First-Aid Treatment Guidelines

Frostbite	
Stages:	
• Incipient (frost nip)	May be painless. Tips of ears, nose, cheeks, fingers, toes, chin affected. Skin blanched white.
• Superficial	Affects skin/tissue just beneath skin; turns purple as it thaws. Skin is firm, waxy; tissue beneath is soft, numb.
• Deep	Tissue beneath skin is solid, waxy, and white with purplish tinge. Entire tissue depth is affected.
First-Aid Treatment Guidelines:	
• Incipient	Warm by applying firm pressure—**no rubbing**; or blow warm breath on spot; or submerge in warm water (102-110EF).
• Superficial	Provide dry coverage, steady warmth; submerge in warm water.
• Deep	Hospital care is needed. **Don't** thaw frostbitten part if needed to walk on. **Don't** thaw if there is danger of refreezing. Apply dry clothing over frostbite. Submerge in water; **do not** rub.
General Hypothermia	
Stages:	Symptoms of Hypothermia:
Shivering	Muscle Tension Coordination Loss Uncontrollable Shivering Stumbling Decreased Muscle Function Fatigue Speech Distortion Forgetfulness Glassy Stare Freezing Extremities Blue, Puffy Skin Dilated Pupils Slow Pulse Shallow Breathing
Indifference	
Decreased Consciousness	
Unconsciousness	
Death	
Emergency Response:	
• Keep person dry; replace wet clothing • Apply external heat to both sides of patient using available heat sources, including other • bodies • Give warm liquids—**not** coffee or alcohol—after shivering stops and if conscious • Handle gently • Transport to medical facility as soon as possible • If more than 30 minutes from a medical facility, warm person with other bodies	

Windchill Index

The human body senses cold as a result of both air temperature and wind velocity. Cooling of exposed flesh increases rapidly as the wind velocity goes up. Frostbite can occur at relatively mild temperatures if wind penetrates the body insulation. For example, when the actual air temperature of the wind is 40°F and its velocity is 30 mph, the exposed skin would perceive this situation as an equivalent still air temperature of 13°F.

If the actual wind speed is not known, the following examples are provided to approximate wind speed.

5 mph = Light flag moves
10 mph = Light flag fully extended
15 mph = Raise newspaper sheet
20 mph = blowing and drifting snow

TABLE A-2: WINDCHILL INDEX shows a chart that can help in determining the windchill index. Site work should be terminated when there is a great danger of freezing exposed flesh.

Table A-2. Windchill Index

	Actual Temperature Reading (°F)											
Estimated Wind Speed (in mph)	50	40	30	20	10	0	-10	-20	-30	-40	-50	-60
	Equivalent Chill Temperature (°F)											
Calm	50	40	30	20	10	0	-10	-20	-30	-40	-50	-60
5	48	37	27	16	6	-5	-15	-26	-36	-47	-57	-68
10	40	28	16	4	-9	-24	-33	-46	-58	-70	-83	-95
15	36	22	9	-5	-18	-32	-45	-58	-72	-85	-99	-112
20	32	18	4	-10	-25	-39	-53	-67	-82	-96	-110	-121
25	30	16	0	-15	-29	-44	-59	-74	-88	-104	-118	-133
30	28	13	-2	-18	-33	-48	-63	-79	-94	-109	-125	-140
35	27	11	-4	-20	-35	-51	-67	-82	-98	-113	-129	-145
40	26	10	-6	-21	-37	-53	-69	-85	-100	-116	-132	-148
(Wind speeds greater than 40 mph have little additional effect.)	*LITTLE DANGER* In <hr with dry skin. Maximum danger of false sense of security.				*INCREASING DANGER* Danger from freezing of exposed flesh within one minute.				*GREAT DANGER* Flesh may freeze within 30 seconds.			

▨ Equivalent chill temperature requiring dry clothing to maintain core body temperature above 36 C (96.8°F) per cold stress TLV.

From: *Threshold Limit Values and Biological Exposure Indices*, ACGIH 2005. Developed by U.S. Army Research Institute of Environmental Medicine, Natick, MA.

Attachment B

Severe Weather Emergency Procedures

Severe Weather

1.0 Scope

As most projects are conducted outside, the potential for severe weather must be considered. Thunderstorms, tornadoes, and winter storms can develop quickly, jeopardizing worker safety. The following emergency procedures are to be followed in case of severe weather.

2.0 Thunderstorms and Lightning

Monitor weather conditions at all times while working. Monitor for a sign of an impending storm such as increased cloudiness, darkened skies, and increased wind. If any of these signs are observed, contact PHSTL to get current assessment of weather conditions.

When a thunderstorm accompanied by lightning is in the project area, cease work immediately. All powered equipment, such as drill rigs, are to be shut down. Seek shelter inside nearby buildings or trailers. If there are no buildings nearby, seek shelter inside your vehicle.

If you are caught outside, do not stand beneath tall, isolated trees or telephone poles. Avoid areas projecting above the landscape such as hilltops. In open areas, go to a low place such as a ravine or valley. Stay away from open water, metal equipment, wire fences, and metal pipes. If you are in a group of people in the open, spread out, staying several yards apart.

If you are caught in a level field or open area far from shelter and you feel your hair stand on end, lightning may be about to strike you. Drop to your knees and bend forward, putting your hands on your knees. **DO NOT LIE FLAT ON THE GROUND.**

If someone has been struck by lightning, monitor life signs and begin administering mouth-to-mouth resuscitation or cardiopulmonary resuscitation as needed. Send for medical assistance. Check conscious victims for burns, especially at the fingers and toes and next to buckles and jewelry. Administer first aid for shock. Do not let the victim walk around.

3.0 Tornadoes

Tornadoes usually develop from thunderstorms and normally occur at the trailing edge of the storm. Most tornadoes occur in the months of April, May, June, and July in the late afternoon and early evening hours.

When storms are predicted for the project area, the PHSTL will monitor weather conditions. A tornado watch is issued when favorable conditions exist for the development of a tornado. A tornado warning is issued by the local weather service office whenever a tornado has actually been sighted or is strongly indicated by radar.

If a tornado warning is issued, seek shelter immediately. If there are permanent buildings located on Site, go there immediately, moving toward interior hallways or small rooms on the lowest floor.
If a tornado warning is issued and you are in a vehicle, leave and go to the nearest building. If there are no buildings nearby, go in the nearest ditch, ravine, or culvert, with your hands shielding your head.

If a tornado is sighted or a warning issued while you are in open country, lie flat in a ditch or depression. Hold onto something on the ground, such as a bush or wooden fence post, if possible.
Once a tornado has passed the site, Site personnel covered by this PHASP are to assemble at the designated assembly area to determine if anyone is missing. Administer first aid and seek medical attention as needed.

4.0 Winter Storms

When snow or ice storms are predicted for the project area, the PHSTL will monitor weather conditions. A winter storm watch is issued when a storm has formed and is approaching the area. A winter storm warning is issued when a storm is imminent and immediate action is to be taken.

When a storm watch is issued, monitor weather conditions and prepare to halt Site activities. Notify the project manager of the situation. Seek shelter at Site buildings or leave the Site and seek warm shelter. If you are caught in a severe winter storm while traveling, seek warm shelter if road conditions prevent safe travel.

If you are stranded in a vehicle during a winter storm:

- STAY IN THE VEHICLE – disorientation comes quickly in blowing and drifting snow;
- Wait for help;
- Keep a window open an inch or so to avoid carbon monoxide poisoning;
- Run the engine and heater sparingly;
- Keep watch – do not let everyone sleep at the same time; and
- Exercise occasionally.

Barr Health and Safety Program Manual
(Appendix to Project Health and Safety Plan)

KEEP THIS DOCUMENT ON-SITE DURING FIELD WORK

BARR

Barr Health and Safety Program Manual
(Appendix to Project Health and Safety Plan)

KEEP THIS DOCUMENT ON-SITE DURING FIELD WORK

INTRODUCTION

This Health and Safety Program Manual is designed to familiarize all employees with the Health and Safety programs of Barr Engineering Co. (Barr) and will provide guidance for Barr staff for safe work practices. We are concerned about employee health, welfare, and safety. It is the policy of Barr to carry out all activities in a manner that promotes the safety and protection of its employees.

In order to implement this program, a commitment has been made by Company management, and a similar commitment must be made by all Barr employees, to promote a safe work environment. Barr employees are expected to contribute to their own and other employees' health and safety by learning and exercising safe work practices and complying with this Barr Health and Safety Program Manual. The information in this Manual will help you understand the Barr Health and Safety program.

This Manual supersedes all previous manuals and other oral or written statements of Health and Safety practice. Barr may add to, modify, or revise portions of this Manual, as the Company deems appropriate, with or without prior notice. Barr retains the discretionary authority to interpret and apply any of the provisions or policies set out in this Manual, as it believes to be appropriate.

If you have questions or need assistance, contact a representative of the Health and Safety Staff.

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Section 1: Barr Health and Safety Program

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Section 1: Barr Health and Safety Program

1.0 Overview

This Health and Safety Program describes methods and practices for providing safety training on hazard recognition, preventing accidents and for reporting and investigating any incidents/accidents that occur while conducting work for Barr. This program also includes information on medical services and first aid.

The Barr Health and Safety Program Manager is responsible for administering the program and reviewing the program on an annual basis. This review will also document how health and safety procedures are being implemented. Job responsibilities for the Barr Health and Safety Program Manager and other company management positions are attached (Attachment 1). Minimum qualification requirements for these positions have been identified and are available through Barr's Human Resources Department. Proper procedures have been established to document that Barr staff meet the qualifications of their job which may include acquiring documentation from staff to demonstrate they are qualified to perform their job duties.

This plan will be provided to all new employees during their initial safety orientation and elements will be covered in annual safety training sessions. Annual evaluation of this program's effectiveness will be discussed at Health and Safety Coordinator meetings and modifications will be made as appropriate.

This Health and Safety program meets the following requirements of AWAIR and Safety Committees (Minnesota OSHA Statutes 182.653, Subd.8, and 176.232); Accident Prevention Plan and Medical Services and First Aid (Michigan OSHA Regulations R408.40114 and R 408.40132); and General Safety and Health Provisions and Safety Training and Education (Federal OSHA 29 CFR 1926.20 and .21).

2.0 Safety Policy Statement

Barr believes an effective safety program provides positive benefits to the company and to clients by safeguarding the Company's most valuable resource, its employees. Barr is committed to providing its employees with a safe and healthful work environment and believes that nearly all occupational injuries and illnesses are preventable.

In order to prevent occupational injuries and illnesses, Barr relies on a combination of training, hazard recognition and elimination, and the proactive involvement of all employees. Barr attempts to provide all employees with training, equipment, and support necessary to perform their work safely. No employee is expected to perform a task for which they have not received adequate safety training or where they believe it cannot be performed safely.

The Barr Human Resource Policy, *Section 1000 Safety/Drug/Alcohol*, lists basic safety rules that apply to all Barr employees. Serious or repeated disregard for safe work practices as described in the Barr Health and Safety Program Manual and/or as written in project health and safety plans may result in disciplinary actions. The Barr Human Resource Policy, *Section 1100 Termination/Separation* describes the disciplinary process.

3.0 Safety Responsibility

Principals-in-Charge (PIC) of projects and functional areas will explain their expectations in regard to safety, either personally or through project managers, and will demonstrate their commitment to health and safety through providing the personnel and equipment needed to safely perform the work and to meet regulatory requirements. Project principals, task, and functional area managers are each responsible for the safety of personnel working under their direction. Managers are expected to act proactively so that safety policies are followed and work conditions are safe, and address enforcement of a disciplinary program if necessary.

All Barr employees must assume primary responsibility for their own safety and a measure of safety for other employees as well. Employees are expected to follow established safety rules and procedures, and to report or correct unsafe conditions or practices. All employees are empowered to decline work which they believe to be unsafe.

4.0 Safety Communication

During their first weeks at Barr, each employee participates in an initial new employee orientation program that covers Barr safety policies and programs. At this time, those employees who will work on field worksites are provided with the resources to obtain safety equipment: safety glasses steel toed boots and hardhat. This orientation session is conducted by Barr safety staff and includes an evaluation of the specific training needs. Follow-up safety training is provided as identified during safety orientation.

Ongoing communication about upcoming safety training sessions, changes in safety practices, changes in OSHA regulations, safety performance celebrations, Health and Safety Coordinator group news and other safety related topics is communicated at monthly Business Unit meetings and through company communications. All staff are encouraged to contact the project manager, PIC, a Health and Safety Coordinator or Health and Safety Program Manager with any safety concerns or suggestions.

5.0 Safe Work Practices

Barr Health and Safety Coordinators have prepared several safety documents for safe work practices while working on project sites to identify hazards and unsafe conditions. These documents provide guidance for controlling or eliminating safety hazards. Employees are expected to review these safety documents prior to the initiation of site work. Additionally, specific information on operating procedures, hazards and safeguards of tools and equipment are covered with the Barr Equipment Coordinator during the equipment checkout process prior to site work. The Barr Equipment Coordinator maintains all equipment to ensure safe working condition. Any machine, tool, or other device that is not in compliance with OSHA standards should not be used by any Barr employee and should be labeled or tagged as requiring maintenance.

When work involves the potential for exposure to hazardous substances, a site-specific Project Health and Safety Plan (PHASP) is developed to address both physical and chemical hazards that may be encountered while performing project tasks. This plan contains a hazard analysis for each task and provides information on hazard recognition and evaluation, air monitoring, exposure levels, personal protective equipment, decontamination procedures and emergency response procedures. This plan also lists names of Barr who have been designated to carry out stated job responsibilities related to the project, including project health and safety. The development of this plan is initiated through the project work order process that indicates the need for a PHASP.

When project site work does not involve potential exposure to hazardous substances, the Barr Health and Safety Program Manual provides guidance for staff on safe work practices. This Manual addresses operating procedures for confined space entry, excavation entry, personal protective equipment, fall protection, water, ice and boat safety and hazard communication. This Manual also addresses electrical equipment, power tools, welding and cutting, compressed gas cylinders, motor vehicle operation and heavy equipment safety. Prior to starting any construction project, Barr project managers are expected to discuss potential safety hazards with project staff and direct them to the Health and Safety Coordinator for additional safety discussions. Also prior to starting work, the project manager will determine if staff are able to perform their roles and responsibilities independently or if the buddy system is recommended for the project work. In some cases, the client and/or the project manager may require a project safety plan be developed for the work.

6.0 Buddy System

Barr personnel shall use a buddy system when a member of a work group may need rapid assistance in the event of an emergency. Under a buddy system, each member of a project field team has a specific agreement with at least one other member of the field team to mutually maintain line-of-sight communication and provide rapid assistance in the event of an emergency.

A buddy is responsible for maintaining communication with his or her buddy through use of communication equipment (e.g., walkie-talkies), line-of-sight observation, or standing-by watching the site activity. Buddies are responsible for providing or obtaining emergency care to the best of their ability without exposing themselves to the emergency conditions. At no time may a buddy enter a confined space or otherwise potentially endanger themselves to rescue their buddies until emergency assistance has arrived.

6.1 Application of Buddy System

A buddy system is required:

- **During Hazardous Waste-Related Operations:** Site activity involves work in an exclusion zone or contamination reduction zone

- **When Using Powered Equipment:** Site activity involves use of powered equipment operated by Barr.

- **In Remote Locations:** Site activity involves work in a remote or isolated area where a physical hazard is present and regular communication is not possible. Barr staff are encouraged to prepare a work itinerary and arrange a call-in schedule with the project manager or another Barr employee when working in these situations.

- **When Potential Extraordinary Hazards Exist:** Site conditions represent an extraordinary or unusual physical hazard.

- **For Confined Space Entry:** Site activity involves confined space entry.

- **If There is Potential for Flammable or Explosive Conditions:** Site activity involves a potential for flammable or explosive conditions.

During Boat Usage: Site activity involves working in a boat on a river or on a lake

When Working in Shallow Water: Work involves standing or walking through water two (2) feet in depth or greater.

When Working on Ice: Work is conducted on frozen bodies of water.

6.2 Utilization of Buddy System

A *buddy may be:*

- Another Barr employee involved in the site activity,
- A client (owner's representative) observing the site activity,
- An assigned employee of Barr's subcontractor,
- An assigned employee of the owner's contractor, or
- A volunteer involved in the site activity,

provided the person is appropriately trained to and physically able to provide the assistance required in the case of an emergency.

6.3 Working Alone

Barr personnel shall utilize the buddy system when possible and/or required by the Barr Health and Safety Program. When use of the buddy system is not required, Barr staff may work as a single employee on a worksite provided they follow Barr's working alone practices. These practices include establishing an alternate means to assure available treatment in the event of a medical emergency. Barr staff working alone are required to keep cellular communication operational and to develop a daily call-in schedule with their Project Manager. If this schedule is not kept, the Project Manager will initiate procedures to locate the Barr employee to determine they are safe. If effective electronic communication is not practicable at the work site, the Project Manager with designate someone to visit the employee or request the employee to contact them at intervals appropriate to the nature of the hazard associated with the work.

7.0 Project Work-Site Inspections/Audits

Barr Health and Safety Coordinators have prepared a Field Safety Planning Form, Work Site Safety Inspection Checklist and Work Site Safety Audit Form for Barr staff to use for continual evaluation of the work site. These forms address planning for a safe project, administration of safety on-site, employee training, site setup and control, air monitoring, personal protective equipment, tools and equipment safety, unsafe conditions, and decontamination. These forms help to identify unsafe conditions that could create a hazard so those conditions can be mitigated. Barr on-site staff is trained on the elements covered in the evaluation and are expected to perform this inspection/audit as appropriate. The project manager is also responsible for insuring periodic inspections/evaluations of the work areas are conducted to ensure compliance with safety rules and programs.

8.0 Safety Training

Recognition and Avoidance of Hazards

All Barr project staff working or managing work on construction sites are required to participate in Field Activities and Safety Practices training sessions that provides information on recognizing and avoiding safety hazards while working on construction sites. During the training, Barr staff will also be advised of other Barr safety training programs (excavation safety, confined space, Hazardous Waste Operations (HAZWOPER), hearing conservation, respirator protection, water safety, boat safety, ice safety, fall protection) that may be applicable to their work. Prior to working as the sole Barr representative on a site, new employees should be accompanied by a Barr staff person familiar with the safety concerns of the project site.

Prior to the initiation of site work, employees will be advised on the recognition and avoidance of unsafe conditions and OSHA regulations that apply to project work site for controlling or eliminating these hazards. Only Barr staff who have received training on the safe operation of equipment or machinery will be permitted to use this equipment. Tools and equipment training will cover operating procedures, hazards, and safeguards of the equipment.

Proper Handling of Poisons, Toxic Materials, Caustics and Other Harmful Substances

During the Field Activities and Safety Practices and HAZWOPER training sessions, Barr staff receive information on Hazard Communication (a.k.a. Employee Right-to-Know). This training covers the concepts of exposure, routes of exposure, hazards associated with chemical exposure, labeling, personal protective equipment, use and safe handling procedures, personal hygiene, and first aid procedures. When Barr staff work with specific chemical substances, they will receive additional training that will address the safe use and potential hazards of that chemical for a specific project. This additional training will cover personal hygiene and personal protective measures for preventing exposure. Access to material safety data sheets are provided for hazardous substances used by Barr staff. Additionally, Barr staff are instructed to inquire about the location of material safety data sheets when working on construction sites.

When the work involves the handling or use of poisons, flammable liquids, gases, toxic materials or caustics, employees will be instructed on the safe handling of these materials and be made aware of the applicable OSHA regulations. Barr staff working in our limnology laboratory are provided with laboratory safety training.

Harmful Plants, Reptiles, Animals or Insects

On specific projects, if harmful plants, reptiles, animals, or insects are expected on the construction site, Barr staff will receive additional training on potential hazards and how to protect themselves from injury and first aid procedures.

Confined Space Entry

All Barr staff that are expected to conduct confined space entry, receive training on the proper procedures to conduct a safe entry. This training addresses the hazards, and necessary precautions, engineering controls to control hazards, personal protective equipment, emergency rescue procedures, emergency rescue equipment, and rescue procedures. Prior to any confined space entry, a confined space entry permit is completed by the Entry Supervisor in consultation with a Health and Safety Coordinator.

9.0 Housekeeping

Chemical substances will be stored in proper containers to minimize the potential for a spill. Areas where chemicals may be used or stored will be maintained using good housekeeping best management practices. This includes, but is not limited to, clean and organized storage, labeling, and secondary containment where necessary.

Staff will be instructed on proper spill prevention, response procedures and communication procedures in the event of a spill or release of materials. The proper communication measures will be initiated based upon the type and quantity of materials spilled. Spill kits that are adequate for anticipated spills are maintained and available at the Edina Field Office for field use.

Prior to project work being performed, staff will consider the amount of waste, trash and scrap material expected to be generated by the project work. During the course of work on a project site, all debris should be kept from work areas, passageways, and stairs in and around buildings and structures. Combustible scrap and debris should be removed at regular intervals during the course of the project. Safe means should be provided to facilitate removal. Containers should be provided for the collection and separation of waste, trash, oily and used rags, investigation-related waste, and other refuse. Waste will be properly separated for reuse or recycling, when applicable. Containers used for garbage and other oily, flammable, or hazardous wastes, such as caustics, acids, contaminated soils and groundwater, should be equipped with covers to prevent dispersion of waste materials and to control potential for run-off. Hazardous waste will be marked in accordance with applicable hazardous waste regulations. All waste materials will be properly stored and handled to minimize the potential for a spill or impact to the environment. Garbage and other waste should be disposed of at frequent and regular intervals.

10.0 Medical Services and First Aid

All Barr staff who work on remote sites (and on construction sites in Michigan) have completed first aid/CPR training and are current in their certification. While working on a project sites, Barr staff are expected to confirm the location of a first-aid kit or to provide a Barr first-aid kit for their own use. Prior to initiating site operations, the location of the local hospital/clinic is identified and a hospital location map is developed specifically for the project site location. If the work involves hazardous substances, an assessment is performed to determine the likelihood that emergency response providers will be needed during the course of project fieldwork. Based on this assessment, the hospital and other emergency response providers may be contacted prior to initiating site work to determine adequacy of their emergency response capabilities.

When Barr staff work in remote locations or work as a single employee on a worksite, Barr has developed alternate means to assure available treatment. Barr staff working on these sites are required to keep cellular communication operational and to develop a daily call-in schedule with the Project Manager. If this schedule is not kept, the Project Manager will initiate procedures to locate the Barr employee to determine they are safe. Information on emergency telephone numbers and the location of the nearest hospital/clinic is communicated to Barr staff at the pre-site work safety meeting.

The contents of the Barr first aid kit has been reviewed and approved by a consulting occupational medicine physician. The first aid kit contents are sealed in individual packages and are stored in a weatherproof container. These first aid kits are checked by the Barr Equipment Coordinator prior to issuance and checked upon return. While at the worksite, on-site Barr staff are responsible for performing a check of the first-aid kit to assure that expendable items are replaced and assuring that the supplies are readily accessible. When working with corrosive materials, water-flushing facilities will be provided for quick drenching or flushing of eyes or body. Form A-3 provides a First-Aid Reference Guide.

Barr has established a relationship with Occupational Medicine Consultants, an occupational medicine clinic in Minnesota. Barr has also established medical relationships with occupational clinics located near Barr branch offices. These clinics provide medical surveillance and are available for advice and consultation on matters of occupational health.

In the event of a medical emergency, Barr staff are advised to request assistance from other on-site workers for prompt transportation to a medical facility. In the event of a life-threatening emergency, Barr staff are advised to contact 911 or other identified emergency number. While working on a construction site, Barr staff will identify the location of the postings for emergency telephone numbers for the local medical clinic, hospital or emergency service. If these numbers are not conspicuously posted, Barr staff are advised to notify the Project Manager to correct this omission and to rely on their hospital map or PHASP until the posting has been completed. In the event that there is no practical location for postings, Barr staff will keep these emergency numbers easily accessible in their vehicles. In the event that telephone communication is not available at the project site, Barr staff are expected to keep cellular communication operational. Alternate accommodations should be made in areas where cellular phones are non-functional.

11.0 Accident Reporting and Accident Investigation

As previously mentioned, in the event of an injury, accident or other emergency, Barr staff are advised to go to the nearest hospital or clinic for assistance. As soon as the Barr employee has been treated, they are advised to notify the Barr Health and Safety Coordinator to complete accident reporting procedures. Accident reporting must be conducted within 24 hours or the next working day. Barr staff have been provided with a copy of the Accident Reporting and Investigation Plan (Attachment 2) and are expected to follow these procedures.

12.0 Employee Information

Barr maintains an Employee Exposure and Training Record file, and an Employee Medical Record file for all staff who work on project work sites. The Employee Exposure Record file primarily consists of copies of training certificates, personal exposure monitoring results and respirator fit-test records. The Employee Medical Record file primarily consists of medical surveillance summary forms indicating suitability for work, and biological monitoring. These files are maintained by Barr safety staff and are secured in a locked room accessible to staff in Human Resources Department. Employees may view the contents of their records upon request. Confidential medical information is maintained by Occupational Medicine Consultants, and may be accessed by contacting the clinic.

Other information related to employee exposures (i.e., PHASPs listing known on-site contaminants, air monitoring for comparative project sites, and chemical inventory) are maintained by the Barr Health and Safety Program Manager and are available upon request. Records concerning participation in the Barr Controlled Substance Screening programs are maintained separately from these employee information records. Safety training information is also maintained in a database maintained by Human Resources Department.

Barr also maintains accident reporting information and summarizes this information on a First Report of Injury form and on the OSHA 300 and 300A log of Occupational Injuries and Illnesses. Each branch office maintains these records during the year, with copies sent to Barr Minneapolis in January of the following year.

13.0 Safety Committee

Barr has designated a Health and Safety Coordinator group with its employee members representing company business units and branch offices. The Health and Safety Coordinator group meets monthly to discuss the Company's safety performance and may recommend workplace safety and health practices to the Management Team.

14.0 OSHA Inspections

The following procedures discuss Barr’s response to OSHA inspections when: (1) Barr is prime contractor, or (2) when another party including the owner serves as prime contractor.

14.1 Procedures to be followed when Barr is Prime Contractor

The procedures listed below are to be followed in the event that an OSHA inspector visits the site, and Barr is the prime contractor (i.e., Barr is in control of the site). The procedures are consistent with Barr’s rights and the requirements for OSHA’s performance of an inspection.

a) Introduce yourself with your name and title. Titles to choose from include field geologist, field engineer, field observer, resident project representative, Barr Project Health and Safety Team Leader, etc. In these first minutes of orientation, try to ask all the questions. Hold off answering any additional questions until you have contacted the Project Manager (see below). If there is more than one Barr employee on-site, the most senior Barr employee should act as Barr’s on-site representative until the Project Manager is contacted.

b) Ask the OSHA inspector to show you their credentials. Inspect the credentials; the credentials should have a picture of the OSHA inspector. If necessary, ask for the phone number of the OSHA inspector’s office to confirm that this is an OSHA inspector.

c) On sites requiring a PHASP, ask the OSHA inspector for certification of 40 hour training, and the most recent 8 hour refresher. The OSHA inspector **may not** enter the hot zone, exclusion zone, or contamination reduction zone (according to 29 CFR 1910.120) without this training. In addition, the OSHA inspector is required to have the appropriate PPE, as specified in the PHASP for work zone entry, and the OSHA inspector **may not** enter those work zones without the appropriate PPE. Certification of participation in a medical surveillance program may be optional for OSHA inspectors, if they don’t routinely work on hazardous waste sites.

d) Ask the OSHA inspector what is the purpose of their site visit.

- What type of inspection is this? Complaint? Follow-up? General Schedule?
- What are the areas of the site that the inspector has come to the site to inspect?
- If there was a complaint, ask to see a written copy of the complaint.
- What type of monitoring, if any, does the inspector expect to conduct?
- If the site is more than a one-hour drive/air flight from Barr’s office, ask the OSHA inspector if they would come back the next day to talk to the Project Manager.

e) Inform the OSHA inspector that you will need to contact the Project Manager since you do not have the authority to either grant or limit the inspection. If Barr is the prime contractor, ask the OSHA inspector to wait off-site and not to take any pictures while you are making this phone call. If Barr is not the prime contractor, see paragraph 12.2 below.

f) Call the Project Manager and indicate what you have learned about this OSHA inspection. You have the right to make this phone call in private. Since Barr is the prime contractor, the Project Manager should tell you to ask the OSHA inspector to wait off-site, until the PIC arrives. Until that time, inform the OSHA inspector that you cannot give the inspector permission to begin the inspection, take any pictures or interview Barr employees. Such permission can only be granted by the Principal in Charge.

g) The Project Manager should in turn try to locate the PIC, Business Unit Facilitator and Health and Safety Program Manager to discuss what Barr’s response to this inspection will be. Additionally, the Project Manager will inform the site owner and if different, our client.

h) Generally, if the site is within a one hour drive or air flight from the office, inform the OSHA inspector that the Principal in Charge is on their way to the site. This is a reasonable time period for the OSHA inspector to wait, and ask the OSHA inspector to wait off-site. Do not talk unnecessarily to the OSHA inspector until the Principal in Charge arrives.

i) If the OSHA inspector will not wait for the arrival of the PIC, call the Project Manager again and explain the predicament. A conference call should be set up at this time for the Opening Conference. The Opening Conference is the first stage of an OSHA inspection.

j) Sooner or later the OSHA inspector will perform their inspection. Continue site operations so that OSHA inspector may observe health and safety procedures. It is not necessary to shut-down operations, however, all site personnel should be informed that an OSHA inspection is in progress. Operations may be shut down if participation in the inspection impedes the progress of the project work. If the OSHA inspector performs air monitoring, be sure to conduct air monitoring side-by-side with the OSHA inspector.

k) Be courteous, answer the OSHA inspector’s questions, take photos of whatever the OSHA inspector photographs, and take careful notes.

14.2 Procedures to be followed when Other Parties Are Prime Contractor

If another party has responsibility for site control such as the owner or the owner’s or client’s contractor and they have granted access to the OSHA inspector to conduct the inspection of their employees, call the Project Manager and explain that the inspection is in process. The guidelines listed above (a through k) still generally apply. The exceptions are that since site control concerns are the responsibility of the prime contractor, we may not be able to ask the OSHA inspector to wait off-site or deny entry to the site if they do not have appropriate training documentation. There are usually several concurrent inspections conducted by OSHA on a construction site. If Barr is included in the OSHA inspection, the OSHA inspector may be asked to wait before starting the inspection of Barr’s activities until the PIC determines the appropriate course of action. If during the course of the OSHA inspection, Barr staff are unable to conduct their work, it is advised to leave the site until site operations commence again.

ATTACHMENT A-1
SAFETY RESPONSIBILITIES

In order to implement Barr health and safety policies and to accomplish the objectives of this Barr Health and Safety Program Manual, Barr has designated safety responsibilities to the Company Safety Officer, Company Health and Safety Program Manager, Principals-In-Charge (PIC), Project Managers, Project Health and Safety Contact Person, Project Health and Safety Team Leaders, Equipment Coordinator, Technicians, and other Barr staff. Job responsibilities are described below:

Company Safety Officer

The Company Safety Officer is the person designated by Barr to have corporate responsibility for the safety of Barr employees and for the Barr Health and Safety Program Manual. This person is Gregory Keil.

Company Health and Safety Program Manager

The Company Health and Safety Program Manager is the person designated by Barr to administer the health and safety program. This person is Karen Stoller. The Company Health and Safety Program Manager reports to the Company Safety Officer. The responsibilities of the Company Health and Safety Program Manager include:

- Providing health and safety oversight for the company.
- Organizing, scheduling, and directing the safety training of Barr staff.
- Maintaining Barr’s health and safety records.
- Maintaining resource materials on applicable health and safety laws, regulations, and practices.
- Making available, appropriate and necessary, safety equipment to Barr staff.
- Supervising persons assigned to implement the Barr health and safety program.
- Administrating and updating the Barr health and safety program.

- Recommending revisions to this Barr Health and Safety Program Manual to the Company Safety Officer.

The Company Health and Safety Program Manager may appoint Health and Safety designees to help in the administration of some of these responsibilities.

First aid/adult CPR training is provided by a certified external training resource.

Principal-in-Charge

The Principal-in-Charge (PIC) is the person designated by Barr to have corporate responsibility for a project and responsibility for employee safety on the project

Project Manager

The Project Manager (PM) is the person assigned by the PIC to have day-to-day safety management responsibility for a given project. These responsibilities include:

- Obtaining information from the client about hazardous substances and other potential hazards on the site.
- Prepare or arranging for preparation of a project (PHASP) by a project team member, if applicable for the site.
- Designating the Project Health and Safety Team Leader, if applicable for the site.
- Verifying that the PHASP is implemented, if applicable for the site.
- Verifying that any incidents, accidents, injuries, or overexposure to hazardous substances are reported to the Company Health and Safety Program Manager.

Health and Safety Coordinator

The Health and Safety Coordinator is responsible for providing guidance for implementing the PHASP, where a PHASP is required. These responsibilities include:

- Reviewing health and safety procedures implemented during project site activities.

- Assisting Project Health and Safety Team Leaders in the selection and procurement of safety equipment, protective clothing, etc.
- Assisting in the preparation of the PHASP for the project site.
- Reviewing the PHASP for the project site.
- Reviewing the PHASP with the PM.
- Assisting in the review and update of the PHASP.

Project Health and Safety Team Leader

The Project Health and Safety Team Leader is designated by the PM and is responsible for implementing safety procedures on the project site. This person will be identified in the PHASP, for sites requiring a PHASP. If not designated, the safety trained Barr employee on the project site with the most experience working at Barr will assume the role on the project site. The Project Health and Safety Team Leader reports to the PM. The Project Health and Safety Team Leader's responsibilities include:

- Reviewing the PHASP with the PM and developing a thorough understanding of the PHASP.
- Selecting and procuring safety equipment, protective clothing, etc.
- Verifying that Barr staff on the project site are familiar with the PHASP and have received necessary training regarding use of safety equipment.
- Inspecting and maintaining safety equipment while it is used on the project.
- Conducting air monitoring on-site in accordance with the PHASP.
- Implementing the PHASP and reviewing health and safety procedures implemented during project site activities.
- Recommending modifications of the PHASP to the PM.
- Assisting in the review and update of the PHASP.

- Informing the PM and the Company Health and Safety Program Manager of any disregard or violations of the Barr Health and Safety Program Manual or the PHASP by Barr staff or others.

- Notifying the PM and Company Health and Safety Program Manager of any safety incidents, accidents, illnesses, injuries, or unanticipated exposures to hazardous substances during the project.

Barr Project Team Members

Project team members are responsible for understanding the Barr Health and Safety Program Manual and any PHASPs as they apply to work in which they are engaged, and for compliance with the provisions of those documents. Barr staff are expected to exercise due care for their personal safety and for the safety of others with whom they work and are also responsible for reporting safety incidents, accidents, injuries, or unanticipated exposure to hazardous substances to the Project Health and Safety Team Leader and to the PM.

Barr staff are expected to exhibit good personal hygiene habits, especially as they involve tobacco use, eating, washing of hands, etc., so as to reduce their personal exposure to hazardous substances known or potentially known to be on a project site. While on project sites, Barr staff shall not use alcohol or controlled substances *(as defined in the Barr Engineering Co. Human Resources Policy Manual – Section 1000)*. If Barr staff are using medications which could affect their alertness at the project site, the Barr Health and Safety Team Leader or the Company Health and Safety Program Manager should be consulted.

Equipment Coordinator

The Equipment Coordinator is responsible for maintenance of safety equipment inventory, maintenance and repair of safety equipment, and proper storage of equipment that is not in use.

ATTACHMENT A-2
Accident/Incident Reporting and Investigation Program

Purpose

This Accident Reporting & Investigation Plan describes methods and practices for reporting and investigating incidents/accidents. In addition, it is the policy of the company to comply with OSHA and Provincial Workplace Health and Safety Contact Centre recording and reporting of occupational injuries and illnesses regulations and applicable workers' compensation laws. This plan also meets the requirements of AWAIR (A Workplace Accident and Injury Reduction) program for an accident investigation/corrective action program.

Barr employees have the important and essential responsibility to report all accidents and near-misses immediately to their Project/Administrative manager and participate in answering questions to complete the Incident/Accident Report Form (Form A-1) and any subsequent incident/accident investigation documentation.

Incident/Accident Reporting Procedures

All accidents/incidents should be reported to Project/Administrative Managers as soon as possible upon its occurrence or after appropriate medical care has been given. If applicable, the Project/Administrative Manager shall take necessary actions to prevent further loss (i.e., limiting access, assessing the integrity of equipment, special equipment/response requirements, etc.). "Close Call" incidents should be reported as well. A “Close Call” is considered an incident that almost happened. An ‘Incident” is considered an event that causes injury, or damages equipment, product or property.

For Barr Engineering Co:

In the event of a fatality or a work-related incident or the in-patient hospitalization of three or more employees Barr will orally report the incident by telephone or in person to the Area Office of the Occupational Safety and Health Administration (OSHA), U.S. Department of Labor, that is nearest to the site of the incident within eight (8) hours of the event. The OSHA toll-free central telephone number is 1-800-321-OSHA (1-800-321-6742).

For Barr Engineering and Environmental Science Canada Ltd

In the event of a fatality, work-related incident resulting in hospitalization for more than two days, incident involving unplanned or uncontrolled explosion, fire or flood that causes or has the potential to cause a serious injury, incident involving the collapse or upset of a crane, derrick or hoist or incident involving the collapse or failure of any component of a building or structure necessary for the structural integrity of the building or structure, Barr will orally report the incident immediately by telephone or in person to the Provincial Workplace Health and Safety Contact Centre that is nearest to the incident.

Barr internal reporting practice will follow this procedure:

1. Project/Administrative manager completes the company Incident/Accident Report form (Form A-1) as soon as possible after the accident is verbally reported. Project/Administrative manager reports incident/accident to the client as soon as possible or within 24 hours of the incident/accident (all incidents shall be reported to the client, including, but not limited to, injuries, spills, property damage, fires, explosions, and vehicle damage).

2. Project/Administrative manager immediately notifies Business Unit Health and Safety Coordinator, and sends a copy of the Incident/Accident Report form to the Health and Safety Coordinator as soon as possible after the accident/incident.

3. Any employee witnessing an accident at work is to call for emergency help or whatever assistance appears to be necessary. In addition, the employee will report the accident to his or her Project/Administrative manager.

Work Related Injury/Illness Records Management

Barr will maintain records of work related injuries and illnesses by recording the incidents on the OSHA 300 and OSHA 300Awithin seven calendar days of receiving information that a recordable illness/injury has occurred. All OSHA 300 logs will be reviewed and signed by the Barr Health and Safety Program Manager to certify the annual summary. Annual OSHA 300A logs will be posted in employee kitchenette or copy centers before February 1st of each year and kept in place until April 30th of same year. All recordkeeping forms will be kept for minimum of five years following the end of the most recent calendar year.

Accident Investigation Procedures

Thorough investigation of all incidents/accidents will lead to identification of incident/accident causes and help to develop an awareness of potential workplace problems and hazards; identify areas for process improvement to increase safety and productivity; and suggest a focus for safety program development. The extent of the incident/accident investigation shall reflect the seriousness of the incident and will use a root cause analysis process. Collected evidence shall be preserved and secured by the Barr Health and Safety Program Manager. Barr Safety staff will conduct the accident investigation and will follow these procedures:

1. Conduct the incident investigation at the scene of the incident/accident (if possible) and complete documentation.

2. Ask the employee involved in the incident and any witnesses, in separate interviews, to describe in their own words exactly what happened.

3. Repeat the employee's version of the event back to the employee and allow the employee to make any corrections or additions.

4. After the employee has given their description of the event, ask appropriate questions that focus on causes. Remind the employee that the purpose of the investigation is to determine the root cause and develop an action plan to prevent reoccurrence.

5. Report findings to Health and Safety Coordinator group who will determine subsequent communications.

6. Prepare lessons learned communication for all staff,

Accident Review Committee

An accident review committee will be established in the event of an incident necessitating an investigation. Membership on this committee will include the Project/Administrative leadership responsible for the project/subunit, Business/Administrative Staffing Coordinator, Business Unit Health and Safety Coordinator, Branch Office Health and Safety Coordinator (as appropriate), Health and Safety Program manager and project staff, as appropriate. The Accident Review Committee will review the Incident/Accident Investigation form and will recommend corrective measures to the respective business unit leader, safety officer and management team as appropriate. Lessons learned will be documented and communicated in business unit meetings to build staff awareness and prevent reoccurrence of similar events.

Incident/Accident Investigation Equipment

Incident/accident investigation equipment available to Barr Safety Staff includes, but is not limited to, cameras, tape measures, rulers, writing utensils, paper, personal protective equipment and marking devices such as flags. This equipment will be made available through support service staff.

Incident/Accident Investigation Training

Barr safety staff assigned to incident/accident investigations shall be trained in their roles and responsibilities as a Health and Safety Coordinator. Training will be included on the monthly Health and Safety Coordinator meeting agenda and will be addressed when appropriate. Training will address incident awareness, first responder, and incident investigation. First responder training includes first aid and adult AED/CPR training by a certified instructor and all Health and Safety Coordinators maintain current certification in both.

FORM 1

INCIDENT/ACCIDENT REPORT FORM

Note: Project/Administrative Managers should complete this form as soon as possible after the occurrence of an incident/accident. Completed form should be sent to Karen Stoller (KSS).

Employee Name: ______________________________

Date & Time of Incident/Accident: ______________________________

Business Unit: ____________________ Job Title: ____________________

Location of Incident/Accident: ______________________________

____

Description of Incident/Accident: ______________________________

____

____

Medical Treatment for Employee: ______________________________

____

Witnesses: ______________________________

Other Relevant Incident/Accident/Employee Information: ______________________________

____

____

____

____

____

Form completed by: ______________________ Date: ______________

ROUTE TO KAREN STOLLER

FORM 2

INCIDENT/ACCIDENT INVESTIGATION FORM

Date of Incident/Accident ____/____/____ Time of Incident/Accident ____________ AM / PM

Employee Name ______________________________

Task at time of Incident ______________________________

Department ______________________________ Job Title ______________________________

Incident/Accident Description (include basic cause, individuals, witnesses, location, equipment, materials, tools, chemicals, safety devices,
and personal protection equipment)

____

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____

____

____

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____

____

Immediate Causes: ______________________________

____

Temporary Precautions Taken: ______________________________

____

Pending Delays/Reasons: ______________________________

____

Corrective Actions to Prevent Recurrence: ______________________________

____

Project Mgr/Adm Mgr ______________________________ (signature) Date ______________

Health & Safety Mgr ______________________________ (signature) Date ______________

Copies to Company Safety Officer, Project/Administrative Manager, OSHA Recordkeeping File

Form 3

CPR Prompt/Spectrum Safety Incorporated
First Aid Snapshots, a Reference Guide

WHOA!

Safety First!
What happened?
What do you observe?
- ☐ # of victims
- ☐ # of witnesses
- ☐ Mechanism of Injury
- ☐ Nature of Illness

Are there any hazards?
ABCs/AVTPU

Wounds & Bleeding

Remember PIE, children love it!
- ☐ Direct pressure to control bleeding
- ☐ Ice or cold application. In a pinch? Look in the fridge (ice, frozen veggies, pop, frozen juice, frozen rice, etc.)
- ☐ Elevate extremity
- ☐ Clean with soap & water, then bandage

Amputated Parts

- ☐ Remember PIE!
- ☐ Treat for shock: Calm & reassure, monitor ABCs, elevate legs, maintain normal body temperature
- ☐ Place amputated tissue in clean or sterile dressing that is dampened but not wet. Wrap the tissue in plastic or foil and cool with ice. Avoid freezing the tissue.

Nosebleed

- ☐ Squeeze one or both nostrils
- ☐ Apply cold directly to the nose
- ☐ Patient should lean forward with heat tilted down

Avulsed Tooth

- ☐ Do not place in milk, mouthwash or alcohol. Milk contains sugar which can destroy tooth tissue
- ☐ Do place in saline solution, water, or in patient's saliva
- ☐ Time is crucial. See the dentist immediately!

Serious Burns

- ☐ Stop the burning by using profuse water or
- ☐ Stop, drop, and roll
- ☐ Ensure ABCs
- ☐ Treat for shock
- ☐ Place dry dressing on burn
- ☐ Call 9-1-1

Minor Burn

- ☐ Cool with water until pain stops
- ☐ Cover with dressing to prevent contamination
- ☐ DO NOT use ointments, creams, lotions, or butter. This will trap heat and increase tissue damage
- ☐ Some over-the-counter remedies such as aloe should not be used until the burn has been cooled and clean

Insect Bites & Stings

Don't slap at an insect when it is on you. It is better to blow or brush off
- ☐ If stinger is left in, it should be scraped off
- ☐ Apply ice or cold application
- ☐ If itching, pain, hives, & difficulty breathing occur, call 9-1-1

Sunburns

Prevention is the best cure!
- ☐ Limit exposure to sun between 11 AM – 2 PM
- ☐ Apply sunscreen with a sun protection factor of 15 SPF. This should be done 30 minutes before going outside

If sunburn occurs:
- ☐ Remove patient from direct exposure to sun
- ☐ Cool by taking a cool shower or bath
- ☐ DO NOT use ointments, creams, lotions, or butter
- ☐ Check with your physician before using pain medications or other over-the-counter remedies
- ☐ If sunburn is serious, see your physician immediately

Heat Illness

The best treatment is prevention!
- ☐ Keep hydrated! Drink lots of water
- ☐ Avoid sugar treats, pop, & caffeine. These make it difficult for a person to absorb fluid
- ☐ Avoid nicotine

Symptoms of heat exhaustion are pale, cool, clammy/sweaty skin, nausea, dizziness, weakness, fatigue. This progresses to heat stroke when the level of consciousness changes
- ☐ Remove to a cool place
- ☐ Cool rapidly
- ☐ Give fluids if tolerated
- ☐ Monitor patient's mental status
- ☐ Treat for shock
- ☐ Call 9-1-1 if necessary

Frostbite

This is preventable. Avoid tobacco use, caffeine, and alcohol. The three stages of frostbite is incipient, superficial, & deep frostbite. Signs & symptoms are tingling and numbness in cold, white or gray skin, & pain. General treatment is:
- ☐ Remove from cold environment
- ☐ Warm in water 104-108 degree F
- ☐ Once rewarmed, elevate part
- ☐ If you can't go indoors, place hands under armpit (if hands are affected)
- ☐ Do not rub, this may cause tissue damage
- ☐ Avoid rewarming & refreezing cycle

Head & Neck Injuries

S&S-Altered mental status, any significant mechanism of injury, unconsciousness, unequal pupils, clear fluid or blood coming from ears, unusual sleepiness, confusion, dizziness, severe headache, difficulty with speech or vision, vomiting, difficulty walking, pale, sweaty. General treatment is:
- ☐ Call 9-1-1
- ☐ Stabilize head
- ☐ Check for consciousness
- ☐ Do not move an unconscious person
- ☐ Keep in position found
- ☐ Treat for shock

Seizures

General treatment for seizures are:
- ☐ Protect the head
- ☐ Do not place anything in the mouth
- ☐ Do not restrain the person
- ☐ If possible, time the seizure

When seizure stops, place in recovery position

Diabetic Emergencies/Hypoglycemia

Hypoglycemia is low blood sugar and is the most common of diabetic emergencies. S&S is: altered mental status (giddy, sleepy, aggressive, or cranky). The skin will appear pale, cool & clammy
- ☐ When in doubt, and as long as the patient remains conscious, give sugar in the form of juices, honey, sugar, candy, or soda pop
- ☐ Do not give diet products such as NutraSweet
- ☐ Follow up with a sandwich or more substantial meal
- ☐ Call 9-1-1

Diabetic Emergencies/Hyperglycemia

Hyperglycemia is high blood sugar. Most often this is an undiagnosed diabetic or a diabetic who is not taking proper care of themselves. This is not the emergency that hypoglycemia is. However, if left untreated, this can progress to diabetic coma:
- ☐ S&S are excessive thirst, excessive urination, fruity breath odor, flushed and dry skin
- ☐ If in doubt, give sugar. This will not hurt the patient
- ☐ Call 9-1-1

Fractures, Sprains, & Dislocations

It is not necessary to know the difference between these three conditions. An x-ray is the only definitive diagnosis. S&S are similar and first aid is the same. Some general S&S are: pain, tenderness, swelling, deformity, and loss of mobility. Some general treatment guidelines are:
- ☐ Stabilize or immobilize the injury site
- ☐ Apply cold application
- ☐ Rest
- ☐ Elevate extremity, if possible
- ☐ Call 9-1-1 if needed or see your physician

Section 2: Hazard Communication
(Employee Right-to-Know and WHMIS)

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Section 2: Hazard Communication
(Employee Right-to-Know and WHMIS)

1.0 Introduction

Barr personnel will be informed of the chemical and physical hazards to which they may be routinely exposed at work, and the means by which they may protect themselves from those hazards. Barr has established a program at each work place which complies with the requirements of the OSHA Standard for Hazard Communication (29 CFR 1910.1200), the Minnesota OSHA Employee Right-To-Know Standard (MN Rule, Chapter 5206) and WHMIS. This program provides information on hazardous chemicals/substances/controlled products, harmful physical agents and infectious agents. OSHA defines hazardous substances as those chemicals present in the workplace which are capable of causing harm, and hazardous chemicals as any chemical that is a health hazard or a physical hazard. A controlled product refers to any hazardous material that is covered under WHMIS regulation.

2.0 Program Administration

Administration of the Barr Employee Right-To-Know (ERTK) program is the responsibility of the Barr Health and Safety staff. An ERTK Administrator has been designated and is responsible for maintenance of the chemical inventory, maintenance and update of the Material Safety Data Sheet (MSDS) books, ERTK training, revisions to the written program and assessment of the program's effectiveness.

3.0 Chemical Inventory

Barr will maintain a list of all hazardous chemicals/substances/controlled products used by Barr staff. The list of hazardous chemicals /substances is known as the Barr Chemical Inventory. The Barr Chemical Inventory includes information such as identity of the hazardous substance, manufacturer, manufacturer’s address, Material Safety Data Sheet (MSDS) date, and storage location of the hazardous substance. A copy of the chemical inventory is located in the front section of designated MSDS binders. The chemical inventory is arranged alphabetically, by product name and is reviewed and updated at a minimum, annually.

4.0 Harmful Physical Agents

Occasionally, Barr project work may involve potential exposure to harmful physical agents. These include heat, noise, ionizing and non-ionizing radiation. When this exposure is anticipated to approximate or exceed the permissible exposure limits for those physical agents, the Project Manager will contact the ERTK program administrator or other Barr Health and Safety staff to assist in determining appropriate control or protection measures to minimize exposure. Appropriate training will be conducted at that time.

5.0 Infectious Agents

Occasionally, Barr project work may involve potential exposure to infectious agents. A list of infectious agents is included in the Minnesota OSHA ERTK regulation and also includes bloodborne pathogens. When exposure to infectious agents or bloodborne pathogens is expected, the Project Manager will contact the ERTK Administrator or other Barr Health and Safety staff to assist in determining appropriate control or protection measures to minimize exposure. If needed, an Exposure Control Plan will also be developed at that time and appropriate training conducted.

6.0 Asbestos Containing Material Awareness

Occasionally, Barr project work may involve potential exposure to asbestos containing materials. Breathing asbestos fibers can cause a buildup of scar-like tissue in the lungs called asbestosis and result in loss of lung function. Asbestos also causes cancer of the lung and other diseases. Asbestos awareness training is required and documented for any Barr employee who may be exposed to asbestos containing materials while working at a client site. If applicable, project specific site plans shall address possible locations where employees may become exposed to asbestos containing materials (ACM) on a project site and describe recommended work practices and personal protective equipment use. Barr employees shall abide by any warning signs/labels and use caution to not disturb any asbestos containing material when working at client sites. Sampling of suspect ACM will be conducted by qualified staff.

7.0 Material Safety Data Sheets

MSDSs have been obtained from the chemical manufacturer or distributor for each hazardous chemical/substance/controlled product listed on the chemical inventory. The MSDS contains detailed information pertaining to hazardous chemicals/substances/controlled products and mixtures containing hazardous chemicals/substances/controlled products. The MSDSs will be filed in 3-ring binders and located in designated areas throughout Barr.

7.1 Availability of MSDSs

Binders containing the chemical inventory and MSDSs for hazardous chemicals/substances/controlled products used at Barr are kept in the following locations:

- Health and Safety Staff Offices
- Limnology Laboratory*
- Air Quality Laboratory*
- Groundwater Laboratory*

* = 3-ring binders containing chemical inventory and MSDSs for hazardous chemicals/substances/controlled products used in that particular area only.

The MSDS binders identified above are accessible to all Barr staff and are located in work areas, where appropriate. Electronic versions of MSDSs on USB flash drives are located in the air quality trailers and two cube trucks. Additionally, all MSDSs are accessible electronically at www.barr.com/msds. In the event that an employee requires an MSDS for a product which is not included in the binders, they may request that MSDS from the ERTK Administrator or any member of the health and safety staff. Barr will obtain and provide to the requesting employee a copy of that MSDS within 10 working days of the request.

MSDSs for products used in the field on hazardous waste-related projects will be included in the Project Health and Safety Plan (PHASP) or the PHASP Appendix. Barr employees working on air quality related projects will typically bring electronic versions of MSDSs to the project site instead of a hard copy. For non-typical chemicals used on work site, the ERTK Administrator will provide copies to the Project Manager to be kept at the project site.

7.2 Procurement of MSDSs

Chemical manufacturers and distributors of hazardous chemicals/substances/controlled products are required to provide MSDSs to the customer upon initial shipment of the hazardous substance and each time the MSDS is updated. The MSDSs may either accompany the order or may be sent to the requestor. When purchasing new products containing hazardous chemicals/substances/controlled products, Barr employees should request an MSDS. The MSDS should be mailed directly to the ERTK program administrator or the Barr employee may route the MSDS to the ERTK program administrator. If necessary, the ERTK program administrator will update the chemical inventory. New or updated copies of the MSDS will be added to the applicable MSDS binders.

7.3 Content of MSDSs

All MSDSs will, at a minimum, meet the content requirements of the OSHA Hazard Communication Standard. When receiving new or updated MSDSs, the ERTK administrator will review the content of the MSDS to determine whether or not the MSDS meets these requirements. If any MSDSs are found not to meet these requirements, new MSDSs will be requested from the manufacturer or distributor.

8.0 Labels and Other Forms of Warning

8.1 Container Labels

All hazardous chemicals/substances/controlled products as defined by the OSHA Hazard Communication Standard, the Minnesota ERTK Standard or WHMIS will be stored in properly labeled containers. When possible, hazardous chemicals/substances/controlled products will be kept in their original containers, with the suppliers label still attached identifying the chemical name, hazard warning and manufacturer information. If the hazardous substances/controlled products are transferred to a new container or are mixed to form a new chemical mixture, a Barr workplace label shall be affixed to the container. Container labels shall not be removed or defaced on incoming containers of hazardous chemicals/substances and shall be legible and intact. Labels that are missing or illegible shall be replaced with workable labels.

Barr uses a commercially supplied labeling system, the Hazardous Materials Information System (HMIS). The HMIS label contains four color coded bars: blue for health, red for flammability, yellow for reactivity, and white for personal protective equipment. The health, flammability, and reactivity bars contain a numerical rating indicating the severity of each hazard. The rating system is:

4 - Extreme

3 - Severe

2 - Moderate

1 - Slight

0 - Minimal

The personal protective equipment box contains a letter code indicating the protective equipment required when handling hazardous chemicals/substances. In addition to the above HMIS information, the identity of the hazardous substance(s) should be recorded on the label. HMIS labels can be obtained from the ERTK program Administrator.

If materials are being transferred to small containers for immediate use by the person doing the transfer, the HMIS system need not be used. The container should however be marked with the identity of the hazardous substance. At the end of the day, all hazardous chemicals/substances in the container should either have been used, returned to an appropriately marked container, or properly disposed.

8.2 Label Language

The labeling system used will be presented in English. In the event that Barr needs to communicate label information to non-English speaking staff, Barr will develop compatible labels in their language.

9.0 Employee Information and Training

9.1 Program Information

Copies of the OSHA Hazard Communication Standard, the Minnesota ERTK Standard, and this Employee Right-to-Know program are kept in each of the MSDS binders. Additionally, a copy of this program is included in the Barr Health and Safety Program Manual.

9.2 Training Program for Hazardous Chemicals/Substances

All Barr staff in the hazardous waste-related operations training program will receive hazardous substance information training during their initial and annual refresher training. In addition, Barr staff will be briefed on potential hazards during their project pre-entry safety meeting, and during daily project "tool-box" safety meetings. Each Barr staff member covered by this standard will receive a copy of this written program annually.

Barr staff using hazardous chemicals/substances in the air quality laboratory or in the limnology laboratory will receive training in accordance with 29 CFR 1910.1450 (Occupational Exposure to Hazardous Chemical in Laboratories). Please refer to Barr Chemical Hygiene Plan for more detailed information.

Barr staff who may use hazardous chemicals/substances/controlled products or be potentially exposed to gas hazards in the course of their job, but who are not included in the hazardous waste-related operations program, will receive ERTK and/or WHMIS training upon initial assignment to a work area and at least annually, during regular staff meetings. Barr staff will also be informed during staff meetings when new products containing hazardous chemicals/substances/controlled products have been purchased and informed of the hazards associated with those hazardous chemicals/substances/controlled products.

Training and information on hazardous chemicals/ substances will include the following elements:

- Overview of requirements contained in Employee Right-to-Know and Hazard Communication Regulations
- Hazardous chemicals present in work area
- Physical and health risks of these hazardous chemicals
- Symptoms of overexposure
- How to determine the presence or release of hazardous chemicals in work area
- How to reduce or prevent exposure to hazardous chemicals through use of control procedures such as work practices, emergency procedures, and personal protective equipment
- Engineering Controls to reduce or prevent exposure to hazardous chemicals
- Procedures to follow if an employee is overexposed to hazardous chemicals
- Explanation of labeling system and MSDSs to obtain and use appropriate hazard information

- Location and availability of the chemical inventory, MSDS file, and written Employee Right-to-Know Program (Hazard Communication Program)

This training may be done during other regularly scheduled training or during staff meetings.

9.3 Training Program for Harmful Physical Agents

Employees whose project work may involve potential exposure to harmful physical agents will receive training prior to the initiation of project field work. Training will be provided on heat stress, noise, ionizing and non-ionizing radiation. Training will provide information on the following elements:

- Type of physical agent and Workplace Exposure Levels
- Known acute and chronic health effects at hazardous levels
- Known symptoms of health effects
- Appropriate emergency treatment
- Proper conditions for use and/or exposure to the physical agent
- Equipment information, if appropriate, that generates a physical agent

A written copy of this information will be provided to employees during this training session.

9.4 Training Program for Infectious Agents

Employees whose project work may involve potential exposure to infectious agents or bloodborne pathogens will receive training prior to the initiation of project fieldwork. Training will be provided on the following elements:

- General explanation of epidemiology and symptoms of infectious diseases
- Methods for recognizing tasks that may involve exposure to infectious agents
- Chain of infection or infectious disease process
- Exposure Control Plan

- Use and limitations of methods of control that will prevent or reduce exposure
- Basis for selection of personal protective equipment
- Proper procedures for cleanup of blood and body fluids
- Recommended immunization practices
- Procedures to follow if an exposure incident occurs
- Appropriate actions to take in emergency involving potential exposure
- Signs, labels, tags and color coding to denote biohazards

A copy of the ERTK standard, including the section on infectious agents, will be provided to employees during this training session. Additionally, employees will be provided interactive question opportunities with training presenter. Access to further information and reference materials will be made available during training.

The information contained in this section is a summary of the training content. Detailed information will be developed in the Exposure Control Plan, if necessitated by project work.

9.5 Training Program for Gas Hazards

Employees whose project work may involve potential exposure to gas hazards will receive training prior to the initiation of project fieldwork and annually thereafter. Training will be provided on the following elements:

- Locations of alarm stations at client facility
- Gas monitoring equipment- portable and fixed detection
- Gas Alarms and action levels
- Gas Hazards- characteristics of gases to include oxygen deficiency, oxygen or nitrogen enrichment, carbon monoxide, hydrogen sulfide, nitrogen oxides and additional client specific gas hazards of concern. Training will also include signs and symptoms of overexposure.

- Personal Rescue Procedures
- Respirator Selection appropriate for gas hazard
- Use and care of Self Contained Breathing Apparatus (SCBA)
- Evacuation procedures

9.6 Training Records

Training records are maintained by the ERTK Administrator and include the following information:

- Training date
- Name, title, and qualifications of trainer
- Names and job titles of employees receiving ERTK training (identified on Barr sign-in sheet)
- Outline of information provided during training session

Training records will be maintained for the duration of an employee’s employment plus 30 years and are available for review.

10.0 Multi-Employer Workplaces

Barr staff using or storing hazardous chemicals/substances/controlled products at a client’s facility, hazardous waste site, construction site, or other site that may expose clients or other contractors (contracted by the client or by Barr) to the hazardous chemicals/ substances will inform the client and/or contractors of the location of the MSDSs, of any precautionary measures that need to be taken to protect employees, and the labeling system used by Barr. This information will be provided during the pre-construction safety meeting, during daily “tool-box” safety meetings, or by other means.

Barr staff working at a client’s location are expected to request information on hazardous chemicals/substances/controlled products used at the worksite, that they may encounter during the course of conducted work for the client. This information shall be provided to the Project Manager or the Project Health and Safety Representative and should include information on the following:

- Methods Client/Controlling Contractor will use to provide Barr access to MSDS for hazardous chemicals/substances/controlled products use on work site.

- Methods Client/Controlling Contractor will use to inform Barr of any precautionary measures during normal operating conditions and foreseeable emergencies.

- Methods Client/Controlling Contractor will use to inform Barr of labeling system.

Contractors who work on sites controlled by Barr and who may be exposed to hazardous chemicals/substances/controlled products will be informed of the location of the MSDSs, the labeling system used at Barr, and any necessary precautionary measures. This information will be provided to the Contractor by the Project Health and Safety Team Leader. The information may be provided during an informal meeting with the contractor, during staff meetings, or during other scheduled training.

MSDSs for hazardous chemical/substances commonly used by Barr staff on hazardous waste sites are located in *Section Y: Material Safety Data S*heets of this Manual. MSDSs for hazardous chemicals/substances/controlled products that are not located in the PHASP Appendix or MSDSs for hazardous chemicals/substances/controlled products used or stored on construction sites or at a client's facility will be maintained in an accessible location on site.

11.0 Non-Routine Work

Periodically, employees may be required to perform non-routine tasks which could be hazardous. Some examples of non-routine tasks are: confined space entry or tank inspections. Prior to starting work on such projects, each affected employee will be given information by the Project Manager about the hazardous chemicals they may encounter during that activity. This information will include specific chemical hazards, protective and safety measures the employee can use, and steps that Barr is taking to reduce the hazards, including ventilation, respirators, the use of the buddy system, and emergency procedures.

12.0 Chemicals in Unlabeled Pipes

Work activities are sometimes performed by employees in areas where chemicals are transferred through unlabeled pipes. Prior to starting work in these areas, Barr staff should contact the Client representative for information regarding:

- The chemical in the pipes
- Potential hazards
- Safety precautions to be taken
- The Client’s safety requirements

13.0 Use of Gas Monitors

When working in an area where gas hazards may be present, all staff will wear a portable gas monitor, specific to the gas hazards of concern. When the buddy system is implemented and staff work side by side, one gas monitor will be sufficient to represent exposure. Prior to use, all gas monitors will be calibrated according to manufacturer’s specification and have a current calibration sticker affixed to the monitor. Additionally, all gas monitors will be bump tested prior to each work shift to assure the monitor and alarms are working properly. When working on client property where gas hazards may be present, staff will review the client’s emergency evacuation plan and be familiar with evacuation routes and alarms prior to work startup. If the client has scheduled an emergency drill while Barr staff are working on site, all Barr staff are expected to participate in the drill.

14.0 Program Communication for Non-English Speaking Employees

While OSHA requires that the Hazard Communication Program, all MSDSs and container labels be written in English, Barr Engineering Company will make every effort to communicate the Hazard Communication Program in the language of non-English speakers. Effective communication will be accomplished through any of the following methods or combinations thereof:

- Training over entire program in employee’s native language through the use of an interpreter/intermediary
- Video presentation in the native language of the employee
- Written materials (handouts, MSDSs, container labels) in the native language of the employees, when available and/or accessible.

Section 3 Hazard Evaluation

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Section 3: Hazard Evaluation

1.0 Safety and Health Risk Analysis for Project Tasks

TABLE C-1: SAFETY AND HEALTH RISK ANALYSIS FOR PROJECT TASKS describes potential safety and health risks which may be encountered by Barr employees while performing the following project tasks. Other physical hazards are discussed in subsequent parts of this section.

Table 1 Safety and Health Risk Analysis for Project Tasks

Task	Task Description	Potential Chemical Hazards	Potential Physical Hazards
Reconnaissance	Walk around site, nonintrusive investigation Observe or measure topography; stake line and grade for construction; inspection of storage containers and site drainage	Potential for skin and inhalation exposure to soil which is known or suspected to contain hazardous substances	Slip, trip, or fall hazards
Observation of Remedial Construction, Observation of Other Construction Activities, and Observation of Excavation/stockpiling of soils	Observe: • Site grading, cap and liner construction • Drain installation • Various other heavy construction in contaminated and clean areas	Potential for skin exposure to soil which is known or suspected to contain hazardous substances and inhalation exposure to dust and soil gas which is known or suspected to contain hazardous substances	Heavy equipment operations, excavation cave-ins, equipment operational hazards, overhead, and underground utilities, slip, trip, or fall hazards
Observation of Intrusive Site Investigations/Test Trenching	Direct and/or Observe: • Soil boring advancement • Geoprobe advancement • Monitoring well installation • Test trenching	Potential for skin exposure to soil which is known or suspected to contain hazardous substances and inhalation exposure to dust and soil gas which is known or suspected to contain hazardous substances	Equipment operation hazards, sidewall cave-ins, slip, trip, or fall hazards, high noise levels, overhead and underground utilities
Nonintrusive Geophysical Survey	Perform electromagnetic, seismic, gravimetric, or other geophysical survey	Potential for skin exposure to soil which is known or suspected to contain hazardous substances	Lifting hazards, slip, trip, or fall hazards, low level electro-magnetic radiation exposure
Soil Gas Survey	Collect soil gas with soil probe; or perform analysis	Potential for skin exposure to soil which is known or suspected to contain hazardous substances and inhalation exposure to soil gas which is known or suspected to contain hazardous substances	Underground utilities, unknown obstructions, slip, trip, or fall hazards, pinch point hazards
Water Sample Collection	Collect water samples from surface water and monitoring wells; or measure water levels	Potential for skin exposure to water which is known or suspected to contain hazardous substances and inhalation	Lifting hazards, slip, trip, or fall hazards, bee hives in casings, water hazards, pinch point

Task	Task Description	Potential Chemical Hazards	Potential Physical Hazards
		exposure to volatiles in water	hazards
Waste or Sludge Sample Collection	Collect waste or sludge material from waste or sludge lagoon/pit	Potential for skin exposure to concentrated waste or sludge and inhalation exposure to waste or sludge vapor which is known or suspected to contain hazardous substances	Slip, trip, or fall hazards
Soil Sample Collection	Collect and classify soil samples from surface soil, soil borings and/or trench soils; perform headspace screening	Potential for skin exposure to soil which is known or suspected to contain hazardous substances and inhalation exposure to soil gas and dust which is known or suspected to contain hazardous substances	Equipment operational hazards, slip, trip, or fall hazards
Aquifer Testing	Slug test; pumping test; monitoring well development	Potential for skin exposure to water which is known or suspected to contain hazardous substances and inhalation exposure to volatiles in water	Slip, trip, or fall hazards, lifting hazards, bee hives in casing, pinch point hazards, dismemberment
Stack Testing	Sample and analyze stack emissions	Potential for skin and inhalation exposure of hazardous emissions	Lifting hazards, slip, trip, or fall hazards, pinch point hazards, exposure to weather hazards

2.0 Chemical Hazards

Site operations may involve handling materials which are known or suspected to contain hazardous substances. Exposure to these materials may occur through one or more of the following routes.

2.1 Inhalation

Substances that primarily pose an inhalation hazard are those that volatilize easily at ambient temperatures (20-25ºC). A rule of thumb is that substances with vapor pressures greater than that of naphthalene (0.08 mm Hg) at ambient temperatures may be considered volatile. Inhalation hazards may exist when particulates containing hazardous substances become airborne.

2.2 Skin/Eye Contact

Some hazardous substances may be absorbed through the skin and be transported to the bloodstream. Many other substances are not absorbed but react with the skin surface causing irritation or burns. Absorption occurs most readily through open wounds, inflamed skin, or through eye contact. Hazardous substances noted with the “skin” notation are known to be absorbed through the skin.

2.3 Ingestion

Ingestion may occur through eating or smoking with hand to mouth contaminant transfer. Incidental ingestion of particulates containing hazardous substances may also occur under dusty conditions generated in areas known or suspected to contain hazardous substances.

2.4 Injection

Exposure may occur if a hazardous substance is injected into the skin through skin puncture or cut by a foreign object such as spikes, metal edges, wood slivers, etc.

3.0 Safety Procedures for Physical Hazards

Site operations and tasks may involve inherent physical safety hazards. The safety procedures for these hazards are described in the following paragraphs. Site-specific hazards may be discussed in the PHASP or Field Safety Review form.

3.1 Utilities

Overhead and underground utilities (e.g., electric, gas, telephone, water, sewer, drainage, etc.) and associated pipes in the project work areas must be located. Underground utilities will be located and marked by the utility owners or site owners before the start of any intrusive activity. Overhead utilities will be located and where appropriate, protected before the set-up and operation of heavy equipment, such as a drill rigs, cranes, loaders, manlifts, etc.

3.2 Heavy Equipment Operations

Site operations may involve the use of heavy equipment such as drill rigs, backhoes, dozers, loaders, scrapers, trucks, etc. by Barr’s subcontractors or the site owner’s contractors. The following information describes additional safety procedures while working around heavy equipment.

a) Stay within the line-of-sight of the operator at all times while working near the equipment. Normal operation of heavy equipment affects the operator’s ability to hear and to see all areas around the equipment.

b) Keep a safe observation distance of at least the reach of the backhoe bucket plus 5 feet except when working directly with the backhoe operator. If working within reach of operating equipment always alert operator of your position.

c) Avoid walking directly in back or to the side of heavy equipment. Avoid operator blind areas. Understand the direction the equipment is likely to move and how quickly it may make the maneuver.

d) Verify that underground and overhead utilities have been identified and located.

e) Be aware of footing and surroundings at all times.

f) Do **not** work near equipment that may appear obviously unsafe because of deterioration, missing parts, obvious defects, or improper operation. Do not permit use of such equipment by any of Barr's subcontractors if equipment appears to be unsafe.

g) If heavy equipment and other vehicles share a common roadway, Barr employees and Barr's subcontractors will be alert to this traffic and yield right-of-way. If working in an area with congested heavy equipment operations, wear a high visibility vest. Park in a clear area, not in an area obstructed from operator's view.

h) Do not operate heavy equipment.

i) Stay out of reach of cables or chains which might break while lifting or pulling objects.

3.3 Excavation Entry Procedure

Any entry to an excavation or trench will be performed in accordance with the Barr excavation entry procedure. All excavation entry will be cleared with an appropriately trained Barr employee. For excavation entry procedures, please see *Section K: Excavation Entry Procedures* of the Barr Health and Safety Program Manual. If soil samples are required from excavation materials, samples will be taken from the backhoe bucket or from the spoils pile, or other non-entry methods, whenever possible.

3.4 Lighting

Work areas must have adequate lighting for employees to see to work and identify hazards. Work will be limited to daylight hours unless artificial lighting is provided. Barr employees will carry flashlights in all normally dark areas, such as confined spaces.

3.5 Lifting

Before manual lifting is performed, a hazard assessment performed by the lifter should be conducted that considers size, bulk, and weight of object to be lifted, as well as potential obscured vision along walking surface, travel distance and path due to carrying the object. Mechanical lifting equipment or two- person lift teams will be implemented as required by the Project Manager.

When the use of lifting equipment (such as forklifts, etc.) is required, only staff trained in use of specific equipment will be allowed to perform lift. Staff are also expected to evaluate each other on repetitive lifting tasks and provide suggestions on how to improve ergonomics associated with each lifting task. If it is not possible to conduct the lift in a safe manner, then staff are advised to communicate with their Project/Administrative manager so that other options can be implemented.

All staff are required to attend Power Lift training included in Barr's Safe Start training program. This training provides the general principles of ergonomics as it applies to the lift and provides a series of lifting positions that provide good support to the back. In the event of an injury that results from manual lifting, employees are advised to notify their Health and Safety Coordinator to report the incident. Follow-up incident investigation will be conducted to identify the root cause and develop an action plan to prevent recurrence.

3.6 Deteriorated/Abandoned Buildings

Abandoned buildings on site may be structurally unstable. Roof, ceiling, floors, walkways, and doors may be damaged. Hard hats, steel-toed boots and safety glasses will always be used when entering those buildings. An initial walk through with a buddy will be conducted in or near any abandoned facility to identify physical hazards. These types of buildings will be entered only if necessary and may be considered a confined space.

3.7 Electrical Power Hazards

Electrical equipment must be properly grounded or double insulated and will be inspected prior to use. Any electrical equipment in questionable condition will not be used. Operation of electrical equipment in wet conditions must be avoided unless equipment and electric service are specifically designed for water immersion.

3.8 Energized Equipment

Work on or near energized equipment will not be conducted until the equipment is appropriately locked-out. Appropriate lockout procedures prevent the equipment from being turned on while a person is working on or near the equipment.

3.9 Compressed Gas Cylinders

Compressed gas cylinders must be properly labeled and secured in an upright position with a chain or other securing devices away from heat sources. Empty containers will be marked empty, have protective valve caps securely in place, and secured in an upright position.

3.10 Slipping

Slipping on wet, muddy surfaces can be minimized by diverting water away from work area, avoiding slippery surfaces, or by providing a better surface to walk on, such as laying boards on the muddy surface. Boots with good treads or boot covers will be worn if the area is wet or muddy. Walking in puddles, drilling mud and drilling additives will be avoided. Slipping on snowy or icy surfaces will be minimized by avoiding these surfaces whenever possible. Regularly used walkways and travel ways will be sanded, salted, or cleared of snow and ice as soon as practicable to prevent slipping.

3.11 Limitations Due To Personal Protective Equipment

The use of personal protective equipment may limit visibility, hearing, or manual dexterity. In addition, wearing personal protective equipment may require additional physical exertion of the wearer. These limitations are evaluated during the preparation of the PHASP and will be re-addressed, as appropriate, prior to performing a particular task.

3.12 Noise Extremes

Noise exposure may occur on site from heavy equipment operation, especially while working in the area of operating equipment. A general rule of thumb to determine if noise levels are high enough to require hearing protection is to observe if two persons standing approximately 2 feet apart have to raise their voices to converse. If conversation cannot occur without shouting, noise levels probably exceed 85 dBA and hearing protection will be utilized. Hearing protection is available, in the form of earplugs, ear muffs, or both, and will be used when working around heavy equipment. Noise monitoring equipment is also available from the Barr Equipment Coordinator.

3.13 Ionizing Radiation

Sites that have been used by hospitals and research facilities will be particularly suspect of posing an ionizing radiation hazard. These materials may be found in drums, including lab packs, as either a solid or liquid. The best precaution for individuals working at these types of landfills is constant monitoring for ionizing radiation using a Geiger counter or similar monitoring instrument. Initial monitoring will be conducted to detect high levels of radiation where radiation is suspected to be present. If radioactive materials are suspected on site, protective measures will be discussed in the PHASP. Radiation monitoring equipment is available from the Barr Equipment Coordinator.

3.14 Nonionizing Radiation

Barr occasionally uses ground conductivity meters, such as a Geonics EM31. The frequency this device generates is 9.8 kHz. A comparison to the ACGIH TLV indicates that this frequency is not contained within the frequency ranges of concern.

3.15 Heat Stress

Four environmental factors – temperature, humidity, radiant heat (such as from the sun or a furnace) and air velocity – affect the amount of stress a worker faces in a hot work area. Perhaps most important to the level of stress an individual faces are personal characteristics such as age, weight, fitness, medical condition and acclimatization to the heat.

The body reacts to high external temperature by circulating blood to the skin which increases skin temperature and allows the body to give off its excess heat through the skin. However, if the muscles are being used for physical labor, less blood is available to flow to the skin and release the heat.

Sweating is another means the body uses to maintain a stable internal body temperature in the face of heat. However, sweating is effective only if the humidity level is low enough to permit evaporation and if the fluids and salts lost are adequately replaced.

Of course, there are many steps a person might choose to take to reduce the risk of heat stress such as moving to a cooler place, reducing the work pace or load, or removing or loosening some clothing.

If the body cannot dispose of excess heat, it will store it. When this happens, the body’s core temperature rises and the heart rate increases. As the body continues to store heat, the individual begins to lose concentration and has difficulty focusing on a task, may become irritable or sick and often loses the desire to drink. The next stage is most often fainting and then possible death if the person is not removed from the hot environment.

3.15.1 Preventing Heat Stress

Most heat-related health problems can be prevented or the risk of developing them reduced. Following a few basic precautions will lessen heat stress.

1. **Acclimatization** to the heat through short exposures followed by longer periods of work in the hot environment can reduce heat stress. New employees and workers returning from an absence of two weeks or more will have a five-day period of acclimatization. This period should begin with 50 percent of the normal workload and normal work time the first day and gradually build up to 100 percent on the fifth day.

2. A variety of **engineering controls**, including general ventilation and spot cooling by local exhaust ventilation at points of high heat production may be helpful. Shielding is required as protection from radiant heat sources. Evaporative cooling and mechanical refrigeration are other ways to reduce heat. Cooling fans can also reduce heat in hot conditions. Eliminating steam leaks will also help. Equipment modifications, the use of power tools to reduce manual labor and using personal cooling devices or protective clothing are other ways to reduce heat exposure for workers.

3. **Work practices** such as providing a period of acclimatization for new workers and those returning from two-week absences and making plenty of drinking water – as much as a quart per worker per hour – available at the workplace can help reduce the risk of heat disorders. Training first aid workers to recognize and treat heat stress disorders and making the names of trained staff known to all workers is essential. Employers will also consider individual workers' physical conditions when determining their fitness for working in hot environments. Older workers, obese workers, and personnel on some types of medication are at greater risk.

4. Alternating **work and rest** periods with longer rest periods in a cool area can help workers avoid heat stress. If possible, heavy work will be scheduled during the cooler parts of the day and appropriate protective clothing provided. Supervisors will be trained to detect early signs of heat strain and will permit workers to interrupt their work if they are extremely uncomfortable.

5. **Employee education** is vital so that workers are aware of the need to replace fluids and salt lost through sweat and can recognize dehydration, exhaustion, fainting, heat cramps, salt deficiency, heat exhaustion and heat stroke as heat disorders. Workers will also be informed of the importance of daily weighing before and after work to avoid dehydration.

3.15.2 Heat Stress First-Aid Treatment Guidelines

TABLE 2: HEAT STRESS FIRST AID TREATMENT GUIDELINES describes the symptoms of the different levels of heat stress and guidelines for first aid treatment.

Table 2 Heat Stress First Aid Treatment Guidelines

<table>
<tr><td colspan="2">**Heat Cramps**</td></tr>
<tr><td colspan="2">Cause: Excessive water loss</td></tr>
<tr><td>Symptoms:</td><td>First-Aid Treatment Guidelines:</td></tr>
<tr><td>• Muscular pain in arms, legs, abdomen
• Faintness, dizziness, exhaustion
• Normal temp, cool, moist skin</td><td>• Administer sips of Gatorade or water (glass every 15 minutes)
• Do not massage cramping muscles (unless it does not increase pain)
• Relax person</td></tr>
<tr><td colspan="2">**Heat Exhaustion**</td></tr>
<tr><td colspan="2">Cause: Large amount of water loss; blood circulation diminishes</td></tr>
<tr><td>Symptoms:</td><td>First-Aid Treatment Guidelines:</td></tr>
<tr><td>• **Moist, clammy skin,** usually pale
• Dilated pupils
• Weak, dizzy, nauseous, headache
• Normal or low temperatures</td><td>• Move to cool place
• Apply cold, wet compresses to skin
• Raise feet 8 to 12 inches
• Administer sips of water or Gatorade (glass every 15 minutes)
• Get medical attention</td></tr>
<tr><td colspan="2">**Heat Stroke**</td></tr>
<tr><td colspan="2">Cause: Body overheats; temperature rises; no sweating occurs</td></tr>
<tr><td>Symptoms:</td><td>First-Aid Treatment Guidelines:</td></tr>
<tr><td>• No sweating occurs
• Dry, hot skin, usually red
• Constricted pupils
• Hot body temperature (105-110 °F)
• Strong, rapid pulse
• Unconsciousness may occur
• Muscular twitching</td><td>• **Get emergency medical assistance immediately**
• Remove from sunlight
• Wet down body with cool water or rubbing alcohol
• Elevate head/shoulders
• Wrap in wet, cold wrapping
• Once cooled to 102 °F, stop cooling measures</td></tr>
</table>

3.16 Cold Stress

Barr staff may be at risk for cold exposure when performing certain job tasks in the winter months. Barr staff will review the health effects of cold exposure at the initial pre-project safety meeting and repeat annually, if appropriate. An assessment will be conducted to identify when an employee may be at risk for cold exposure through use of the Field Safety Review form. The Field Safety Review form will be used to address and inform employees of cold weather safety issues such as the dangers associated with working around snow and ice buildups. The form will also help identify cold weather supplies to bring to the job site. These supplies will be inspected and restocked when necessary. The buddy system will be implemented to make sure that no Barr employee is working alone when at risk for cold exposure.

Fatal exposures to cold have been reported when persons fail to escape from low environmental air temperatures or from immersion in low temperature water. Hypothermia, a condition in which the body’s deep core temperature falls significantly below 98.6 ºF, can be life-threatening. A drop in core temperature to 95 ºF or lower must be prevented.

Air temperature is not sufficient to determine the cold hazard of the work environment. The windchill must be considered as it contributes to the effective temperature. The body’s physiologic defense against cold includes constriction of the blood vessels, inhibition of the sweat glands to prevent loss of heat via evaporation, glucose (fuel) production, and involuntary shivering to produce heat by rapid muscle contraction.

The frequency of accidents increases with cold exposures as the body’s nerve impulses slow down, individuals react sluggishly and numb extremities make for increased clumsiness. Additional safety hazards include ice, snow blindness, reflections from the snow, and possible skin burns from contact with cold metal.

There are certain predisposing factors that make an individual more susceptible to cold stress. It is the responsibility of the project team members to inform the Project Health and Safety Team Leader if any of the predisposing factors listed below apply to that individual. This enables the Project Health and Safety Team Leader to monitor the individual if necessary, or use other means of preventing/reducing the individual’s likelihood of experiencing a cold-related illness/disorder.

3.16.1 Predisposing Factors

Predisposing factors that will increase an individual’s susceptibility to cold stress are listed below.

- Dehydration - The use of diuretics and alcohol, and diarrhea can cause dehydration. Dehydration reduces blood circulation to the extremities.

- Fatigue during physical activity - Exhaustion reduces the body’s ability to contract blood vessels. This results in the blood circulation occurring closer to the surface of the skin and the rapid loss of body heat.

- Age - Some elderly and very young individuals may have an impaired ability to sense cold.

- Alcohol consumption - Alcohol dilates the blood vessels near the skin surface resulting in body heat loss.

- Sedative drugs - Sedatives may interfere with the transmission of impulses to the brain thereby interfering with the body's physiological defense against cold.

- Poor circulation - Vasoconstriction of peripheral vessels reduces blood flow to skin surface.

- Heavy workload - Heavy workloads generate metabolic heat and make an individual perspire. If perspiration is absorbed by the individual's clothing and is in contact with skin, cooling of the body will occur.

- The use of PPE - PPE usage which traps sweat inside the PPE may increase an individual's susceptibility to cold stress.

- Lack of acclimatization - Acclimatization, the gradual introduction of workers into a cold environment allows the body to physiologically adjust to cold working conditions.

- History of cold injury - Previous injury due to cold exposures may result in increased cold sensitivity.

3.16.2 Preventing Cold Stress

There are a variety of measures that can be implemented to prevent or reduce the likelihood of employees developing cold related illness/disorders. These include acclimatization, fluid and electrolyte replenishment, eating a well-balanced diet, wearing warm clothing, the provision of shelter from the cold, thermal insulation of metal surfaces, adjusting work schedules, and employee education.

- **Acclimatization:** Acclimatization is the gradual introduction of workers into a cold environment to allow their body to physiologically adjust to cold working conditions. However, the physiologic changes are usually minor and require repeated uncomfortably cold exposures to induce them.

- **Fluid and Electrolyte Replenishment:** Cold, dry air can cause employees to lose significant amounts of water through the skin and lungs. Dehydration affects the flow of blood to the extremities and increases the risk of cold injury. Warm, sweet, caffeine-free, nonalcoholic drinks and soup are good sources to replenish body fluids.

- **Eating a Well-Balanced Diet:** Restricted diets including low-salt diets can deprive the body of elements needed to withstand cold stress. Eat high-energy food throughout the day.

- **Warm Clothing:** It is beneficial to maintain air space between the body and outer layers of clothing in order to retain body heat. However, the insulating effect provided by such air spaces is lost when the skin or clothing is wet.

- **Work Schedule Adjustment:** Schedule work during the warmest part of the day if possible; rotate personnel; and, adjust the work schedule to enable employees to recover from the effects of cold stress.

The parts of the body most important to keep warm are the feet, hands, head and face. As much as 40% of body heat can be lost when the head is exposed.

- **Recommended Clothing includes:**

    - For inner layers (t-shirt, shorts, socks), thin, thermal insulating, nonmoisture absorbent, moisture wicking material such as polypropylene is recommended.

    - Wool or thermal trousers. Denim is not a good protective fabric since it absorbs moisture very well.

    - Felt-lined, rubber-bottomed, leather-topped boots with a removable felt insole is preferred. Wool socks with polypropylene inner socks. Consider winter boots one half size larger than regular size to accommodate thick socks.

    - Wool shirts/sweaters are recommended to be worn over inner layer.

    - A wool cap is good head protection. Use a liner under a hard hat.

    - Mittens are better insulators than gloves. Wool liners for either mittens or gloves.

    - Face masks or scarves are good protection against wind.

    - Tyvek/polycoated tyvek provide good wind protection.

  - Wear loose fitting clothing, especially footwear.
  - Carry extra clothing in vehicle. Change out of wet clothes or socks.

- **Provision of Shelter from the Cold:** Shelters with heaters will be provided for the employees' rest periods if possible. Sitting in a heated vehicle is a viable option. Care will be taken that the exhaust is not blocked and that windows are partially open to provide ventilation.

- **Thermal Insulation of Metal Surfaces:** At temperatures of 30 ºF or lower, cover metal tool handles with thermal insulating material if possible.

- **Employee Education:** Signs, symptoms and treatment of cold stress will be reviewed in project safety meetings where applicable. The Buddy System will help in preventing cold stress once the employees are trained to recognize the signs and symptoms of cold stress.

3.16.3 Suggested Cold Stress Prevention Guidelines

It may not be practically or economically feasible to implement all the above prevention measures. Follow the guidelines given below when the **ambient air temperature is -5 ºF or lower:**

- Contact the Project Manager or the Project Health and Safety Contact to determine if the project team should be on-site in such temperatures.

- Dress warm.

- Replenish fluids and electrolytes at regular intervals.

- Provide shelter from the cold.

- Adjusting work-rest schedules.

3.16.4 Cold Stress First-Aid Treatment Guidelines

TABLE 3: COLD STRESS FIRST-AID TREATMENT GUIDELINES describes symptoms of different stages in cold stress and first aid treatment guidelines.

Table 3 Cold Stress First-Aid Treatment Guidelines

Frostbite	
Stages:	
• Incipient (frost nip)	May be painless. Tips of ears, nose, cheeks, fingers, toes, chin affected. Skin blanched white.
• Superficial	Affects skin/tissue just beneath skin; turns purple as it thaws. Skin is firm, waxy; tissue beneath is soft, numb.
• Deep	Tissue beneath skin is solid, waxy, white with purplish tinge. Entire tissue depth is affected.
First-Aid Treatment Guidelines:	
• Incipient	Warm by applying firm pressure—**no rubbing**; or blow warm breath on spot; or submerge in warm water (102-110ºF).
• Superficial	Provide dry coverage, steady warmth; submerge in warm water.
• Deep	Hospital care is needed. **Don't** thaw frostbitten part if needed to walk on. **Don't** thaw if there is danger of refreezing. Apply dry clothing over frostbite. Submerge in water; **do not** rub.

General Hypothermia		
Stages:	Symptoms of Hypothermia:	
Shivering	Muscle Tension	Coordination Loss
Indifference	Uncontrollable Shivering	Stumbling
Decreased Consciousness	Decreased Muscle Function	Fatigue
Unconsciousness	Speech Distortion	Forgetfulness
Death	Glassy Stare	Freezing Extremities
	Blue, Puffy Skin	Dilated Pupils
	Slow Pulse	Shallow Breathing
Emergency Response:		
• Keep person dry; replace wet clothing • Apply external heat to both sides of patient using available heat sources, including other • bodies • Give warm liquids—**not** coffee or alcohol—after shivering stops and if conscious • Handle gently • Transport to medical facility as soon as possible • If more than 30 minutes from a medical facility, warm person with other bodies		

3.16.5 Windchill Index

The human body senses "cold" as a result of both air temperature and wind velocity. Cooling of exposed flesh increases rapidly as the wind velocity goes up. Frostbite can occur at relatively mild temperatures if wind penetrates the body insulation. For example, when the actual air temperature of the wind is 40 ºF and its velocity is 30 mph, the exposed skin would perceive this situation as an equivalent still air temperature of 13 ºF.

If the actual wind speed is not known, the following examples are provided to approximate wind speed.

5 mph = Light flag moves

10 mph = Light flag fully extended

15 mph = Raise newspaper sheet

20 mph = Blowing and drifting snow

TABLE 4: WINDCHILL INDEX shows a chart that can help in determining the windchill index. Site work will be terminated when there is a great danger of freezing exposed flesh.

Table 4 Windchill Index

	Actual Temperature Reading (°F)											
Estimated Wind Speed (in mph)	50	40	30	20	10	0	-10	-20	-30	-40	-50	-60
	Equivalent Chill Temperature (°F)											
Calm	50	40	30	20	10	0	-10	-20	-30	-40	-50	-60
5	48	37	27	16	6	-5	-15	-26	-36	-47	-57	-68
10	40	28	16	4	-9	-24	-33	-46	-58	-70	-83	-95
15	36	22	9	-5	-18	-32	-45	-58	-72	-85	-99	-112
20	32	18	4	-10	-25	-39	-53	-67	-82	-96	-110	-121
25	30	16	0	-15	-29	-44	-59	-74	-88	-104	-118	-133
30	28	13	-2	-18	-33	-48	-63	-79	-94	-109	-125	-140
35	27	11	-4	-20	-35	-51	-67	-82	-98	-113	-129	-145
40	26	10	-6	-21	-37	-53	-69	-85	-100	-116	-132	-148
(Wind speeds greater than 40 mph have little additional effect.)	*LITTLE DANGER* In <hr with dry skin. Maximum danger of false sense of security.				*INCREASING DANGER* Danger from freezing of exposed flesh within one minute.				*GREAT DANGER* Flesh may freeze within 30 seconds.			

▨ Equivalent chill temperature requiring dry clothing to maintain core body temperature above 36 °C (96.8 °F) per cold stress TLV.

From: *Threshold Limit Values and Biological Exposure Indices*, ACGIH 1998 or most current. Developed by U.S. Army Research Institute of Environmental Medicine, Natick, MA.

3.17 Fire Extinguishers

Fire extinguishers have been provided in company vehicles and for employee use in the field. For those staff who may need to use a fire extinguisher, training will be provided on the general principles of fire extinguisher use and the hazards involved in incipient stage of fire-fighting. Training will be conducted prior to initial assignment and on an annual basis. All fire extinguishers will be visually inspected on a monthly basis and will be included in an annual maintenance check. The dates of all inspections will be recorded on a tag on each fire extinguisher.

3.18 Fatigue Management

A normal work shift is generally considered to be a work period of no more than eight consecutive hours during the day, five days a week with at least an eight-hour rest. Any shift that incorporates more continuous hours, requires more consecutive days of work, or requires work during the evening should be considered extended or unusual. Extended shifts may be used to maximize scarce resources. Long or unusual shifts are often required during response and recovery phases of client-critical situations such as oil spills, which generally come without warning, require continuous monitoring, and may overwhelm staff both technically and tactically. Fatigue management guidelines will be discussed with Barr staff whose work responsibilities might require these shift types.

When applicable, the following guidelines are recommended to manage worker fatigue:

- Arrange work schedules to manage worker fatigue.
- Evaluate job tasks prior to project work to control fatigue.
- Schedule periodic breaks to minimize fatigue and increase mental fitness.
- Avoid operating motor vehicles and/or heavy equipment while excessively fatigued.
- Report fatigue issues to your Health and Safety Coordinator or Project Manager.

Section 4: Safety Training Program

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Section 4: Safety Training Program

1.0 Introduction

Barr will provide safety training where it has been determined to be required for work assignments. Barr employees performing those designated work assignments will be required to attend these training sessions. Barr employees will be paid for time spent in required training.

Training programs will be designed according to the needs of the employees and the projects to which they may be assigned. The safety training program for Barr staff is intended to:

- Make employees aware of potential hazards they may encounter during the performance of work activities at such sites.

- Provide the training necessary to perform work tasks at such sites in a safe and healthful manner.

- Train employees to recognize and avoid potentially dangerous situations that may occur during work activities at such sites.

- Meet OSHA safety training requirements, as applicable.

2.0 Types of Training

Barr provides the following types of safety training:

- **Initial Hazardous Waste-Related Operations (HAZWOPER) Training** for all Barr staff who will be assigned to work on sites containing or suspected to contain hazardous substances. Initial training will be provided prior to assignment to work on these sites and is scheduled for 40-hours of instruction time. Additionally, all Barr staff assigned to work on sites containing or suspected to contain hazardous substances will have a minimum of three days of direct supervision under a trained, experienced Project Health and Safety Team Leader before working independently on sites containing or suspected to contain hazardous substances.

- **HAZWOPER Management Training** for PMs who will be responsible for the management of Barr’s work on sites containing or suspected to contain hazardous substances, and who are not covered under initial training. Management training will be given upon assignment of management responsibilities for these sites to those employees who have not previously received Initial Training or Management Training, and is scheduled for 24-hours of instruction time.

- **Supervisor for HAZWOPER Training** for those employees who have on-site safety supervisory responsibility for work on sites containing or suspected to contain hazardous substances. This one-time training is in addition to the initial 40-hour training. It may also occur concurrently with an 8-hour refresher training session, if the applicable topics are covered. Training sessions cover such topics as the Barr Health and Safety Program, personal protective equipment program, and health hazard monitoring procedures and techniques.

- **HAZWOPER Refresher Training** for all Barr staff who have worked on or managed sites containing or suspected to contain hazardous substances. Refresher training will be given annually after the initial training or after the most recent refresher training session and is scheduled for 8-hours of instruction time.

- **Construction Practices Training** for all Barr staff who will be assigned to conducted fieldwork where there may be construction activities. Training covers Barr’s responsibilities, on-site preparation, specifications, construction observation, field safety, to include heavy equipment safety, motor vehicle safety, ladders and scaffolds, excavation entry and confined space entry.

- **Confined Space Entry Training** for all Barr staff who will be assigned to conduct fieldwork involving confined space entry. Confined spaces are spaces that are large enough so that an employee can enter, has limited means for entry or exit and is not designed for continuous occupancy.

- **Excavation Safety Training** for all Barr staff who manage projects or who will conduct fieldwork involving working around excavations. Prior to any work around excavation, an inspection and if necessary, excavation entry approval is required.

- **First Aid/CPR Training** for Barr staff who are assigned to conduct field work on a routine basis, and who may work in remote locations. This also includes all field staff who work on construction sites in Michigan.

- **Mine Safety and Health Administration (MSHA) Training** for all Barr staff who will be assigned to conduct field work on mining property. Two types of annual training - Hazard Awareness (2 hr) and Annual Refresher (8 hr) are provided to staff.

- **Scaffold Training** for Barr staff who erect, dismantle, or work on scaffolds. A Scaffold "Competent Person" must supervise all erecting/dismantling of scaffolds.

- **Fall Protection Training** for Barr staff who work at heights six feet or greater above the ground or lowest level and where guardrail systems do not provide protection from falling.

- **Lockout/Tagout Training** for Barr staff who work near equipment where the unexpected start-up of a machine or equipment may release stored energy that could cause injury.

3.0 Specific OSHA HAZWOPER Requirements

All Barr employees and Barr's subcontractors working on site will have attended the 40-hour initial training for work on hazardous waste sites, have kept current with an 8-hour refresher annually, and have had at least three days of supervised on-site training. In addition, any Barr employee acting as the Barr on-site representative has had an additional 8 hours of supervisor training. These training requirements are required by the OSHA standard, 29 CFR 1910.120 Hazardous Waste Operation and Emergency Response.

All Barr employees who visit the site only occasionally for performance of limited tasks, have attended a 24-hour training session and have kept current with an 8-hour refresher, and have had at least one day of supervised on-site training. The content of initial training and refresher training includes recognition of the signs and symptoms of overexposure to chemical and physical hazards, proper use of personal protective equipment, decontamination procedures, use of air monitoring equipment, recognition of physical hazards, medical surveillance requirements, and PHASPs. Company specific safety concerns may also be covered at the annual refresher training. Each Barr employee on site will be issued a training certificate that indicates the type of training received, the training organization and the date training was received. Copies of all training certificates are kept on file at Barr's office.

4.0 Safety Training Records

The Company Health and Safety Manager is responsible for the maintenance of safety training records. The records will show who is trained, the date(s) training occurred, and the training category intended to be fulfilled. Records of training will be kept in the Barr Health and Safety administrative files.

Section 5: Construction Safety

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Section 5: Construction Safety

1.0 Introduction

The nature of Barr’s business requires that Company employees work on construction sites. It is the policy of the Company to provide for the safety of employees who work on such projects through careful training, careful planning, providing equipment, and through empowering employees to make personal judgments as to the safety of their work situations. It is Barr’s policy that Barr personnel working on construction sites be provided with the equipment and training necessary to perform their work in a safe and healthful manner. This chapter covers elements of construction safety not otherwise addressed in this Manual. Employees working on construction sites are advised to review other Manual chapters as appropriate.

2.0 Construction Practices Safety Training

All staff who intend to work on construction sites are required to attend construction practices training. Additional on-site training for working around earth moving equipment is also required.

3.0 Heavy Equipment

3.1 Equipment Observation

Barr personnel will, whenever possible, perform observation of heavy equipment operation from a safe distance. Barr personnel should not approach or enter the swing arm range of heavy equipment unless:

- The equipment has ceased work and the swing arm has been grounded.
- The operator has clearly signaled that it is safe to enter the area.
- The area to be entered is free of other hazards.
- Visual or verbal communication with the operator is maintained.

3.2 Traffic Lanes

If heavy equipment lanes have been designated, Barr personnel will not walk or drive in those lanes. Barr personnel will not cross heavy equipment traffic lanes, except at designated crossing points.

Heavy Equipment Usage

Barr staff will not operate heavy equipment on construction sites unless they have received training on the operation of that specific equipment. Barr staff will not ride on or in any piece of heavy equipment unless that equipment has a proper passenger seat and seat belt.

4.0 Motor Vehicle Operation

Barr personnel who anticipate the need to use motor vehicles on an active construction site should obtain pre-approval from the project manager.

Operating Guidelines

The following guidelines are for operating motor vehicles on construction sites:

- Park only in designated parking areas.
- Walk-around the vehicle prior to driving.
- Wear seatbelt at all times when the vehicle is in motion.
- Turn headlights on whenever the vehicle is in motion.
- Observe all site speed limits.
- Give heavy equipment and trucks the right-of-way at all times.

5.0 Electrical Equipment

Temporary electrical services to construction sites is often necessary to provide power for cranes, construction elevators, welding equipment, power tools, site offices, lunch rooms, and other facilities. While Barr personnel will not be handling electrical equipment (other than office equipment), Barr personnel must observe the following rules around electrical equipment:

- Do not drive over or step on power lines unless they have been covered by a protective cap.
- Do not operate any equipment they are not trained and authorized to use.
- Any electrical equipment on a construction site should be connected to a ground-fault circuit interrupter (GFCI).

- All power and extension cords should be free of cuts, abrasions, and other signs of damage. All cords should be rated for their intended industrial use.

- Electrical equipment must be in good repair and should be free of damage to its casings and controls.

6.0 Hand and Power Tools

Barr personnel should stand safely away from the point of operation when power tools are being used. If cutting, grinding, or other tools with rotating parts are being used, personnel should position themselves perpendicular to the direction of rotation. Personnel should not stand over or near the air lines being used with compressed air driving tools.

All hand and power tools should be maintained in a safe condition. Equipment guarding provided by the manufacturers should be used and kept in place. Appropriate PPE (eye, face, head and foot) protection should be used during the use of hand and power tools. Any tool that is malfunctioning or is unsafe to use should be tagged and notification should be made to the equipment coordinator.

7.0 Welding and Cutting Operations

Welding and cutting activities generate intense light at the point of operation which can cause severe eye irritation, if observed without protective lenses. Welding and cutting activities also generate hot sparks and slag which can burn eyes, skin, and clothes on contact.

Welding and cutting activities should be observed from a safe distance to avoid contact with sparks, slag, and gases. If close inspection of the activity is required, wait until welding or cutting has ceased. Do not directly observe actual welding or cutting activities, even from a distance, unless you have protective eye wear approved for such purposes. Do not touch any metal that has recently been welded or cut, since it can remain hot enough to cause a burn, for up to one hour.

8.0 Compressed Gas Cylinders

Compressed gas cylinders used at field sites must be:

- Secured to a fixed structure or kept in a secure mobile cart.

- Stored with a protective cap on when not in use.

- Stored in an area where they are protected from traffic, heat, and physical damage

9.0 Ladders

Ladders are to be used for access and egress from elevated work stations or for short-term observations and should not to be used for extended work periods (longer than a week). Barr staff shall use ladders only for the purpose for which they were designed. Use the right ladder for the job (step, platform, straight, or extension). Ladders shall neither be loaded beyond the maximum intended load for which they were built nor beyond the manufacturer's rated capacity. Only one person is permitted to use a ladder at a time.

When using a step ladder, never stand on a step higher than the second step from the top. When using a straight or extension ladder, select one of sufficient length so that the work can be performed while standing on or below the third rung from the top. The base of the extension or straight ladder should be 1-foot away from the wall for every 4-feet that the ladder rises (4:1 Rule). For example, if the ladder touches the wall 16 feet above the ground, the base of the ladder should be 4 feet from the wall.

Always inspect the ladder before each use, looking for damaged parts. If any damage is found, the ladder should be tagged and taken out of service immediately. Always maintain three points of contact on any ladder. Ladder rungs and steps shall be clean, parallel, uniformly spaced and level when the ladder is in position for use. When using a straight ladder to gain access to a roof, the ladder should extend at least three feet above the roof to provide holding points for dismounting and remounting the ladder.

10.0 Scaffolds

Scaffolds are intended to provide secure platforms for elevated work and are preferred to ladders for work platforms. Only qualified and competent employees are allowed to modify scaffolding systems. Though it is preferable to have the client arrange for all scaffolding erection and dismantling needs, when necessary, qualified Barr employees may erect and dismantle scaffolding under the supervision of a Barr Scaffold Competent Person up to but not exceeding 20 feet in height. When scaffolding in excess of 20 feet in height is required, it is the policy of Barr to have a client or a subcontractor erect and dismantle scaffolding necessary for the completion of elevated tasks.

Prior to scaffold installation, the proposed location should be checked for any unsafe conditions (such as overhead power lines, or doors and windows that can be opened into the work space on the scaffold) that could create a hazard for scaffold workers. Scaffold should not be used closer than 10 feet to energized power lines. Employees should not work on scaffolds during storms or high winds of more than 40 miles per hour.

Scaffold and scaffold components should be inspected for visible defects by a Barr Scaffold Competent Person prior to each work shift and after any occurrence which could affect a scaffold's structural integrity. Any unsafe equipment and/or conditions are required to be tagged out by a competent person.

11.0 Protection from Falling Objects

When a Barr employee may be exposed to falling objects, each affected employee is expected to wear a hardhat. In addition, one of the following measures should be incorporated to provide additional protection from falling objects. If one of these measures cannot be implemented, Barr employees are expected to remove themselves from the area.

- Erect toe boards, screens, and/or guardrail systems to prevent objects falling from higher levels.
- Erect a canopy structure and keep potential falling objects far enough from the edge of the higher level so that those objects do not go over the edge if they are accidentally displaced.
- Barricade the area into which objects could fall, prohibit Barr staff from entering the barricaded area, and keep objects that may fall far enough away from the edge of a higher level so that those objects do not go over the edge if they are accidentally displaced.

12.0 Guardrail Systems

Where guardrail systems are required, these systems will comply with the following specifications:

- Top edge height of top rails will be 42 inches, plus or minus three (3) inches above the working/walking level.

- Mid rails will be installed between the top edge of the guardrail system and the walking/working surface.

- Guardrail systems will be capable of withstanding, without failure, a force of at least 200 pounds applied within two (2) inches of the top edge, in any outward or downward direction, at any point along the top edge.

- Guardrail systems will be surfaced so as to prevent injury to an employee from punctures or lacerations, and to prevent snagging of clothing.

- Toe boards will be used when there is potential for employees working below the guardrail system to be exposed to falling objects.

- Additional specifications contained in the OSHA Fall Protection Standard (29 CFR 1926.501).

13.0 Field Offices

Field office spaces should meet the following requirements:

- The office space should have adequate lighting.

- Fall and winter office space should have a heating system capable of maintaining a temperature of at least 65°F.

- The office should have a telephone, electrical service, smoke detector, and a fire extinguisher.

- All electrical and appliance installations conform to applicable electrical and life-safety codes.

Section 6: Personal Protective Equipment (PPE) Program

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Section 6: Personal Protective Equipment (PPE) Program

1.0 Scope

Barr has established this personal protective equipment (PPE) program for Barr employees to provide guidelines and procedures that enable employees to effectively use the PPE provided to them. Discussion of protective equipment normally used by Barr personnel, except respiratory protection, is provided in this section. Respiratory protection is described in *Section G: Respirator Program* of this Manual.

Protective equipment, including personal protective equipment for eyes, face, head and extremities, protective clothing, respiratory devices, and protective shields and barriers will be provided to Barr employees, and maintained in a sanitary and reliable condition. All personal protective equipment provided to Barr employees complies with ANSI standards cited by OSHA where applicable. This equipment will be used when needed by reason of hazards of processes or environment, chemical hazards, radiological hazards, or mechanical irritants that are capable of causing injury or impairment in the function of any part of the body through absorption, inhalation, or physical contact.

The Barr Project Manager and Barr Health and Safety staff will assess the potential hazards present on a project work site that may necessitate the use of PPE. Based on this assessment, engineering and work practice controls shall be used to eliminate or minimize exposure whenever possible as a first line of defense. When controls fail to reduce exposure, the appropriate PPE will be selected to protect employees from hazards identified in the preliminary hazard assessment. This information will be documented in the PHASP and communicated to each employee prior to conducting fieldwork. Each employee is responsible for discussing these identified PPE needs with the Equipment Coordinator to acquire properly fitting PPE and receive proper fitting/use assistance. While working on the project site, each employee is expected to use the identified PPE as documented in the PHASP.

2.0 Hazard Assessment

Barr will assess the hazards present on a project work site to determine the need for PPE. This hazard assessment is multi-staged and begins with the identification of hazard groups for each of the tasks scheduled for the work site. Each scheduled project task is evaluated for hazards associated with those activities and is assigned a particular Hazard Group. Each Hazard Group represents a different potential for exposure and consequently has a corresponding level of personal protective equipment assigned to it. Each Hazard Group is described in detail in *Section C: Hazard Evaluatio*n.

Work activities assigned to the same Hazard Group have generally similar exposure potentials, even if the work activities are different. In this way, the work activity and its exposure potential prescribes the personal protective level, rather than the type or portion of the site where the work activity is performed. Table F-1 describes these Hazard Groups.

Table 1 Hazard Group Descriptions

Hazard Group	Description
Group 0	No contact with hazardous substances is expected during this work activity. No construction hazards are immediately adjacent to the work area while this work activity is being performed. No specific level of protection is required except for normal work/street clothes.
Group 1 (Level D1)	No contact with hazardous substances is expected during this work activity. Construction hazards are immediately adjacent to the work area while this work activity is being performed. Level D1 protection would be appropriate.
Group 2 (Level D2)	Contact with “low” levels of hazardous substances is expected during this work activity. Construction hazards are immediately adjacent to the work area while this work activity is being performed. Level D2 protection would be appropriate.
Group 3 (Level C3/D3)	Contact with “moderate” levels of hazardous substances is expected during this work activity. Construction hazards are immediately adjacent to the work area while this work activity is being performed. Level D3 protection would be appropriate. Possible upgrade to a corresponding Level C protection.
Group 4 (Level C4/D4)	Contact with “high” levels of hazardous substances are expected during this work activity or contact with contaminated liquids is possible. Construction hazards are immediately adjacent to the work area while this work activity is being performed. Level D4 protection would be appropriate. Possible upgrade to a corresponding Level C protection.

Each PHASP will list the project tasks and their corresponding Hazard Groups anticipated at the time of PHASP preparation and is shown in Table F-2. This information corresponds with TABLE F-3 GUIDELINES FOR PERSONAL PROTECTION LEVELS and is organized according to Hazard Group.

Table F-3 describes personal protective equipment (PPE) selected to protect against potential hazards. These protection levels may be modified (upgraded or downgraded) by the Barr Project Health and Safety Team Leader depending on specific site conditions, equipment configuration, status or phase of site activities, air monitoring results and previous experience. The level of PPE used should be reevaluated for appropriateness upon the first indication of suspected hazardous substances through the detection of odors from exposed soils/fluids, appearance of oiliness in soils, or unnatural soil discoloration.

Table 2 Hazard Groups for Project Tasks

Task	Hazard Group				
	0	1	2	3	4
Nonintrusive Activities					
Site Preparation • Reconnaissance • Perform geophysical survey • Perform topographical survey • Tank and piping inspections • Construction supervision		D1	D2	D3	
Intrusive Activities					
Drilling • Observe soil boring operations • Observe monitoring well installation • Observe monitoring well development		D1	D2	D3	
Trenching/Excavation • Observe test trenching • Observe excavation operations • Collect soil samples from trenches		D1	D2	D3/C3	D4/C4
Soil Sampling • Collect soil samples from soil borings • Perform headspace screening • Collect waste samples		D1	D2	D3/C3	D4/C4
Water Sampling • Collect water samples from monitoring wells • Conduct hydraulic conductivity tests • Measure water levels in wells • Collect surface water samples		D1	D2	D3/C3	
Decontamination Activities					
Equipment DECON Operations • Observe steam cleaning of equipment				D3/C3 w/face shield	

Table 3 Guidelines for Personal Protection Levels 1

	D1	D2	D3	D4	C3	C4
General Safety Equipment Hard Hat(2)	R	R	R	R	R	R
Safety Glasses	R	R	R	R	R	R
Chemical Goggles	O	O	O	O	O	O
Face Shield	O	O	O	O	O	O
Hearing Protection(3)	R	R	R	R	R	R
Safety Vest(4)	R	R	R	R	R	R
Boots Steel-Toed Boots/Insulated Steel-Toed Boots	R	R	R	-	R	-
Chemical Resistant Steel-Toed Boots(5)	-	O	O	R	O	R
Boot Covers(6)	-	R	R	R	R	R
Clothing Cotton Coveralls	-	O	-	-	-	-
Kleengard	-	O	-	-	-	-
Tyvek(4)	-	-	R	-	R	-
Poly-Coated Tyvek	-	-	O	R	O	R
Respirators ☐Mask Respirator with OP/AG cartridge/P100 filter	-	-	-	-	R	R
Full Face—with OV/AG cartridge/P100 filter	-	-	-	-	O	O
Emergency Life Support Apparatus (ELSA) 5-Minute Escape Bottle	-	O	O	O	O	O
Gloves Inner Glove (Surgical)	-	R	R	R	R	R
Outer Glove (Nitrile, neoprene, monkey grip)(7)	-	O	R	R	R	R

R = Required O = Optional - = Not Required

Special Considerations

1 **Work activities** conducted during colder months may require modification of these PPE levels. Refer to *Section C: Hazard Evaluation.*

2 **Hard hat** not required in the absence of construction activities or overhead hazards, unless required by client. Hard hat liners should be used during colder months.

3 **Hearing protection** is required during soil boring, monitoring well installation, and excavation activities involving heavy equipment, when personnel may be exposed to high noise levels (for example, cannot hear normal conversation or have to raise voice to be understood). Refer to *Section H: Hearing Conservation Program.*

4 **Brightly colored safety vests** should be used when working on and adjacent to roadways, working in remote areas during hunting season, or when working on active construction sites during winter months while wearing non-contrasting protective clothing (i.e., white Tyvek).

5 **Chemical resistant steel-toed boots** may be used instead of steel-toed leather boots and boot covers if water is available for DECON.

6 **Boot covers** or chemical resistant boots required if walking in contaminated soil or liquids.

7 **A second pair of surgical gloves** may be used where outer gloves are required.

To complete the hazard assessment, each project task is evaluated for potential safety and health hazards. These potential hazards include potential for inhalation exposure, potential for ingestion exposure, potential for skin/eye contact, potential for flammable vapors, and potential for physical hazards. This evaluation is shown in Table F-4.

Table 4 Overview of Project Task Hazards

Task	Potential for Inhalation Exposure	Potential for Ingestion Exposure	Potential for Skin Contact/Eye Irritation	Potential for Flammable Vapors*	Potential for Physical Hazards
Nonintrusive Activities					
Site Preparation • Reconnaissance • Perform geophysical survey • Perform topographical survey • Tank and Piping Inspections • Construction Supervision	Moderate	Low	Low	Moderate	Low
Intrusive Activities					
Drilling • Observe soil boring operations • Observe monitoring well installation • Observe monitoring well development	Moderate	Low	Moderate	High	Moderate
Trenching/Excavation • Observe test trenching • Observe excavation operations • Collect soil samples from trenches	Moderate	Low	Moderate	High	Moderate
Soil Sampling • Collect soil samples from soil borings • Perform headspace screening • Collect waste samples	Moderate	Low	Moderate	Moderate	Low
Water Sampling • Collect water samples from monitoring wells • Conduct hydraulic conductivity tests • Measure water levels in wells • Collect surface water samples	Moderate	Low	Moderate	Moderate	Moderate
Decontamination Activities					
Equipment DECON Operations • Observe steam cleaning of equipment	Low	Low	Moderate	Moderate	Moderate

*Flammability ranges for selected hazardous substances onsite are found in the PHASP.

All parts of this Hazard Assessment are included in the PHASP. The PHASP identifies the workplace evaluated, the preparer of the PHASP (and hence, the Hazard Assessment), and the date of the PHASP. Currently, each phase is identified according to its particular stage in the Hazard Assessment and is considered to complete the hazard assessment process.

3.0 PPE Selection

Levels of personal protection vary according to the activity being conducted and the hazards that may be encountered. Personal protective equipment selection is made on the basis of site-specific chemical and physical hazards. The U.S. EPA terminology for protective equipment will be used: Levels A, B, C and D. Within each level, there may be variations on the specific PPE used and are designated as D1, D2, D3, D4, C1, C2, C3, C4, etc. A brief description of the levels of protection that may be required is provided below. Levels of protection for a particular project will be specified in the PHASP.

3.1 Level D

Level D protection should be used when a hazardous atmosphere is not present nor is expected based on planned work activities. Level D protection is designed to offer eye and skin protection. Level D does not provide protection from inhalation exposure to hazardous substances. Sub-levels within Level D (D1, D2, D3, D4) are designed to adjust the level of skin and body protection to the appropriate site conditions.

3.2 Level C

Level C protection is designed to offer air purifying respiratory protection in addition to body protection to a comparable sublevel in Level D, and will be used when:

- The types of air contaminants have been identified, an air-purifying respirator (APR) that can remove the contaminants is available, the air contaminants have adequate warning properties, oxygen levels are sufficient, and the criteria for the use of an APR have been met (Barr Respirator Program).

- Concentrations of airborne organic compounds in the breathing zone are 2.5 ppm (benzene equivalent) above background for a period of 10 minutes with a ceiling of 25 ppm (benzene equivalent), or above project specific action levels.

- Concentrations of contaminate particulates which may become airborne in the breathing zone are greater than established action level for those contaminates.

Sublevels within Level C (C1, C2, C3, C4) are designed to adjust the level of skin and body protection appropriate to site conditions with a particular level of respiratory protection. Respirator selection is based on the types of inhalation hazards present on the site. When Level C respiratory protection is required, a full face or half-mask air-purifying respirator with a P100 filter, organic vapor/acid gas cartridges, chemical-specific cartridges, or a combination of both filters and cartridges will be used. The PHASP designates the appropriate combination. The Barr Respirator Program describes respirator usage guidelines in greater detail.

3.3 Level B

Level B protection is designed to offer supplied air respiratory protection in the form of a self-contained breathing apparatus (SCBA) or supplied air (SA) through an air line and will be used when:

- Concentrations of total airborne organic compounds exceed 25 ppm of unknown organics in the breathing zone, or project specific action levels
- Concentrations of hazardous substances in the air are immediately dangerous to life and health (IDLH) or above the maximum use limit of an APR with full-face mask
- Oxygen deficient or potentially oxygen deficient atmospheres (19.5 percent or less) are possible
- Confined space entry requires Level B protection.

Level B protective equipment will consist of all equipment specified for Level C protection except the full-face APR equipment will be replaced with self-contained breathing apparatus (SCBA), or a supplied air (SA) system with an egress bottle, if IDLH conditions are possible.

Use of Level B requires that buddies actually accompany each other and, in addition, at least one other person must be at Level B and available as backup, ready to provide emergency assistance.

3.4 Level A

Level A protective equipment should be worn when the highest level of respiratory, skin, and eye protection is needed. Barr does not expect to work on projects involving this level of protection. In the event that Barr employees are required to work in Level A Protection, additional special training and equipment will be required.

4.0 Personal Protective Equipment Use Guidelines

4.1 Protective Clothing

Each Barr employee is responsible for furnishing and wearing clothing appropriate to the location and nature of work to be performed at typical construction project sites. Barr prohibits the use of jewelry and personal clothing that could become entangled in tools, equipment or machinery, or cause any other apparent danger in the workplace. The employee is expected to recognize the hazards of exposure either to heat or cold as well as the hazards associated with underbrush, trash, dust, etc. All staff who may be exposed to a flash fire or electrical equipment flashover, will wear flame resistant outerwear and use other protective equipment appropriate to the hazard. Barr will supply personal protective clothing that is specifically required for safety reasons by a work assignment. Barr staff are responsible for making the need for such clothing known to the Company Health and Safety Manager if provisions for such protective clothing have not been addressed. Protective clothing listed in a PHASP will be designated and selected according to the types of hazards potentially involved.

4.1.1 Hard Hats

Hard hats are required when the potential for construction hazards or overhead hazards exist or when intrusive activities involving powered equipment are conducted. Examples include soil borings, well installation, test excavating or other construction/investigation activities involving the observation of heavy equipment operations. In addition, hard hats are required if required by other contractors or by the owner. Hardhats will meet ANSI standards at a minimum and CSA standards when used in Alberta, Canada.

4.1.2 Safety Glasses

Safety glasses are required when activities involving powered equipment such as soil boring, well installation, test excavation or other activities involving the observation of heavy equipment operations occur. Side shields are required when work involves handling or being in close proximity to chemical, grinding, grouting operations, or concrete pouring or other activities where particles/aerosol can become easily airborne and may irritate the eye if eye contact occurs. A splash shield should be worn when materials known or suspected to contain hazardous substances may splash or spray to the face. Prescription safety glasses will be provided to staff who need vision correction. Safety glasses will meet ANSI standards at a minimum and CSA standards when used in Alberta, Canada.

4.1.3 Steel-Toed Boots

Steel-toed boots are required when activities involving powered equipment such as soil boring, well installation, test excavating or other construction/investigation activities involving the observation of heavy equipment operations. In addition, steel-toed boots are required if required by contractors, owner or when activities may involve carrying/handling heavy materials. Steel-toed boots with steel midsoles should be used when work may involve walking on sharp objects, such as when walking on landfills. Steel-toed boots will meet ASTM F2412/F2413 (ANSI Z41) standard at a minimum and CSA standards when used in Alberta, Canada.

4.1.4 Hearing Protection

Ear plugs or muffs will be available for employees exposed to continuous excessive noise levels. Hearing protection may be required in a PHASP or by the client, depending upon the work location. Training will be provided by the Equipment Maintenance technician on proper use of hearing protection.

4.1.5 Safety Vests

Highly reflective safety vests are required when working on and adjacent to roadways, or working in remote areas during hunting season. This clothing is also required when working around earth-moving equipment.

4.1.6 Personal Floatation Devices (PFDs)

Barr staff on board a boat or watercraft are required to wear a U.S. Coast Guard approved Type I, II, or III PFD for work on boats or watercraft. In Michigan only Type I PFDs are acceptable. Barr staff are required to wear a U.S. Coast Guard approved PFD (Type I PFD in Michigan) for work over or adjacent to water (i.e., work on or under bridges) where the danger of drowning exists and where Barr staff are not constantly protected from falling into the water. Barr staff working on or under bridges who are constantly protected by guardrail systems, net, or body harness systems are adequately protected from the danger of drowning and are NOT required to wear PFDs.

Additionally, PFDs may be required in certain cases of working in shallow water (less than four feet). This will be addressed on a site-specific basis with the project manager and will depend on water velocity and other site conditions. However, where tasks require staff to work on steep or slippery banks or where the potential to fall into shallow water and the danger of drowning exists, PFD use is required.

Only properly fitted PFDs may be worn and the PFD must be worn properly with zippers, straps and ties fastened and all loose ends tucked in to avoid snagging. Before being worn, the PFD will be inspected for defects that could alter its strength or buoyancy. Defective units will not be used and should be returned to the equipment maintenance technician.

The criteria used to determine the need for PPE for a specific activity are listed below. Specific personal protective equipment needs for project work are discussed in the PHASP.

4.1.7 Cotton Coveralls/Work Clothes

Cotton coveralls may be used to protect skin and work clothes from nontoxic particulates such as dust, dirt, and mud. May be used when contact with soils or water known or suspected to contain hazardous substances is restricted to handling samples.

4.1.8 Kleengard

Kleengard is a disposable and breathable fabric that can be used to protect skin and work clothes from nontoxic substances. Required when activities are restricted to the exclusion zone and where contact with soils or water known or suspected to contain hazardous substances is restricted to handling samples. If torso contact with known or suspected hazardous substance materials cannot be avoided, an upgrade to tyvek will be necessary. Kleengard is not acceptable when working on coal tar sites or sites known or suspected to contain PCBs, unless all contact with those hazardous substances can be avoided.

4.1.9 Tyvek

Tyvek is disposable nonporous material. It may be used to provide protection from toxic particulates such as lead dust and asbestos, and may be used for wind protection in the winter. Required when tasks may involve bodily contact with materials known or suspected to contain hazardous substances. This would include collecting of samples from backhoe bucket during test trenching, working with driller to collect samples, and other activities where splashing or 0getting dirty0 is likely.

4.1.10 Poly-coated Tyvek

Poly-coated tyvek is a disposable, polyethylene-coated tyvek material. It may be used as protection from potential chemical liquid splash. Required when bodily contact may occur with high concentrations of hazardous substances. Also required when concentration of hazardous substances is unknown and activities may encounter bodily contact with these substances or when investigation/remediation activity generates a splash potential.

4.1.11 Saranex Tyvek

Saranex tyvek is a saran-coated tyvek material and may be used when a higher level of skin protection is required than that offered by poly-coated tyvek.

4.1.12 Chemical Resistant Boots

Chemical-resistant steel-toed boots may be worn when walking in materials known or suspected to contain hazardous substances is anticipated or when work may involve walking in wet conditions. They may be worn uncovered only when there is sufficient water on the site for thorough decontamination, or when the nature of the contaminant facilitates quick volatilization from footwear. Two pair of disposable boot covers or a heavier overboot may be worn over leather steel-toed boots in lieu of one pair over chemical-resistant boots.

4.1.13 Boot Covers

Disposable boot covers will be worn over leather steel-toed work boots when walking in materials known or suspected to contain hazardous substances. They may also be worn when muddy conditions are anticipated. They may be worn over chemical-resistant boots when there is not sufficient water on the site for decontamination.

4.1.14 Gloves

Inner vinyl, nitrile, or latex surgical gloves (4 mil thickness) will be worn as a precaution when handling materials known or suspected to contain hazardous substances or when a dermal (skin) hazard exists. They may also be worn inside outer gloves to provide protection against degradation/leakage of the outer gloves when there is a greater likelihood of contact with materials known or suspected to contain hazardous substances.

Outer gloves of nitrile, vinyl, neoprene, butyl, or viton (11-14 mil thickness) will be worn when handling materials known or suspected to contain hazardous substances or when a serious dermal (skin) hazard exists. Selection of glove type is based on degradation and permeability of glove material to expected contaminants on the site. In most cases, a second pair of surgical gloves may be used where outer gloves are required. In cold weather, insulated orange vinyl-coated gloves (monkey-grips) may be worn as outer gloves.

One pair of surgical gloves (nitrile, latex) is required when handling containers that contain samples known or suspected to contain hazardous substances. A second pair of surgical gloves is required when collecting the sample known or suspected to contain hazardous substances from split spoon sampler or bailer or when performing headspace analysis. This second pair (outer layer) should be replaced immediately after handing or collecting the sample. This outer layer should consist of a thicker material (nitrile, neoprene) when handling high concentrations of hazardous substances or materials known or suspected to contain coal tar or PCB or when collecting a sample from the backhoe bucket.

4.1.15 Respiratory Protection

Respiratory equipment will be provided for Barr staff for use where respiratory protection might be required by a PHASP or OSHA regulation. Barr will fit-test all respirator users.

The complete Barr Respirator Program is described in *Section G: Respirator Program*.

5.0 Employee Owned Equipment

Barr employees are not expected to provide their own protective equipment. Barr will provide employees with appropriate protective equipment necessitated by identified hazards. In the event that a Barr employee chooses to provide their own protective equipment (i.e., prescription safety glasses or steel toed boots), they are expected to notify Barr safety staff for a determination of its adequacy and to provide an opportunity for maintenance and sanitation procedures for this equipment to be addressed. When that equipment is considered to be defective or damaged, Barr will cover the expense of purchasing new steel-toed boots and/or prescription safety glasses.

6.0 Work Task Duration

In selecting personal protective equipment, the estimated duration of job tasks and project duration is considered, in addition to other considerations. Protective equipment is chosen that will provide protection for a full work shift, or for the duration of the task to be accomplished. If site conditions are such that protective equipment cannot provide adequate protection for the duration of the task, several factors are considered to determine appropriate work task duration, including:

- Clothing/glove permeation and penetration rates for chemicals
- Respirator/filter cartridge capacity and breakthrough time
- Ambient temperature and weather conditions
- Integrity of the tyvek, boot covers, and gloves

These factors are incorporated into the selection of personal protective equipment, and will be addressed as appropriate in the PHASP. In addition, as soon as the integrity of any PPE is compromised, the work task should stop until the PPE can be replaced.

7.0 Maintenance and Storage

Nondisposable protective equipment such as hard hats, boots, and safety glasses will be decontaminated, if necessary, prior to leaving the project site. Respirators will be decontaminated after each use. Most disposable clothing such as tyvek, boot covers and outer gloves are discarded at the end of a work shift. If, after inspection, and decontamination procedures, it has been determined that the clothing may be reused, these items may be stored appropriately until re-used. All used disposable clothing will be discarded upon demobilization from a site. Defective or damaged personal protective equipment will not be used and will be replaced as necessary.

8.0 Decontamination and Disposal

Decontamination and disposal procedures for personal protective equipment are covered in the Appendix to the PHASP.

9.0 Training and Fitting

All Barr employees with 24- and 40-hour training have been trained in the use and selection of personal protective equipment, and have been provided hands-on training on using PPE. Each Barr employee with 40-hour training has been fit-tested with a respirator according to the procedures outlined in the Barr Respirator Program.

Barr employees who require PPE will be fitted for and provided with steel-toed boots, hard hat, and safety glasses with side shields (and safety sunglasses, if necessary). An inventory of protective clothing, gloves, and boot covers is maintained in various sizes. Each employee is encouraged to try on the various sizes to determine the best fitting size of all personal protective equipment.

After selection of the proper PPE, and in addition to the PPE training received during 24- and 40-hour training, each employee will receive training by a member of the health and safety staff or by the Equipment Coordinator. The training will include, but is not limited to when PPE is necessary, what PPE is necessary, how to properly don, doff, adjust, and wear PPE; the limitations of the PPE; and the proper care, maintenance, useful life, and disposal of the PPE. Each trained employee will demonstrate this knowledge, and their ability to properly use the PPE, before being allowed to perform work that requires the use of PPE. Upon completion of the training, each employee will receive a certificate that includes their name, date of training and a list of PPE they have been received training on.

Employees will be retrained when there have been changes in the workplace that render previous training obsolete, when there have been changes in the types of PPE used that renders previous training obsolete, or when it is apparent that the employee requires additional training to adequately understand proper usage of PPE.

10.0 Dressing/Removal Procedures for Personal Protective Equipment

Clothing required as protection from exposure to hazardous substances will be put on at the site before entry into the exclusion zone. If protective outer garments are necessary, the suit (tyvek, poly-coated tyvek, saranex, etc.) will be put on first, followed by boots, boot covers and gloves. Hems on the legs of protective clothing should be worn outside of chemical resistant boots and taped at the ankle, if necessary. If boot covers are used, the hems may be tucked into the boot cover and taped below the knee at approximately mid-calf level. Hems on the sleeves of protective clothing may be worn outside of gloves, and taped at the wrist if necessary. Respirators will be put on following the guidelines provided in the Barr Respirator Program, prior to putting on gloves.

Barr employees leaving the exclusion zone will remove and decontaminate their equipment and protective clothing, if necessary, at designated DECON zones as described in *Section R: Decontamination Procedures* of this Manual. Figure R--1 summarizes the decontamination procedures. Respirator removal procedures to be followed are found in the *Section G: Barr Respirator Program*.

11.0 PPE Inspection

All Barr employees will periodically inspect the integrity of their own PPE, both before and during use. The frequency and degree of inspection depends on the specific article and its frequency of use. The primary inspection will be done by the user before use. Inspection guidelines follow.

11.1 Protective Clothing Inspection

- Visually inspect for tears, nonuniform coatings, imperfect seams, malfunctioning closures.
- Hold up to the light to check for pinholes.
- Flex product to check for cracks and deterioration.

11.2 In-Use Inspection

PPE should be periodically inspected for signs of ripping/tearing or heavy contamination of PPE. In the event of torn/ripped or heavily contaminated PPE, Barr employees should proceed to the DECON zone to remove and replace the PPE.

11.3 Respiratory Protection Inspection

The inspection of respiratory protection equipment is discussed in the Barr Respirator Program.

12.0 Evaluation of Effectiveness of PPE Program

The Barr PPE program is evaluated annually for its effectiveness. This evaluation occurs at refresher training sessions and is also reviewed regularly on project basis by the Barr Health and Safety Staff.

13.0 PPE Limitations

Selection of chemical-resistant clothing should be performed by personnel trained in evaluation of the clothing and its limitations. Consideration of the following factors and limitations is generally considered in the selection of PPE described in the PHASP.

- Not all materials protect against all chemicals and chemical combinations, and not all materials provide a barrier for prolonged exposure periods. Since most contaminated soils/water are mixtures of hazardous substances, there is limited permeation data available for those mixtures. Selection should be made for clothing offering the widest range of protection against the chemicals expected on site.

- Protective clothing is generally nonporous and is designed to prevent skin exposure to hazardous substances. Consequently, the nonporous nature does not allow for sufficient cooling of the body through sweating and other heat release body functions. Temperature extremes will be considered in the PHASP when selection of PPE is made, and suggestions will be made on duration of use of PPE, and recommended break schedule as appropriate to weather conditions. Guidelines for working in PPE during temperature extremes is discussed in the Section C: Hazard Evaluation of this Manual.
- In cold weather, the polymer coating on some disposable clothing may become inflexible and tear more easily.
- The use of boot covers to protect footwear from contamination may increase the potential for slipping or tripping hazards.

Other limitations to consider are:

- Ability of material to withstand the physical stress of tasks (e.g., boot covers torn by walking on sharp objects).
- Degree to which protective clothing may interfere with a worker’s ability to perform tasks (e.g., full-facepiece respirator interferes with ability to read survey instrument).

Section 7: Respirator Protection Program

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Section G: Respirator Protection Program

1.0 Introduction

This program describes the use of respirator protection equipment at Barr Engineering Company. The purpose of this procedure is to provide protection of all employees from respiratory hazards such as harmful vapors, dusts and mists and oxygen deficient atmospheres. Respirators are to be used only where engineering of respiratory hazards is not feasible, while engineering controls are being installed, or in emergencies.

A. The respirator protection administrator is the Health and Safety Manager, who prepared this written program, conducts on-going evaluation of program implementation and is properly trained in respirator program implementation.

B. The respirator protection program is reviewed and updated as necessary.

2.0 Respirator Selection

We have selected respirators based on the operations we perform and the hazardous substances we encounter. Respirator selection information has been obtained from several sources including information on the material safety data sheets, air monitoring information, and technical knowledge of work tasks. Appropriate respirators will be provided at no cost to employees and will be specific to project needs. Only NIOSH certified respirators will be used.

Selection of respirator protection will consider the following factors:

A. Nature of hazards associated with the operation or process

B. Nature of the work operation

C. Physical and chemical properties of hazardous substance(s)

D. Adverse health effects from exposure to hazardous substance(s)

E. Warning properties of hazardous substance(s)

F. Permissible Exposure Limits and Threshold Limit Values

G. Estimate of employee exposure

H. Measured concentration of hazardous substance(s) in air/soil/water

I. Worker activities in the area of the operation and potential stress of these work conditions on employees wearing respirators

J. Period of time respirator protection will be worn in a work shift

K. Physical characteristics, functional capabilities, and limitations of the respirator

L. In the event the exposure information is not available, then exposures will be considered to be IDLH and employee entry to work area will be denied.

3.0 Exposure Assessments

Project-specific exposure assessments will also be conducted during development of the Project Health and Safety Plan (PHASP). These exposure assessments will consider specific hazardous substances expected on-site, expected airborne concentrations, and project task operations. Table G-1 of this program summarizes the general operations in where respirators may be used, and which respirators have been selected for each operation.

4.0 Medical Evaluation

All employees who use respirators have completed a confidential medical evaluation by the Barr occupational health clinic. The clinic provides respirator protection use approval or specifies any restrictions placed on an individual employee’s use of respirators. New employees and those new to tasks that will require respirator use complete a Respirator Qualification Questionnaire before being assigned to tasks requiring respirator use. Employees will be required to complete additional respirator medical evaluations when an employee shows signs or symptoms that are related to their ability to wear a respirator. Respirator Qualifications OSHA Questionnaire and Respirator Qualification Surveys are available from the Safety staff.

Medical evaluation is required prior to respirator fit testing and prior to respirator use. This medical evaluation is provided at no cost to the employee. Employees are provided the opportunity to discuss the results of their medical evaluation with the physician or other licensed health care professional.

5.0 Respirator Fit Testing

All workers who use tight fitting respirators will complete respirator fit testing prior to respirator use.

A. Respirator fit testing is performed by the Program Administrator or their designee. The qualitative fit testing procedures found in 29 CFR 1910.134, Appendix A are followed; and are included in this section.

B. Fit testing is conducted for employees before they are assigned tasks, which require the use of a respirator.

C. Current employees receive fit testing annually. Any employee may request additional fit testing if their current respirator becomes uncomfortable or the respirator appears not to fit properly. New fit testing will be conducted if respirator makes or models are changed.

D. Employees wearing respirators that pass the qualitative fit-test will be designated as having a Fit-Factor of 10. This Fit-Factor will provide protection in an atmosphere 10X the OSHA Permissible Exposure Limit (PEL) and applies to half mask and full facepiece respirators.

E. Respirators should not be worn when conditions prevent a good face seal. Such conditions may be a growth of a beard, sideburns, or temple pieces on glasses. No employees of Barr who are required to wear respirators, may wear beards. Also, the absence of one or both dentures can seriously affect the fit of the facepiece.

F. Contact Lenses may be used with respirators. Any employee who wears corrective eyewear must be sure that the respirator does not interfere with the eyewear, make it uncomfortable, or force the wearer to remove the eyewear. An adapter kit that accommodates prescription lenses is available from the manufacturer for full facepiece respirators.

G. Respirator fit testing for Self-Contained Breathing Apparatus/Supplied Air respirators will be conducted for the facepiece only and will be conducted using an air-purifying filter instead of supplied air.

6.0 Respirator Use During Routine and Emergency Situations

Employees are required to read and follow respirator use instructions (instruction booklet provided with respirator) and are required to check the seal each time they put on a respirator. Employees are expected to wear respirators during operations listed in Table G-1, if exposure assessment deems necessary or as specified in the site specific PHASP. Emergency situations involving significant chemical spills will be referred to trained emergency response personnel. In an emergency situation where air quality or safety is questionable, we will evacuate the building or project site and reassess.

The use of the Emergency Life Support Apparatus (ELSA) will provide a 5-minute supply of air for escape use only. The ELSA may be designated for confined space entry and will be indicated on the confined space entry permit when appropriate.

7.0 Respirator Protective Equipment Assignment and Storage

Respirator protection equipment may be individually assigned. If individually assigned, each employee is provided a respirator storage box. This box contains respirator disinfectant cleaning powder, alcohol wipes for midday use, a spare exhaust valve, two spare inhalation valves, two cartridge gaskets, a designated “dirty” plastic bag, a designated “clean” plastic bag, two spare P100 filters, and two spare organic vapor/acid gas/P100 cartridges. Respirators are stored in a plastic bag in their storage box when not in use.

Respirators are also available through general supply. For employees who are using unassigned respirators, the Equipment Coordinator is responsible for inspecting, cleaning, disinfecting and storing respirators so that they are available for use. Respirators available for general use are stored in individual plastic bags and are loosely sorted in boxes according to size. When stored appropriately, respirators will be protected from damage and contamination.

8.0 Respirator Cleaning, Disinfecting, Inspecting, Repairing, Discarding Procedures

Employees inspect, clean, disinfect, and store their own respirators. Respirator cleaning procedures outlined in this section will be followed. Respirators should be cleaned and disinfected each day after use and more frequently, if necessary.

The employee using the respirator will inspect the respirator before each use. Respirators are also being inspected during cleaning. Respirator inspection includes a check on the condition of facepiece, headbands, valves, and other parts. An inspection checklist is provided in this section. The Respirator Inspection Record can be used to provide a record of these inspections and is also provided in this section.

Employees are expected to perform simple respirator repair, as needed. Worn or deteriorated parts will be replaced. Repairs on respirators are done only with parts designated for the respirator by the manufacturer and respirator parts are discarded when they cannot perform as designed by the manufacturer. If a respirator is damaged or is not working correctly, the respirator user will contact the Equipment Coordinator to receive a replacement.

Respirators for emergency use such as SCBA/Airline respirators, will be thoroughly inspected at least once a month and after each use. Repairs on SCBA/Airline respirators are performed only by the manufacturer or certified repair service. SCBA/Airline respirator inspection records are maintained by the Equipment Coordinator and include information on inspection dates and comments of respirator maintenance.

9.0 Respirator Cartridge/Filter Changeout Schedule

Respirators, or replaceable cartridges and filters are changed according to the following schedule:

A. P95 filters will be replaced after 8 hours of respirator use for oil-based particles and after 40 hours of use for non-oil based particles. The filters will also be replaced if breathing resistance increases.

B. P100 filters will be changed after 40 hours use, or after 30 days elapsed time, whichever comes sooner. The filters will also be replaced if breathing resistance increases.

C. Organic vapor cartridges will be replaced after 8 hours of respirator use where air monitoring levels are less than 10X the PEL for the hazardous substances detected on-site. Information on estimated service time for a particular airborne contaminant will be included in the Project Health and Safety Plan (PHASP) if the service life is less than 8 hours.

D. Respirator replaceable cartridges and filters may be changed on a more frequent basis than described above, according to each employee's discretion.

E. When using respirator model 3M 8271 P95 Particulate Respirator or 3M 8577 P95 Particulate Respirator with Nuisance Level Organic Vapor Relief, the respirator is discarded when breathing resistance becomes excessive, when the respirator becomes dirty, or when the respirator is no longer holding its shape well. If this respirator is used for inhalation protection against oil-based particles, then the respirator is discarded after 8 hours of use.

10.0 SCBA/Airline Respirators

When using airline respirators connected to compressed breathing quality air, the quality of the breathing air certification will be checked upon receipt from the vendor. Only Grade D or better breathing air will be used for SCBA/Airline respirators. The SCBA/Airline respirator will be thoroughly checked prior to issuance to assure adequate air quality, quantity, and flow of breathing air.

In the event that an air compressor is provided at a client's facility, the breathing air quality shall be checked as described in the air compressor instruction manual. When using an air compressor, it should be located in a clean area, away from vehicle exhaust, paint booth exhaust, chemical processes and free of other air contaminants. The air compressor should have "in-line" purification or be dedicated for breathing air only. For airlines with in line purifications, a carbon monoxide monitor will be placed in-line and be set to alarm at 10 ppm carbon monoxide. The fittings for the compressed air should be incompatible for non-respirable gases.

11.0 Respirator Program Hazard Training

Employees receive training on hazardous substances they may encounter in our building and at client facilities and received training on the appropriate respirator protection for working with those hazardous substances, as part of the annual Employee Right to Know training program. This information is also covered upon review of a Project Health and Safety Plan (PHASP) for a project site.

12.0 Voluntary Respirator Use

Employees may voluntarily decide to use respiratory protection when it is not required. However, employees need to make certain that the respirator itself does not present a hazard. Information for employees using respirators on a voluntary basis is provided later in this section.

13.0 Respirator Training

The individual performing respirator fit testing will review respirator training topics at the time of fit testing. Training topics will include information on respirators, proper respirator use, putting on and removing respirators, performance of a user seal check for the respirator being tested, limitations of the respirator being fit tested, user maintenance and storage of respirators, and respirator fit-test.

Respirator training is conducted annually during the respirator fit-test at no cost to the employee. Respirator retraining is conducted more frequently if needed.

The user will be instructed and trained in the proper use of respirators and their limitations. Training will provide the employee an opportunity to handle the respirator, have it fitted properly, test the facepiece-face seal, wear it in normal air for a long familiarity period, and finally to wear it in a test atmosphere. Every respirator wearer will receive fitting instructions, including demonstrations and practice in how the respirator should be worn, how to adjust, and how to determine if it fits properly.

14.0 Respirator Program Administrator

The respirator program administrator evaluates the respirator protection program and keeps records of the evaluation.

A. Respirator approval records provided by the clinic are retained in the employee's medical surveillance file. Medical records pertaining to the medical questionnaire and any follow-up exam will be retained by the clinic.

B. Respirator protection training records and respirator fit testing records are kept in the employee's exposure file and are maintained by the respirator program administrator. These training records are kept for at least 5 years. The fit testing records are kept until superseded by a more recent fit test.

C. If employees are observed failing to wear respirators as instructed, appropriate retraining, appropriate revision to this program, or appropriate disciplinary action will be taken. The respirator program administrator is responsible for recommending appropriate remedial action to protect employee health and safety.

D. The respirator program administrator performs a formal review of the respirator protection program at least once every two years. The review covers employee knowledge and practices about respirator protection, review of medical evaluation procedures, review of respirator selection, and updating of this written respirator protection program as needed. A Respirator Program Evaluation Checklist is provided in this section.

E. Respirator use is evaluated during routine project work site evaluations. This evaluation addresses respirator use, respirator filter changeout, and respirator decontamination.

15.0 OSHA-Accepted Fit Test Protocols — General Requirements

Barr will conduct fit testing using the following procedures. These procedures will apply to all OSHA-accepted fit test methods, both QLFT and QNFT.

A. The employee will be allowed to pick the most acceptable respirator from a sufficient number of respirator models and sizes so that the respirator is acceptable to, and correctly fits, the user.

B. Prior to the selection process, the employee will be shown how to put on a respirator, how it should be positioned on the face, how to set strap tension and how to determine an acceptable fit. A mirror will be available to assist the employee in evaluating the fit and positioning of the respirator. This instruction may not constitute the employee’s formal training on respirator use, because it is only a review.

C. The employee will be informed that he/she is being asked to select the respirator that provides the most acceptable fit. Each respirator represents a different size and shape, and if fitted and used properly, will provide adequate protection.

D. The employee will be instructed to hold each chosen facepiece up to the face and eliminate those that obviously do not give an acceptable fit.

E. The more acceptable facepieces are noted in case the one selected proves unacceptable; the most comfortable mask is donned and worn at least five minutes to assess comfort. Assistance in assessing comfort can be given by discussing the points listed in the next paragraph (6). If the employee is not familiar with using a particular respirator, the employee will be directed to don the mask several times and to adjust the straps each time to become adept at setting proper tension on the straps.

F. Assessment of comfort will include a review of the following points with the employee and allowing the employee adequate time to determine the comfort of the respirator.

    1. Position of the mask on the nose.

    2. Room for eye protection.

    3. Room to talk.

4. Position of mask on face and cheeks.

G. The following criteria will be used to help determine the adequacy of the respirator fit:

1. Chin properly placed.
2. Adequate strap tension, not overly tightened.
3. Fit across nose bridge.
4. Respirator of proper size to span distance from nose to chin.
5. Tendency of respirator to slip.
6. Self-observation in mirror to evaluate fit and respirator position.

H. The employee will conduct a user seal check, either the negative and positive pressure seal checks. Before conducting the negative and positive pressure checks, the employee will be told to seat the mask on the face by moving the head from site-to-side and up and down slowly while taking in a few slow deep breaths. Another facepiece shall be selected and retested if the employee fails the user seal check tests.

I. The test shall not be conducted if there is any hair growth between the skin and the facepiece sealing surface, such as stubble beard growth, beard, mustache or sideburns which cross the respirator sealing surface. Any type of apparel which interferes with a satisfactory fit shall be altered or removed.

J. If an employee exhibits difficulty in breathing during the tests, she or he shall be referred to a physician or other licensed health care professional, as appropriate, to determine whether the employee can wear a respirator while performing her or his duties.

K. If the employee finds the fit of the respirator unacceptable, they will be given the opportunity to select a different respirator and to be retested.

L. Exercise regimen. Prior to the commencement of the fit test, the employee will be given a description of the fit test and the employee’s responsibilities during the test procedure. The description of the process will include a description of the test exercises that the employee will be performing. The respirator to be tested will be worn for at least five minutes before the start of the fit test.

M. The fit test shall be performed while the employee is wearing any applicable safety equipment that may be worn during actual respirator use which could interfere with respirator fit, such as eyeglasses.

N. Test Exercises

1. The following test exercises are to be performed for all fit testing methods. Each test exercise will be performed for one minute except for the grimace exercise which shall be performed for 15 seconds. The employee will be questioned by the tester conductor regarding the comfort of the respirator upon completion of the protocol. If it has become unacceptable, another model of respirator will be tried. The respirator will not be adjusted once the fit test exercises begin. Any adjustment voids the test, and the fit test must be repeated. The employee will perform exercises, in the test environment, in the following manner:

   a. Normal breathing. In a normal standing position, without talking, the employee will breath normally.

   b. Deep breathing. In a normal standing position, the employee will breathe slowly and deeply, taking caution so as not to hyperventilate.

   c. Turning head side to side. Standing in place, the subject will slowly turn his/her head from side to side between the extreme positions on each side. The head shall be held at each extreme momentarily so the subject can inhale at each side.

   d. Moving head up and down. Standing in place, the subject will slowly move his/her head up and down. The subject will be instructed to inhale in the up position (i.e., when looking toward the ceiling).

   e. Talking. The employee will talk out loud slowly and loud enough so as to be heard clearly by the tester. The employee can read from a prepared text such as the Rainbow Passage, count backward from 100, or recite a memorized poem or song.

Rainbow Passage

When the sunlight strikes raindrops in the air, they act like a prism and form a rainbow. The rainbow is a division of white light into many beautiful colors. These take the shape of a long round arch, with its path high above, and its two ends apparently beyond the horizon. There is, according to legend, a boiling pot of gold at one end. People look, but no one ever finds it. When a person looks for something beyond reach, friends say he is looking for the pot of gold at the end of the rainbow.

f. Grimace. The test subject shall grimace by smiling or frowning. (This applies only to QNFT testing; it is not performed for QLFT.)

g. Jogging in place (substituted for bending over).

h. Normal breathing. Same as exercise 1.

16.0 Qualitative Fit Test (QLFT) Protocols

A. General

1. The Persons administering QLFT will be able to prepare test solutions, calibrate equipment and perform tests properly, recognize invalid tests, and ensure that test equipment is in proper working order.

2. The QLFT equipment will be kept clean and well maintained so as to operate within the parameters for which it was designed.

B. Bitrex™ (Denatonium Benzoate) Solution Aerosol Qualitative Fit Test Protocol

The Bitrex™ (Denatonium benzoate) solution aerosol QLFT protocol uses the published saccharin test protocol because that protocol is widely accepted. Bitrex is routinely used as a taste aversion agent in household liquid which children should not be drinking and is endorsed by the American Medical Association, the National Safety Council, and the American Association of Poison Control Centers. The entire screening and testing procedure will be explained to the employee prior to the conduct of the screening test.

1. Taste Threshold Screening

The Bitrex taste threshold screening, performed without wearing a respirator, is intended to determine whether the employee being tested can detect the taste of Bitrex.

a) During threshold screening, as well as during fit testing, employee shall wear an enclosure about the head and shoulders that is approximately 12 inches (30.5 cm) in diameter by 14 inches (35.6 cm) tall. The front portion of the enclosure shall be clear from the respirator and allow free movement of the head when a respirator is worn. An enclosure substantially similar to the 3M hood assembly, parts # FT 14 and # FT 15 combined, is adequate.

b) The test enclosure will have a 3/4 inch hole in front of the employee's nose and mouth area to accommodate the nebulizer nozzle.

c) The employee will don the test enclosure. Throughout the threshold screening test, the employee will breathe through his or her slightly open mouth with tongue extended. The employee is instructed to report when he/she detects a bitter taste.

d) Using a DeVilbiss Model 40 Inhalation Medication Nebulizer or equivalent, the tester will spray the Threshold Check Solution into the enclosure. This Nebulizer shall be clearly marked to distinguish it from the fit test solution nebulizer.

e) The Threshold Check Solution is prepared by adding 13.5 milligrams of Bitrex to 100 ml of 5% salt (NaCI) solution in distilled water.

f) To produce the aerosol, the nebulizer bulb is firmly squeezed so that the bulb collapses completely, and is then released and allowed to fully expand.

g) An initial ten squeezes are repeated rapidly and then the test subject is asked whether the Bitrex can be tasted. If the employee reports tasting the bitter taste during the ten squeezes, the screening test is completed. The taste threshold is noted as ten regardless of the number of squeezes actually completed.

h) If the first response is negative, ten more squeezes are repeated rapidly and the test subject is again asked whether the Bitrex is tasted. If the employee reports tasting the bitter taste during the second ten squeezes, the screening test is completed. The taste threshold is noted as twenty regardless of the number of squeezes actually completed.

i) If the second response is negative, ten more squeezes are repeated rapidly and the employee is again asked whether the Bitrex is tasted. If the employee reports tasting the bitter taste during the third set of ten squeezes, the screening test is completed. The taste threshold is noted as thirty regardless of the number of squeezes actually completed.

j) The tester will take note of the number of squeezes required to solicit a taste response.

k) If the Bitrex is not tasted after 30 squeezes (step 10), the employee is unable to taste Bitrex and may not perform the Bitrex fit test.

l) If a taste response is elicited, the employee shall be asked to take note of the taste for reference in the fit test.

m) Correct use of the nebulizer means that approximately 1 ml of liquid is used at a time in the nebulizer body.

n) The nebulizer will be thoroughly rinsed in water, shaken to dry, and refilled at least each morning and afternoon or at least every four hours.

2. Bitrex Solution Aerosol Fit Test Procedure

a) The employee will not eat, drink (except plain water), smoke, or chew gum for 15 minutes before the test.

b) The employee uses the same enclosure as that described in 2(a) above.

c) The employee will don the enclosure while wearing the respirator selected. The respirator will be properly adjusted and equipped with any type particulate filter(s).

d) A second DeVilbiss Model 40 Inhalation Medication Nebulizer or equivalent is used to spray the fit test solution into the enclosure. This nebulizer will be clearly marked to distinguish it from the screening test solution nebulizer.

e) The fit test solution is prepared by adding 337.5 mg of Bitrex to 200 ml of a 5% salt (NaCI) solution in warm water.

f) As before, the employee will breathe through his or her slightly open mouth with tongue extended, and be instructed to report if he/she tastes the bitter taste of Bitrex.

g) The nebulizer is inserted into the hole in the front of the enclosure and an initial concentration of the fit test solution is sprayed into the enclosure using the same number of squeezes (either 10, 20 or 30 squeezes) based on the number of squeezes required to elicit a taste response as noted during the screening test.

h) After generating the aerosol, the employee will be instructed to perform the test exercises.

i) Every 30 seconds the aerosol concentration will be replenished using one-half the number of squeezes used initially (e.g., 5, 10 or 15).

j) The employee will indicate to the tester if at any time during the fit test the taste of Bitrex is detected. If the employee does not report tasting the Bitrex, the test is passed.

k) If the taste of Bitrex is detected, the fit is deemed unsatisfactory and the test is failed. A different respirator will be tried and the entire test procedure is repeated (taste threshold screening and fit testing).

C. Isoamyl Acetate Protocol

Note: This protocol is not appropriate to use for the fit testing of particulate respirators. If used to fit test particulate respirators, the respirator must be equipped with an organic vapor.

1. Odor Threshold Screening

Odor threshold screening, performed without wearing a respirator, is intended to determine if the individual tested can detect the odor of isoamyl acetate at low levels.

a) Three one-liter glass jars with metal lids are required.

b) Odor-free water (e.g., distilled or spring water) at approximately 25ºC (77ºF) shall be used for the solutions.

c) The isoamyl acetate (IAA) (also known as isopentyl acetate) stock solution is prepared by adding 1 ml of pure IAA to 800 ml of odor-free water in a one-liter jar, closing the lid and shaking for 30 seconds. A new solution shall be prepared at least weekly.

d) The screening test shall be conducted in a room separate from the room used for actual fit testing. The two rooms shall be well-ventilated to prevent the odor of IAA from becoming evident in the general room air where testing takes place.

e) The odor test solution is prepared in a second jar by placing 0.4 ml of the stock solution into 500 ml of odor-free water using a clean dropper or pipette. The solution shall be shaken for 30 seconds and allowed to stand for two to three minutes so that the IAA concentration above the liquid may reach equilibrium. This solution shall be used for only one day.

f) A test blank shall be prepared in a third jar by adding 500 cc of odor-free water.

g) The odor test and test blank jar lids shall be labeled (e.g., 1 and 2) for jar identification. Labels shall be placed on the lids so that they can be peeled off periodically and switched to maintain the integrity of the test.

h) The following instruction shall be typed on a card and placed on the table in front of the two test jars (i.e., 1 and 2): “The purpose of this test is to determine if you can smell banana oil at a low concentration. The two bottles in front of you contain water. One of these bottles also contains a small amount of banana oil. Be sure the covers are on tight, then shake each bottle for two seconds. Unscrew the lid of each bottle, one at a time, and sniff at the mouth of the bottle. Indicate to the test conductor which bottle contains banana oil.”

i) The mixtures used in the IAA odor detection test shall be prepared in an area separate from where the test is performed, in order to prevent olfactory fatigue in the subject.

j) If the test subject is unable to correctly identify the jar containing the odor test solution, the IAA qualitative fit test shall not be performed.

k) If the test subject correctly identifies the jar containing the odor test solution, the test subject may proceed to respirator selection and fit testing.

2. Isoamyl Acetate Fit Test

a) The fit test chamber shall be a clear 55-gallon drum liner suspended inverted over a two-foot diameter frame so that the top of the chamber is about six inches above the test subject's head. If no drum liner is available, a similar chamber shall be constructed using plastic sheeting. The inside top center of the chamber shall have a small hook attached.

b) Each respirator used for the fitting and fit testing shall be equipped with organic vapor cartridges or offer protection against organic vapors.

c) After selecting, donning, and properly adjusting a respirator, the test subject shall wear it to the fit testing room. This room shall be separate from the room used for odor threshold screening and respirator selection, and shall be well-ventilated, as by an exhaust fan or lab hood, to prevent general room contamination.

d) A copy of these exercises and any prepared text from which the subject is to read shall be taped to the inside of the test chamber.

e) Upon entering the test chamber, the test subject shall be given a six-inch by five-inch piece of paper towel, or other porous, absorbent, single-ply material, folded in half and wetted with 0.75 ml of pure IAA. The test subject shall hang the wet towel on the hook at the top of the chamber. An IAA test swab or ampule may be substituted for the IAA wetted paper towel provided it has been demonstrated that the alternative IAA source will generate an IAA test atmosphere with a concentration equivalent to that generated by the paper towel method.

f) Allow two minutes for the IAA test concentration to stabilize before starting the fit test exercises. This would be an appropriate time to talk with the test subject; to explain the fit test, the importance of his/her cooperation, and the purpose for the test exercises; or to demonstrate some of the exercises.

g) If at any time during the test, the subject detects the banana-like odor of IAA, the test is failed. The subject shall quickly exit from the test chamber and leave the test area to avoid olfactory fatigue.

h) If the test is failed, the subject shall return to the selection room and remove the respirator. The test subject shall repeat the odor sensitivity test, select and put on another respirator, return to the test area and again begin the fit test procedure described in (b) (1) through (7) above. The process continues until a respirator that fits well has been found. Should the odor sensitivity test be failed, the subject shall wait at least five minutes before retesting. Odor sensitivity will usually have returned by this time.

i) If the subject passes the test, the efficiency of the test procedure shall be demonstrated by having the subject break the respirator face seal and take a breath before exiting the chamber.

j) When the test subject leaves the chamber, the subject shall remove the saturated towel and return it to the person conducting the test, so that there is no significant IAA concentration buildup in the chamber during subsequent tests. The used towels shall be kept in a self-sealing plastic bag to keep the test area from being contaminated.

17.0 User Seal Check Procedures

Each employee who uses a tight-fitting respirator is to perform a user seal check to ensure that an adequate seal is achieved each time the respirator is put on. Either positive and negative pressure checks, or the respirator manufacturer’s recommended user seal check method shall be used. User seal checks are not substitutes for qualitative or quantitative fit tests.

17.1 Facepiece Positive and/or Negative Pressure Checks

A. Positive pressure check. Close off the exhalation valve and exhale gently into the facepiece. The face fit is considered satisfactory if a slight positive pressure can be built up inside the facepiece without any evidence of outward leakage of air at the seal. For most respirators this method of leak testing requires the wearer to first remove the exhalation valve cover before closing off the exhalation valve and then carefully replacing it after the test.

B. Negative pressure check. Close off the inlet opening of the canister or cartridge(s) by covering with the palm of the hand(s) or by placing hands over the filter seal(s), inhale gently so that the facepiece collapses slightly, and hold the breath for ten seconds. The design of the inlet opening of some cartridges cannot be effectively covered with the palm of the hand. The test can be performed by covering the inlet opening of the cartridge with a thin latex or nitrile glove. If the facepiece remains in its slightly collapsed condition and no inward leakage of air is detected, the tightness of the respirator is considered satisfactory.

18.0 Respirator Cleaning Procedures

These procedures are provided for cleaning respirators. They are general in nature. The respirator must be properly cleaned and disinfected in a manner that prevents damage to the respirator and does not cause harm to the user.

18.1 Procedures for Cleaning Respirators

A. Remove filters, cartridges, or canisters. Disassemble facepieces by removing speaking diaphragms, demand and pressure-demand valve assemblies, hoses, or any components recommended by the manufacturer. Discard or repair any defective parts.

B. Wash components in warm (43º C [110º F] maximum) waster with A-33 Dry Airkem disinfectant detergent an odor counteractant. A stiff bristle (not wire) brush may be used to facilitate the removal of dirt.

C. Rinse components thoroughly in clean, warm (43º C [110º F] maximum), preferably running water. Drain. The importance of thorough rinsing cannot be overemphasized. Detergents or disinfectants that dry on facepieces may result in dermatitis. In addition, some disinfectants may cause deterioration of rubber or corrosion of metal parts if not completely removed.

D. Components should be hand-dried with a clean lint-free cloth or air-dried.

E. Reassemble facepiece, replacing filters, cartridges, and canisters where necessary.

F. Test the respirator to ensure that all components work properly.

19.0 Information for Employees Using Respirators When Not Required Under the Standard

Respirators are an effective method of protection against designated hazards when properly selected and worn. Respirator use is encouraged, even when exposures are below the exposure limit, to provide an additional level of comfort and protection for workers. However, if a respirator is used improperly or not kept clean, the respirator itself can become a hazard to the worker. Sometimes, workers may wear respirators to avoid exposures to hazards, even if the amount of hazardous substance does not exceed the limits set by OSHA standards. If Barr provides respirators for your voluntary use, or if you provide your own respirator, you need to take certain precautions to be sure that the respirator itself does not present a hazard.

You should do the following:

A. Read and heed all instructions provided by the manufacturer on use, maintenance, cleaning and care, and warnings regarding the respirator’s limitations.

B. Choose respirators certified for use to protect against the contaminant of concern. NIOSH, the National Institute for Occupational Safety and Health of the U.S. Department of Health and Human Services, certifies respirators. A label or statement of certification should appear on the respirator or respirator packaging. It will tell you what the respirator is designed for and how much it will protect you.

C. Do not wear your respirator into atmospheres containing contaminants for which your respirator is not designed to protect against. For example, a respirator designed to filter dust particles will not protect you against gases, vapors, or very small solid particles of fumes or smoke.

D. Keep track of your respirator so that you do not mistakenly use someone else’s respirator.

20.0 Respirator Program Evaluation Checklist

The respirator program will be evaluated at least annually, with program adjustments, as appropriate, made to reflect the evaluation results. The elements for this evaluation are found on Form G-1.

Table 1
Respirator Selection Information

The respirator use selections listed here have been based on information about usual operations and usual chemicals in use at Barr and on client's project sites. If your work task or chemical usage differs from these descriptions, check with the Respirator Program Administrator before proceeding.

Operations or Task	**Potential Respirator Hazards**	**Recommended Respirator Type with Filter/Cartridge**	**Brand Name and Model No. of Respirator Used in this Facility**[1]
Hazardous Waste Operations at controlled and un-controlled hazardous waste site.	Organic Vapors Metal particulates Coal Tar Pitch Volatiles	Half Mask/Full Facepiece respirator fitted with organic vapor/acid gas/P100 Filter/Cartridge. Specific Configuration will be described in PHASP.	3M 700X Half-Mask Survivair Series 2000 Half-Mask MSA Ultratwin Full facepiece
Confined Space Entry to Sanitary Sewer	Methane Hydrogen Sulfide Oxygen Deficiency	Full-face/Half Mask respirator fitted with combination Organic Vapor/Acid Gas/P100 Filter/Cartridge. Specific configuration will be described in confined space entry permit. SCBA/SA	3M 700X Half-Mask Survivair Series 2000 Half-Mask MSA Ultratwin Full Facepiece MSA SCBA/SA Ultralite air mask, pressure demand, Model FHR.
Engineering services in taconite processing plant	Taconite dust, possibly containing silica	Half mask respirator with P100 filter	3M 8271 Filtering Facepiece
Stack testing operations	Sulfur Dioxide Particulates Carbon Monoxide	Special determination needed on Filter/Cartridge type and will depend on parameter tested and stack testing situation. Determination will be described in stack testing safety checklist. SCBA/SA	3M 700X Half-Mask Survivair Series 2000 Half-Mask MSA Ultratwin Full Facepiece MSA SCBA/SA Ultralite air mask, pressure demand type, Model FHR
Lab Pack Activities	Miscellaneous chemical compounds	Special determination needed on Filter/Cartridge type and will depend on the chemical compounds handled. Determination will be described in PHASP for the work.	3M 8271 Filtering Facepiece 3M 700X Half-Mask Survivair Series 2000 Half-Mask MSA Ultratwin Full Facepiece
Confined space entry to Storm Sewer to observe sewer repair	Methane Oxygen Deficiency	Special determination needed on Filter/Cartridge type and will depend on the chemical compounds used in sewer repair. If dusty conditions only, half mask respirator with P100 filters. SCBA/SA	3M 8271 Filtering Facepiece MSA SCBA/SA Ultralite air mask, pressure demand, Model FHR.
Hazardous Waste Operations involving highly toxic contaminants	Potentially cyanide compounds	Special determination needed on Filter/Cartridge type and will depend on contaminant detected and operations on-site. Determination will be described in PHASP. SCBA/SA	3M 700X Half-Mask Survivair Series 2000 Half-Mask MSA Ultratwin Full Facepiece MSA SCBA/SA Ultralite air mask, pressure demand type, Model FHR ISI ELSA 5 minute supply of air for escape use only. MSA

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[1] We will use only NIOSH-certified respirators. Single strap dust masks are not NIOSH-certified, and are not an appropriate respirator choice for any work.

Form 1
Barr Engineering Company
Respirator Program Evaluation Checklist

A. Program Administration

_____ (1) Is there a written policy which acknowledges employer responsibility for providing a safe and healthful workplace, and assigns program responsibility, accountability, and authority?

_____ (2) Is program responsibility vested in one individual who is knowledgeable and who can coordinate all aspects of the program at the jobsite?

_____ (3) Can feasible engineering controls or work practices eliminate the need for respirators?

_____ (4) Are there written procedures/statements covering the various aspects of the respirator program, including:

_____ Designation of an administrator
_____ Respirator selection
_____ Purchase of MSHA/NIOSH certified equipment
_____ Medical aspects of respirator usage
_____ Issuance of equipment
_____ Fitting
_____ Training
_____ Maintenance, storage, and repair
_____ Inspection
_____ Use under special condition
_____ Work area surveillance

B. Program Operation

_____ (1) Respirator protective equipment selection

_____ Are work area conditions and worker exposures properly surveyed?
_____ Are respirators selected on the basis of hazards to which the worker is exposed?
_____ Are selections made by individuals knowledgeable of proper selection procedures?

_____ (2) Are only certified respirators purchased and used; do they provide adequate protection for the specific hazard and concentration of the contaminant?

_____ (3) Has a medical evaluation of the prospective user been made to determine physical and psychological ability to wear the selected respirator protective equipment?

_____ (4) Where practical, have respirators been issued to the users for their exclusive use, and are there records covering issuance?

_____ (5) Respirator protective equipment fitting

_____ Are the users given the opportunity to try on several respirators to determine whether the respirator they will subsequently be wearing is the best fitting one?
_____ Is the fit tested at appropriate intervals?
_____ Are those users who require corrective lenses properly fitted?
_____ Are users prohibited from wearing contact lenses when using respirators?
_____ Is the facepiece-to-face seal tested in a best atmosphere.
_____ Are workers prohibited from wearing respirators in contaminated work areas when they the facial hair or other characteristics may cause face-seal leakage?

_____ (6) Respirator use in the work area

_____ Are respirators being worn correctly (i.e., head covering over respirator straps)?
_____ Are workers keeping respirators on all the time while in the work area?

_____ (7) Cleaning and Disinfecting

- _____ Are respirators cleaned and disinfected after each use when different people use the same device, or as frequently as necessary for devices issued to individual users?
- _____ Are proper methods of cleaning and disinfecting utilized?

_____ (8) Storage

- _____ Are respirators stored in a manner so as to protect them from dust, sunlight, heat, excessive cold or moisture, or damaging chemicals?
- _____ Are respirators stored properly in a storage facility so as to prevent them from deforming?
- _____ Is storage in lockers and tool boxes permitted only if the respirator is in a carrying case or carton?

_____ (9) Inspection

- _____ Are respirators inspected before and after each use and during cleaning?
- _____ Are qualified individuals/users instructed in inspection techniques?
- _____ Is respirator protective equipment designated as “emergency use” inspected at least monthly (in addition to after each use)?
- _____ Are SCBA incorporating breathing gas containers inspected weekly for breathing gas pressure?
- _____ Is a record kept of the inspection of “emergency use” respirator protective equipment?

_____ (10) Repair

- _____ Are replacement parts used in repair those of the manufacturer of the respirator?
- _____ Are repairs made by manufacturers or manufacturer-trained individuals?

_____ (11) Special use conditions

- _____ Is a procedure developed for respirator protective equipment usage in atmospheres immediately dangerous to life or health?
- _____ Is a procedure developed for equipment usage for entry into confined spaces?

_____ (12) Training

- _____ Are users trained in proper respirator use, cleaning, and inspection?
- _____ Are users trained in the basis for selection of respirators?
- _____ Are users evaluated, using competency-based evaluation, before and after training?

Form 2
Barr Engineering Company
Respirator Inspection Checklist

A. Half-Mask Facepiece – check for:

1. Excessive dirt
2. Cracks, tears, holes
3. Distortion
4. For Full-Facepiece, also check for cracked/scratched/or loose fitting lenses

B. Headstraps – check for:

1. Breaks or tears (replace headstrap)
2. Loss of elasticity (replace headstrap)
3. Broken or malfunctioning buckles or attachments (obtain new buckles)
4. Straps that allow the facepiece to slip (replace headstrap)

C. Inhalation Valve/Exhalation Valve – check for:

1. Detergent residue, dust particles, or dirt on valve or valve seat (clean residue with soap and water)
2. Cracks/tears/or distortion in the valve material or valve seat (contact Equipment Maintenance Technician)
3. Missing or defective valve cover (obtain valve cover from Equipment Maintenance Technician).
4. Proper seating (lays flat and seals (replace valve)

D. Filter/Cartridge

1. Proper filter/cartridge for the hazard
2. Approval designation (NIOSH stamp)
3. Missing or worn gaskets (contact Equipment Maintenance Technician)
4. Worn threads – both filter threads and facepiece threads (replace filter/cartridge and contact Equipment Maintenance Technician)
5. Cracks or dents in filter/cartridge housing (replace filter/cartridge)

E. Atmosphere Supplying Respirators

1. Check facepiece, headstraps, valves, and breathing tubes in same manner as air purifying respirators
2. Breathing air quality (Grade D or better certification)
3. Breaks or kinks in air supply hoses and end fitting attachments (contact Equipment Maintenance Technician)
4. Tightness of connections
5. Proper setting of regulators and valves (contact Equipment Maintenance Technician)
6. Correct operation of air purifying elements
7. Correct operation of alarms

Form G-3
Barr Engineering Company
Respirator Inspection Record

1. TYPE ______________________ 2. NO.______________________

3. DEFECTS FOUND:
    A. Facepiece ______________________
    B. Inhalation Valve ______________________
    C. Exhalation Valve Assembly ______________________
    D. Headbands ______________________
    E. Cartridge Holder ______________________
    F. Cartridge/Canister ______________________
    G. Filter ______________________
    H. Harness Assembly ______________________
    I. Hose Assembly ______________________
    J. Speaking Diaphragm ______________________
    K. Gaskets ______________________
    L. Connections ______________________
    M. Other Defects ______________________

____

Form G-4
Barr Engineering Company
Respirator Fit-Test Training Program

The following topics have been covered in training:

- ☐ A. Why the respirator is necessary and how improper fit, usage, or maintenance can compromise the protective effect of the respirator.
- ☐ B. Discussion on why engineering controls cannot be used instead of respirator protective equipment.
- ☐ C. Why this respirator was selected.
- ☐ D. Limitations of selected respirator.
- ☐ E. Putting on the respirator.
- ☐ F. Wearing the respirator.
- ☐ G. Maintenance of the respirator.
- ☐ H. Recognizing and handling an emergency situation.
- ☐ I. Inspecting the respirator.
- ☐ J. Use of air purifying respirator.
- ☐ K. Use of supplied air respirator protective equipment.
- ☐ L. Purpose of medical evaluation.
- ☐ M. Proper fit-testing techniques.
- ☐ N. Assessing good initial respirator fit.
    - ☐ Chin properly placed
    - ☐ Adequate strap tension, not overly tightened
    - ☐ Fit across nose bridge
    - ☐ Distance from nose to chin
    - ☐ Tendency of respirator to slip
    - ☐ Self-observation in mirror

Form G-5
Barr Engineering Company
Respirator Fit-Test and Training Record

NAME: ____

FIT TEST DATE: _______________________ CORRECTIVE LENSES NEEDED: YES ☐ NO ☐

Briefed on fundamental principles of respirator protection, use, selection, inspection, cleaning, maintenance and storage of equipment. YES ☐ NO ☐

	Respirator
Respirator Type (1/2 Mask/FF)	______________
Manufacturer	______________
Model	______________
Size	______________
Facepiece Composition (Rubber/Silicone)	______________

TEST PERFORMED	**Respirator**
Negative Pressure Test:	P ☐ F ☐
Positive Pressure Test:	P ☐ F ☐
Banana 011 Test:	P ☐ F ☐

The individual named above has been fit-tested according to procedures specified in Barr Engineering's Respirator Protection Program. This qualitative fit test protocol meets OSHA 29 CFR 1910 and 29 CFR 1926 requirements.

______________________________ ______________ ____________________________

Employee's Signature Initials Date

______________________________ ______________ ____________________________

Employee's Signature Initials Date

Section 8: Hearing Conservation Program

Table of Contents

Attachments

Section 8: Hearing Conservation Program

1.0 Introduction

Barr personnel will be provided with the equipment, training, environmental and medical surveillance, and technical support to be protected from the adverse effects of occupational exposure to noise. Barr has established a program which complies with the OSHA standard for Occupational Noise Standard (29 CFR 1910.95).

2.0 Action Level

Barr will implement the requirements of this program whenever employees are, or may reasonably be expected to be exposed to noise levels in excess of 85 dBA, as an 8-hour time weighted average (TWA). Work taking place on active construction sites, around heavy equipment, or near drill rigs is assumed to have the potential for employee overexposure to noise.

3.0 Noise Exposure Control

Barr will, whenever practical, provide its employees with equipment that will not generate noise levels in excess of 85 dBA. In many cases, however, Barr does not have control over noisy equipment or environments (e.g., client site, other contractor activities). In such cases, the following controls should be used:

- Whenever possible, work as far from the noise source as possible.
- Where possible, position noisy equipment behind a barrier or wall.
- Minimize the length of time of exposure to loud noise through work practices and planning.
- Use hearing protective devices.

4.0 Hearing Protective Devices

The use of hearing protective devices (HPD) are required whenever Barr staff are exposed to noise levels in excess of 85 dBA (8-hour TWA) which cannot be otherwise controlled. Barr provides an assortment of disposable ear plugs and ear muffs that they evaluate for the specific noise environments in which they will be used. Barr has hearing protection available to all employees at no cost.

Project staff should consult the Project Health and Safety Contact or other representative of the health and safety staff concerning the suitability of particular types of hearing protection. It is the responsibility of project team members to obtain from the equipment room sufficient number of HPDs for the number of Barr personnel on-site and the duration of the project.

Barr staff working on projects requiring hearing protection will receive annual training in the use of these devices from the equipment technician or at the project pre-entry safety meeting..

5.0 Medical Surveillance

Barr staff who may be exposed to noise in excess of 85 dBA (8-hour TWA) will be identified by the health and safety staff. Those employees identified as potentially noise exposed will receive baseline and annual audiometric testing. Employees will observe at least 14 hours without exposure to workplace noise and will be notified to avoid high levels of noise prior to testing to establish a baseline audiogram. Testing will be performed by a qualified audiometric technician operating under the supervision of an occupational health physician. Barr staff are informed in writing of the results of their audiometric tests by the occupational health physician.

A new audiogram for each employee exposed at or above an 8-hour, time-weighted average of 85 decibles will be obtained at least annually after obtaining the baseline audiogram. Each employee’s audiogram will be compared to that employee’s baseline audiogram to determine if the audiogram is valid and if a standard threshold shift has occurred.

Barr staff with diagnosed standard threshold shifts will be notified in writing of the shift within 21 days of the determination. When the shift is first detected, the employee will be called in for subsequent testing to confirm the shift. Following confirmation of the shift, the occupational health physician will counsel the employee on the need for subsequent referral. The Barr health and safety staff will counsel the employee on the need for hearing protection, review requirements with the affected employee, and shall re-evaluate the employee’s use of hearing protection and/or shall be refitted.

6.0 Noise Monitoring

Barr health and safety staff or project team members may perform noise monitoring of representative projects and equipment to determine the need for noise control procedures and/or protective equipment for Barr staff working on similar projects or with similar equipment. Barr will maintain an accurate record of all employee exposure measurements and maintain the records as required under 1910.95(m). Barr staff will be informed of personal representative noise monitoring results.

When noise monitoring is performed at a project site, input from Barr staff on-site will be obtained. Generally, sites are small enough that Barr staff can easily observe monitoring activity. Following collection of data, the results and monitoring protocol will be reviewed with on-site project personnel.

7.0 Posting of Occupational Noise Exposure Standard

A copy of the Occupational Noise Exposure Standard (29 CFR 1910.95) is attached in Attachment H-1. *OSHA Hearing Conservation Amendment* should be posted in work-site trailers, where Barr staff may be exposed to noise levels in excess of 85 dBA (8-hour TWA).

ATTACHMENT 1
OSHA Hearing Conservation Amendment

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WORKPLACE SAFETY CODIFIED REGULATIONS
TITLE 29—LABOR
PART 1910—OCCUPATIONAL SAFETY AND HEALTH STANDARDS
SUBPART G—OCCUPATIONAL HEALTH AND ENVIRONMENTAL CONTROL
29 CFR 1910.95 OCCUPATIONAL NOISE EXPOSURE.

29 CFR 1910.95 Occupational noise exposure.

[§1910.95 amended at 61 FR 5508, Feb. 13, 1996]
(a) Protection against the effects of noise exposure shall be provided when the sound levels exceed those shown in Table G-16 when measured on the A scale of a standard sound level meter at slow response. When noise levels are determined by octave band analysis, the equivalent A-weighted sound level may be determined as follows:

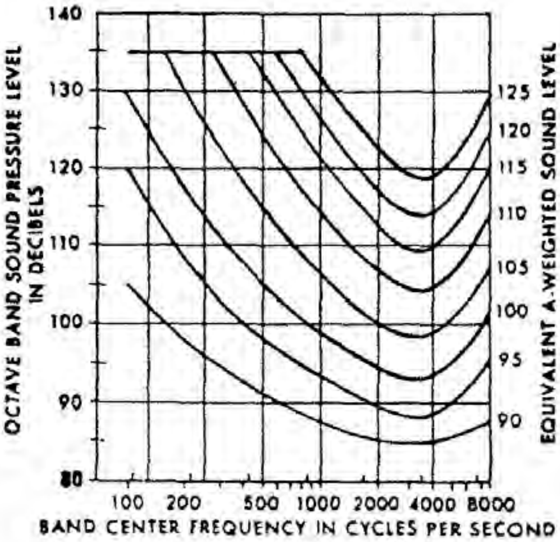

Figure G-9

Figure G-9
Equivalent sound level contours. Octave band sound pressure levels may be converted to the equivalent A-weighted sound level by plotting them on this graph and noting the A-weighted sound level corresponding to the point of highest penetration into the sound level contours. This equivalent A-weighted sound level, which may differ from the actual A-weighted sound level of the noise, is used to determine exposure limits from Table G-16.

Table G-16--Permissible Noise Exposures[1]

Duration per day, hours	Sound level dBA slow response
8	90
6	92
4	95
3	97
2	100
11/2	102
1	105
1/2	110
1/4 or less	115

[1] When the daily noise exposure is composed of two or more periods of noise exposure of different levels, their combined effect should be considered, rather than the individual effect of each. If the sum of the following fractions: $C_1/T_1 + C_2/T_2 \ C_n/T_n$ exceeds unity, then, the mixed exposure should be considered to exceed the limit value. Cn indicates the total time of exposure at a specified noise level, and Tn indicates the total time of exposure permitted at that level.

Exposure to impulsive or impact noise should not exceed 140 dB peak sound pressure level.

(b) (1) When employees are subjected to sound exceeding those listed in Table G-16, feasible administrative or engineering controls shall be utilized. If such controls fail to reduce sound levels within the levels of Table G-16, personal protective equipment shall be provided and used to reduce sound levels within the levels of the table.
(2) If the variations in noise level involve maxima at intervals of 1 second or less, it is to be considered continuous.
(c) *Hearing conservation program.*
[§1910.95(c) revised at 48 FR 9776, March 8, 1983]
(1) The employer shall administer a continuing, effective hearing conservation program, as described in paragraphs (c) through (o) of this section, whenever employee noise exposures equal or exceed an 8-hour time-weighted average sound level (TWA) of 85 decibels measured on the A scale (slow response) or, equivalently, a dose of fifty percent. For purposes of the hearing conservation program, employee noise exposures shall be computed in accordance with Appendix A and Table G-16a, and without regard to any attenua-tion provided by the use of personal protective equipment.
(2) For purposes of paragraphs (c) through (n) of this section, an 8-hour time-weighted average of 85 decibels or a dose of fifty percent shall also be referred to as the action level.
(d) *Monitoring.*
[§1910.95(d) revised at 48 FR 9776, March 8, 1983]
(1) When information indicates that any employee's exposure may equal or exceed an 8-hour time-weighted average of 85 decibels, the employer shall develop and implement a monitoring program.
(i) The sampling strategy shall be designed to identify employees for inclusion in the hearing conservation program and to enable the proper selection of hearing protectors.
(ii) Where circumstances such as high worker mobility, significant variations in sound level, or a significant

component of impulse noise make area monitoring generally inappropriate, the employer shall use representative personal sampling to comply with the monitoring requirements of this paragraph unless the employer can show that area sampling produces equivalent results.

(2) (i) All continuous, intermittent and impulsive sound levels from 80 decibels to 130 decibels shall be integrated into the noise measurements.

(ii) Instruments used to measure employee noise exposure shall be calibrated to ensure measurement accuracy.

(3) Monitoring shall be repeated whenever a change in production, process, equipment or controls increases noise exposures to the extent that:

(i) Additional employees may be exposed at or above the action level; or

(ii) The attenuation provided by hearing protectors being used by employees may be rendered inadequate to meet the requirements of paragraph (j) of this section.

(e) *Employee notification.* The employer shall notify each employee exposed at or above an 8-hour time-weighted average of 85 decibels of the results of the monitoring.

[§1910.95(e) revised at 48 FR 9776, March 8, 1983]

(f) *Observation of monitoring.* The employer shall provide affected employees or their representatives with an opportunity to observe any noise measurements conducted pursuant to this section.

[§1910.95(f) revised at 48 FR 9777, March 8, 1983]

(g) *Audiometric testing program.*

[§1910.95(g) revised at 48 FR 9777, March 8, 1983]

(1) The employer shall establish and maintain an audiometric testing program as provided in this paragraph by making audiometric testing available to all employees whose exposures equal or exceed an 8-hour time-weighted average of 85 decibels.

(2) The program shall be provided at no cost to employees.

(3) Audiometric tests shall be performed by a licensed or certified audiologist, otolaryngologist, or other physician, or by a technician who is certified by the Council of Accreditation in Occupational Hearing Conservation, or who has satisfactorily demonstrated competence in administering audiometric examinations, obtaining valid audiograms, and properly using, maintaining and checking calibration and proper functioning of the audiometers being used. A technician who operates microprocessor audiometers does not need to be certified. A technician who performs audiometric tests must be responsible to an audiologist, otolaryngologist or physician.

(4) All audiograms obtained pursuant to this section shall meet the requirements of Appendix C: *Audiometric Measuring Instruments.*

(5) *Baseline audiogram.*

(i) Within 6 months of an employee's first exposure at or above the action level, the employer shall establish a valid baseline audiogram against which subsequent audiograms can be compared.

(ii) *Mobile test van exception.* Where mobile test vans are used to meet the audiometric testing obligation, the employer shall obtain a valid baseline audiogram within 1 year of an employee's first exposure at or above the action level. Where baseline audiograms are obtained more than 6 months after the employee's first exposure at or above the action level, employees shall wearing [wear] hearing protectors for any period exceeding six months after first exposure until the baseline audiogram is obtained.

(iii) Testing to establish a baseline audiogram shall be preceded by at least 14 hours without exposure to workplace noise. Hearing protectors may be used as a substitute for the requirement that baseline audiograms be preceded by 14 hours without exposure to workplace noise.

(iv) The employer shall notify employees of the need to avoid high levels of non-occupational noise exposure during the 14-hour period immediately preceding the audiometric examination.

(6) *Annual audiogram.* At least annually after obtaining the baseline audiogram, the employer shall obtain a new audiogram for each employee exposed at or above an 8-hour time-weighted average of 85 decibels.

(7) *Evaluation of audiogram.*

(i) Each employee's annual audiogram shall be compared to that employee's baseline audiogram to determine if the audiogram is valid and if a standard threshold shift as defined in paragraph (g)(10) of this section has occurred. This comparison may be done by a technician.

(ii) If the annual audiogram shows that an employee has suffered a standard threshold shift, the employer may obtain a retest within 30 days and consider the results of the retest as the annual audiogram.

(iii) The audiologist, otolaryngologist, or physician shall review problem audiograms and shall determine whether there is a need for further evaluation. The employer shall provide to the person performing this evaluation the following information:

(A) A copy of the requirements for hearing conservation as set forth in paragraphs (c) through (n) of this section;

(B) The baseline audiogram and most recent audiogram of the employee to be evaluated;

(C) Measurements of background sound pressure levels in the audiometric test room as required in Appendix D: Audiometric Test Rooms.

(D) Records of audiometric calibrations required by paragraph (h)(5) of this section.

(8) *Follow-up procedures.*

(i) If a comparison of the annual audiogram to the baseline audiogram indicates a standard threshold shift as defined in paragraph (g)(10) of this section has occurred, the employee shall be informed of this fact in writing, within 21 days of the determination.

(ii) Unless a physician determines that the standard threshold shift is not work related or aggravated by occupational noise exposure, the employer shall ensure that the following steps are taken when a standard threshold shift occurs:

(A) Employees not using hearing protectors shall be fitted with hearing protectors, trained in their use and care, and required to use them.

(B) Employees already using hearing protectors shall be refitted and retrained in the use of hearing protectors and provided with hearing protectors offering greater attenuation if necessary.

(C) The employee shall be referred for a clinical audiological evaluation or an otological examination, as appropriate, if additional testing is necessary or if the employer suspects that a medical pathology of the ear is caused or aggravated by the wearing of hearing protectors.

(D) The employee is informed of the need for an otological examination if a medical pathology of the ear that is unrelated to the use of hearing protectors is suspected.

(iii) If subsequent audiometric testing of an employee whose exposure to noise is less than an 8-hour TWA of 90 decibels indicates that a standard threshold shift is not persistent, the employer:

(A) Shall inform the employee of the new audiometric interpretation; and

(B) May discontinue the required use of hearing protectors for that employee.

(9) *Revised baseline.* An annual audiogram may be substituted for the baseline audiogram when, in the judgment of the audiologist, otolaryngologist or physician who is evaluating the audiogram:

(i) The standard threshold shift revealed by the audiogram is persistent; or

(ii) The hearing threshold shown in the annual audiogram indicates significant improvement over the baseline audiogram.

(10) *Standard threshold shift.*

(i) As used in this section, a standard threshold shift is a change in hearing threshold relative to the baseline audiogram of an average of 10 dB or more at 2000, 3000, and 4000 Hz in either ear.

(ii) In determining whether a standard threshold shift has occurred, allowance may be made for the contribution of aging (presbycusis) to the change in hearing level by correcting the annual audiogram according to the procedure described in Appendix F: *Calculation and Application of Age Correction to Audiograms.*

(h) *Audiometric test requirements.*

[§1910.95(h) revised at 48 FR 9777, March 8, 1983]

(1) Audiometric tests shall be pure tone, air conduction, hearing threshold examinations, with test frequencies including as a minimum 500, 1000, 2000, 3000, 4000, and 6000 Hz. Tests at each frequency shall be taken separately for each ear.

(2) Audiometric tests shall be conducted with audiometers (including microprocessor audiometers) that meet the specifications of, and are maintained and used in accordance with, American National Standard Specification for Audiometers, S3.6-1969, which is incorporated by reference as specified in §1910.6.

[§1910.95(h)(2) amended at 61 FR 9236, March 7, 1996]

(3) Pulsed-tone and self-recording audiometers, if used, shall meet the requirements specified in Appendix C: *Audiometric Measuring Instruments.*

(4) Audiometric examinations shall be administered in a room meeting the requirements listed in Appendix D: *Audiometric Test Rooms.*

(5) *Audiometer calibration.*

(i) The functional operation of the audiometer shall be checked before each day's use by testing a person with known, stable hearing thresholds, and by listening to the audiometer's output to make sure that the output is free from distorted or unwanted sounds. Deviations of 10 decibels or greater require an acoustic calibration.

(ii) Audiometer calibration shall be checked acoustically at least annually in accordance with Appendix E: *Acoustic Calibration of Audiometers.* Test frequencies below 500 Hz and above 6000 Hz may be omitted from this check. Deviations of 15 decibels or greater require an exhaustive calibration.

(iii) An exhaustive calibration shall be performed at least every two years in accordance with sections 4.1.2; 4.1.3; 4.1.4.3; 4.2; 4.4.1; 4.4.2; 4.4.3; and 4.5 of the American National Standard Specification for Audiometers, S3.6 - 1969. Test frequencies below 500 Hz and above 6000 Hz may be omitted from this calibration.

(i) *Hearing protectors.*

[§1910.95(i) revised at 48 FR 9778, March 8, 1983]

(1) Employers shall make hearing protectors available to all employees exposed to an 8-hour time-weighted average of 85 decibels or greater at no cost to the employees. Hearing protectors shall be replaced as necessary.

(2) Employers shall ensure that hearing protectors are worn:

(i) By an employee who is required by paragraph (b)(1) of this section to wear personal protective equipment; and

(ii) By any employee who is exposed to an 8-hour time-weighted average of 85 decibels or greater, and who:

(A) Has not yet had a baseline audiogram established pursuant to paragraph (g)(5)(ii); or

(B) Has experienced a standard threshold shift.

(3) Employees shall be given the opportunity to select their hearing protectors from a variety of suitable hearing protectors provided by the employer.

(4) The employer shall provide training in the use and care of all hearing protectors provided to employees.

(5) The employer shall ensure proper initial fitting and supervise the correct use of all hearing protectors.

(j) *Hearing protector attenuation.*

[§1910.95(j) revised at 48 FR 9778, March 8, 1983]

(1) The employer shall evaluate hearing protector attenuation for the specific noise environments in which the protector will be used. The employer shall use one of the evaluation methods described in *Appendix B: Methods for Estimating the Adequacy of Hearing Protection Attenuation.*

(2) Hearing protectors must attenuate employee exposure at least to an 8-hour time-weighted average of 90 decibels as required by paragraph (b) of this section.

(3) For employees who have experienced a standard threshold shift, hearing protectors must attenuate employee exposure to an 8-hour time-weighted average of 85 decibels or below.

(4) The adequacy of hearing protector attenuation shall be re-evaluated whenever employee noise exposures increase to the extent that the hearing protectors provided may no longer provide adequate attenuation. The

employer shall provide more effective hearing protectors where necessary.

(k) *Training program.*

[§1910.95(k) revised at 48 FR 9778, March 8, 1983]

(1) The employer shall institute a training program for all employees who are exposed to noise at or above an 8-hour time-weighted average of 85 decibels, and shall ensure employee participation in such program.

(2) The training program shall be repeated annually for each employee included in the hearing conservation program. Information provided in the training program shall be updated to be consistent with changes in protective equipment and work processes.

(3) The employer shall ensure that each employee is informed of the following:

(i) The effects of noise on hearing;

(ii) The purpose of hearing protectors, the advantages, disadvantages, and attenuation of various types, and instructions on selection, fitting, use, and care; and

(iii) The purpose of audiometric testing, and an explanation of the test procedures.

(l) *Access to information and training materials.*

[§1910.95(l) revised at 48 FR 9778, March 8, 1983]

(1) The employer shall make available to affected employees or their representatives copies of this standard and shall also post a copy in the workplace.

(2) The employer shall provide to affected employees any informational materials pertaining to the standard that are supplied to the employer by the Assistant Secretary.

(3) The employer shall provide, upon request, all materials related to the employer's training and education program pertaining to this standard to the Assistant Secretary and the Director.

(m) *Recordkeeping*—

[§1910.95(m) revised at 48 FR 9778, March 8, 1983]

(1) *Exposure measurements.* The employer shall maintain an accurate record of all employee exposure measurements required by paragraph (d) of this section.

(2) *Audiometric tests.*

(i) The employer shall retain all employee audiometric test records obtained pursuant to paragraph (g) of this section:

(ii) This record shall include:

(A) Name and job classification of the employee;

(B) Date of the audiogram;

(C) The examiner's name;

(D) Date of the last acoustic or exhaustive calibration of the audiometer; and

(E) Employee's most recent noise exposure assessment.

(F) The employer shall maintain accurate records of the measurements of the background sound pressure levels in audiometric test rooms.

(3) *Record retention.* The employer shall retain records required in this paragraph (m) for at least the following periods.

(i) Noise exposure measurement records shall be retained for two years.

(ii) Audiometric test records shall be retained for the duration of the affected employee's employment.

(4) *Access to records.* All records required by this section shall be provided upon request to employees, former employees, representatives designated by the individual employee, and the Assistant Secretary. The provisions of 29 CFR 1910.1020(a)-(e) and (g)-(i) apply to access to records under this section.

[§1910.95(m)(4) amended at 71 FR 16672, April 3, 2006]

(5) *Transfer of records.* If the employer ceases to do business, the employer shall transfer to the successor employer all records required to be maintained by this section, and the successor employer shall retain them for the

remainder of the period prescribed in paragraph (m)(3) of this section.

(n) *Appendices.*

[§1910.95(n) revised at 48 FR 9778, March 8, 1983]

(1) Appendices A, B, C, D, and E to this section are incorporated as part of this section and the contents of these appendices are mandatory.

(2) Appendices F and G to this section are informational and are not intended to create any additional obligations not otherwise imposed or to detract from any existing obligations.

(o) *Exemptions.* Paragraphs (c) through (n) of this section shall not apply to employers engaged in oil and gas well drilling and servicing operations.

[§1910.95(o) revised at 48 FR 9779, March 8, 1983]

(p) [Removed]

[§1910.95(p) revised at 48 FR 9779, March 8, 1983; removed at 71 FR 16672, April 3, 2006]

Appendix A to §1910.95—Noise Exposure Computation

[Appendix A revised at 48 FR 9779, March 8, 1983; amended at 54 FR 24333, June 7, 1989]

This Appendix Is Mandatory

I. Computation of Employee Noise Exposure

(1) Noise dose is computed using Table G-16a as follows:

(i) When the sound level, L, is constant over the entire work shift, the noise dose, D, in percent, is given by: $D = 100\ C/T$ where C is the total length of the work day, in hours, and T is the reference duration corresponding to the measured sound level, L, as given in Table G-16a or by the formula shown as a footnote to that table.

(ii) When the workshift noise exposure is composed of two or more periods of noise at different levels, the total noise dose over the work day is given by:

$$D = 100\ (C_1/T_1 + C_2/T_2 + ... + C_n/T_n),$$

where C_n *indicates the total time of exposure at a specific noise level,*

and T_n indicates the reference duration for that level as given by

Table G-16a.

(2) The eight-hour time-weighted average sound level (TWA), in decibels, may be computed from the dose, in percent, by means of the formula: $TWA = 16.61 \log_{10} (D/100) + 90$. For an eight-hour workshift with the noise level constant over the entire shift, the TWA is equal to the measured sound level.

(3) A table relating dose and TWA is given in Section II.

Table G-16a

A-weighted sound level, L (decibel)	Reference duration, T (hour)
80.............................	32
81.............................	27.9
82.............................	24.3
83.............................	21.1

84	18.4
85	16
86	13.9
87	12.1
88	10.6
89	9.2
90	8
91	7.0
92	6.1
93	5.3
94	4.6
95	4
96	3.5
97	3.0
98	2.6
99	2.3
100	2
101	1.7
102	1.5
103	1.3
104	1.1
105	1
106	0.87
107	0.76
108	0.66
109	0.57
110	0.5
111	0.44
112	0.38
113	0.33
114	0.29

Table G-16a--Contd.

A-weighted sound level, L (decibel)	Reference duration, T (hour)
115	0.25
116	0.22
117	0.19
118	0.16
119	0.14
120	0.125
121	0.11
122	0.095
123	0.082
124	0.072
125	0.063
126	0.054
127	0.047
128	0.041

129	0.036
130	0.031

In the above table the reference duration, T, is computed by

$$T = \frac{8}{2^{(L-90)/5}}$$

formula

where L is the measured A-weighted sound level.

II. Conversion Between "Dose" and "8-Hour Time-Weighted Average" Sound Level

Compliance with paragraphs (c)-(r) of this regulation is determined by the amount of exposure to noise in the workplace. The amount of such exposure is usually measured with an audiodosimeter which gives a readout in terms of "dose." In order to better understand the requirements of the amendment, dosimeter readings can be converted to an "8-hour time-weighted average sound level." (TWA)

In order to convert the reading of a dosimeter into TWA, see Table A-1, below. This table applies to dosimeters that are set by the manufacturer to calculate dose or percent exposure according to the relationships in Table G-16a. So, for example, a dose of 91 percent over an eight hour day results in a TWA of 89.3 dB, and, a dose of 50 percent corresponds to a TWA of 85 dB.

If the dose as read on the dosimeter is less than or greater than the values found in Table A-1, the TWA may be calculated by using the formula: $TWA = 16.61 \log_{10} (D/100) + 90$ where TWA = 8-hour time-weighted average sound level and D = accumulated dose in percent exposure.

Print-friendly version of Table A-1 (WEB Image)

Table A-1--Conversion From 'Percent Noise Exposure' or 'Dose' to '8-Hour Time-Weighted Average Sound Level' (TWA)

Dose or percent noise exposure	TWA
10	73.4
15	76.3
20	78.4
25	80.0
30	81.3
35	82.4
40	83.4
45	84.2
50	85.0
55	85.7

60	86.3
65	86.9
70	87.4
75	87.9
80	88.4
81	88.5
82	88.6
83	88.7
84	88.7
85	88.8
86	88.9
87	89.0
88	89.1
89	89.2
90	89.2
91	89.3
92	89.4
93	89.5
94	89.6
95	89.6
96	89.7
97	89.8
98	89.9
99	89.9
100	90.0
101	90.1
102	90.1
103	90.2
104	90.3
105	90.4
106	90.4
107	90.5
108	90.6
109	90.6
110	90.7
111	90.8
112	90.8
113	90.9
114	90.9
115	91.1
116	91.1
117	91.1
118	91.2
119	91.3
120	91.3
125	91.6
130	91.9
135	92.2
140	92.4
145	92.7
150	92.9
155	93.2
160	93.4
165	93.6
170	93.8
175	94.0

180	94.2
185	94.4
190	94.6
195	94.8
200	95.0
210	95.4
220	95.7
230	96.0
240	96.3
250	96.6
260	96.9
270	97.2
280	97.4
290	97.7
300	97.9
310	98.2
320	98.4
330	98.6
340	98.8
350	99.0
360	99.2
370	99.4
380	99.6
390	99.8
400	100.0
410	100.2
420	100.4
430	100.5
440	100.7
450	100.8
460	101.0
470	101.2
480	101.3
490	101.5
500	101.6
510	101.8
520	101.9
530	102.0
540	102.2
550	102.3
560	102.4
570	102.6
580	102.7
590	102.8
600	102.9
610	103.0
620	103.2
630	103.3
640	103.4
650	103.5

Table A-1--Conversion From 'Percent Noise Exposure' or 'Dose' to '8-Hour Time-Weighted Average Sound Level' (TWA)--Contd.

Dose or percent noise exposure	TWA
660	103.6
670	103.7
680	103.8
690	103.9
700	104.0
710	104.1
720	104.2
730	104.3
740	104.4
750	104.5
760	104.6
770	104.7
780	104.8
790	104.9
800	105.0
810	105.1
820	105.2
830	105.3
840	105.4
850	105.4
860	105.5
870	105.6
880	105.7
890	105.8
900	105.8
910	105.9
920	106.0
930	106.1
940	106.2
950	106.2
960	106.3
970	106.4
980	106.5
990	106.5
999	106.6

Appendix B to §1910.95—Methods for Estimating the Adequacy of Hearing Protector Attenuation

[Appendix B revised at 48 FR 9780, March 8, 1983]

This Appendix Is Mandatory

For employees who have experienced a significant threshold shift, hearing protector attenuation must be sufficient to reduce employee exposure to a TWA of 85 dB. Employers must select one of the following methods by which to estimate the adequacy of hearing protector attenuation.

The most convenient method is the Noise Reduction Rating (NRR) developed by the Environmental Protection Agency (EPA). According to EPA regulation, the NRR must be shown on the hearing protector package. The NRR is then related to an individual worker's noise environment in order to assess the adequacy of the attenuation of a given hearing protector. This Appendix describes four methods of using the NRR to determine whether a particular hearing protector provides adequate protection within a given exposure environment. Selection among the four procedures is dependent upon the employer's noise measuring instruments.

Instead of using the NRR, employers may evaluate the adequacy of hearing protector attenuation by using one of the three methods developed by the National Institute for Occupational Safety and Health (NIOSH), which are described in the "List of Personal Hearing Protectors and Attenuation Data," HEW Publication No. 76-120, 1975, pages 21-37. These methods are known as NIOSH methods #1, #2 and #3. The NRR described below is a simplification of NIOSH method #2. The most complex method is NIOSH method #1, which is probably the most accurate method since it uses the largest amount of spectral information from the individual employee's noise environment. As in the case of the NRR method described below, if one of the NIOSH methods is used, the selected method must be applied to an individual's noise environment to assess the adequacy of the attenuation. Employers should be careful to take a sufficient number of measurements in order to achieve a representative sample for each time segment.

Note: The employer must remember that calculated attenuation values reflect realistic values only to the extent that the protectors are properly fitted and worn.

When using the NRR to assess hearing protector adequacy, one of the following methods must be used:

(i) When using a dosimeter that is capable of C-weighted measurements:

(A) Obtain the employee's C-weighted dose for the entire workshift, and convert to TWA (see Appendix A, II).

(B) Subtract the NRR from the C-weighted TWA to obtain the estimated A-weighted TWA under the ear protector.

(ii) When using a dosimeter that is not capable of C-weighted measurements, the following method may be used:

(A) Convert the A-weighted dose to TWA (see Appendix A).

(B) Subtract 7 dB from the NRR.

(C) Subtract the remainder from the A-weighted TWA to obtain the estimated A-weighted TWA under the ear protector.

(iii) When using a sound level meter set to the A-weighting network;

(A) Obtain the employee's A-weighted TWA.

(B) Subtract 7 dB from the NRR, and subtract the remainder from the A-weighted TWA to obtain the estimated A-weighted TWA under the ear protector.

(iv) When using a sound level meter set on the C-weighting network:

(A) Obtain a representative sample of the C-weighted sound levels in the employee's environment.

(B) Subtract the NRR from the C-weighted average sound level to obtain the estimated A-weighted TWA under the ear protector.

(v) When using area monitoring procedures and a sound level meter set to the A-weighing network.

(A) Obtain a representative sound level for the area in question.

(B) Subtract 7 dB from the NRR and subtract the remainder from the A-weighted sound level for that area.

(vi) When using area monitoring procedures and a sound level meter set to the C-weighting network:

(A) Obtain a representative sound level for the area in question.

(B) Subtract the NRR from the C-weighted sound level for that area.

Appendix C to §1910.95—Audiometric Measuring Instruments

[Appendix C revised at 48 FR 9780, March 8, 1983]

This Appendix Is Mandatory.

1. In the event that pulsed-tone audiometers are used, they shall have a tone on-time of at least 200 milliseconds.
2. Self-recording audiometers shall comply with the following requirements:

(A) The chart upon which the audiogram is traced shall have lines at positions corresponding to all multiples of 10 dB hearing level within the intensity range spanned by the audiometer. The lines shall be equally spaced and shall be separated by at least ¼ inch. Additional increments are optional. The audiogram pen tracings shall not exceed 2 dB in width.

(B) It shall be possible to set the stylus manually at the 10-dB increment lines for calibration purposes.

(C) The slewing rate for the audiometer attenuator shall not be more than 6 dB/sec except that an initial slewing rate greater than 6 dB/sec is permitted at the beginning of each new test frequency, but only until the second subject response.

(D) The audiometer shall remain at each required test frequency for 30 seconds (± 3 seconds). The audiogram shall be clearly marked at each change of frequency and the actual frequency change of the audiometer shall not deviate from the frequency boundaries marked on the audiogram by more than ±3 seconds.

(E) It must be possible at each test frequency to place a horizontal line segment parallel, to the time axis on the audiogram, such that the audiometric tracing crosses the line segment at least six times at that test frequency. At each test frequency the threshold shall be the average of the mid points of the tracing excursions.

Appendix D to §1910.95—Audiometric Test Rooms

[Appendix D revised at 48 FR 9781, March 8, 1983]

This Appendix Is Mandatory

Rooms used for audiometric testing shall not have background sound pressure levels exceeding those in Table D-1 when measured by equipment conforming at least to the Type 2 requirements of American National Standard Specification for Sound Level Meters, S1.4-1971 (R1976), and to the Class II requirements of American National Standard Specification for Octave, Half-Octave, and Third-Octave Band Filter Sets, S1.11-1971 (R1976).

Print-friendly version of Table D-1 (WEB Image)

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Table D-1--Maximum Allowable
Octave-Band Sound Pressure Levels for Audiometric Test Rooms

Octave-band center frequency (Hz)	500	1000	2000	4000	8000
Sound pressure level (dB)	40	40	47	57	62

Appendix E to §1910.95—Acoustic Calibration of Audiometers

[Appendix E revised at 48 FR 9781, March 8, 1983]

This Appendix Is Mandatory

Audiometer calibration shall be checked acoustically, at least annually, according to the procedures described in this Appendix. The equipment necessary to perform these measurements is a sound level meter, octave-band filter set, and a National Bureau of Standards 9A coupler. In making these measurements, the accuracy of the calibrating equipment shall be sufficient to determine that the audiometer is within the tolerances permitted by American Standard Specification for Audiometers, S3.6-1969.

(1) Sound Pressure Output Check

A. Place the earphone coupler over the microphone of the sound level meter and place the earphone on the coupler.

B. Set the audiometer's hearing threshold level (HTL) dial to 70 dB.

C. Measure the sound pressure level of the tones at each test frequency from 500 Hz through 6000 Hz for each earphone.

D. At each frequency the readout on the sound level meter should correspond to the levels in Table E-1 or Table E -2, as appropriate, for the type of earphone, in the column entitled "sound level meter reading."

(2) Linearity Check

A. With the earphone in place, set the frequency to 1000 Hz and the HTL dial on the audiometer to 70 dB.

B. Measure the sound levels in the coupler at each 10-dB decrement from 70 dB to 10 dB, noting the sound level meter reading at each setting.

C. For each 10-dB decrement on the audiometer the sound level meter should indicate a corresponding 10 dB decrease.

D. This measurement may be made electrically with a voltmeter connected to the earphone terminals.

(3) Tolerances

When any of the measured sound levels deviate from the levels in Table E-1 or Table E-2 by ±3 dB at any test frequency between 500 and 3000 Hz, 4 dB at 4000 Hz, or 5 dB at 6000 Hz, an exhaustive calibration is advised. An exhaustive calibration is required if the deviations are greater than 15 dB or greater at any test frequency.

Table E-1--Reference Threshold Levels for
Telephonics--TDH-39
Earphones

Frequency, Hz	Reference threshold level for TDH-39 earphones, dB	Sound level meter reading, dB
500	11.5	81.5
1000	7	77
2000	9	79
3000	10	80
4000	9.5	79.5
6000	15.5	85.5

Table E-2--Reference Threshold Levels for
Telephonics--TDH-49
Earphones

Frequency, Hz	Reference threshold level for TDH-49 earphones, dB	Sound level meter reading, dB
500	13.5	83.5
1000	7.5	77.5
2000	11	81.0
3000	9.5	79.5
4000	10.5	80.5
6000	13.5	83.5

Appendix F to §1910.95—Calculations and Application of Age Corrections to Audiograms

[Appendix F revised at 48 FR 9781, March 8, 1983]

This Appendix Is Non-Mandatory

In determining whether a standard threshold shift has occurred, allowance may be made for the contribution of aging to the change in hearing level by adjusting the most recent audiogram. If the employer chooses to adjust the audiogram, the employer shall follow the procedure described below. This procedure and the age correction tables were developed by the National Institute for Occupational Safety and Health in the criteria document entitled "Criteria for a Recommended Standard … Occupational Exposure to Noise," ((HSM)-11001).

For each audiometric test frequency;

(i) Determine from Tables F-1 or F-2 the age correction values for the employee by:

(A) Finding the age at which the most recent audiogram was taken and recording the corresponding values of age corrections at 1000 Hz through 6000 Hz;

(B) Finding the age at which the baseline audiogram was taken and recording the corresponding values of age corrections at 1000 Hz through 6000 Hz.

(ii) Subtract the values found in step (i)(B) from the value found in step (i)(A).

[Corrected at 48 FR 29687, June 23, 1983]

(iii) The differences calculated in step (ii) represented that portion of the change in hearing that may be due to aging.

EXAMPLE: Employee is a 32-year-old male. The audiometric history for his right ear is shown in decibels below.

Print-friendly version of Audiometric Test Frequency table (WEB Image)

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Employee's age	Audiometric test frequency (Hz)				
	1000	2000	3000	4000	6000
26	10	5	5	10	

	1000	2000	3000	4000	6000
					5
*27	0	0	0	5	5
28	0	0	0	10	5
29	5	0	5	15	5
30	0	5	10	20	10
31	5	10	20	15	15
*32	5	10	10	25	20

The audiogram at age 27 is considered the baseline since it shows the best hearing threshold levels. Asterisks have been used to identify the baseline and most recent audiogram. A threshold shift of 20 dB exists at 4000 Hz between the audiograms taken at ages 27 and 32.

(The threshold shift is computed by subtracting the hearing threshold at age 27, which was 5, from the hearing threshold at age 32, which is 25). A retest audiogram has confirmed this shift. The contribution of aging to this change in hearing may be estimated in the following manner:

Go to Table F-1 and find the age correction values (in dB) for 4000 Hz at age 27 and age 32.

Print-friendly version of Frequency table (WEB Image)

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	Frequency (Hz)				
	1000	2000	3000	4000	6000
Age 32	6	5	7	10	14
Age 27	5	4	6	7	11
Difference	1	1	1	3	3

The difference represents the amount of hearing loss that may be attributed to aging in the time period between the baseline audiogram and the most recent audiogram. In this example, the difference at 4000 Hz is 3 dB. This value is subtracted from the hearing level at 4000 Hz, which in the most recent audiogram is 25, yielding 22 after adjustment. Then the hearing threshold in the baseline audiogram at 4000 Hz (5) is subtracted from the adjusted annual audiogram hearing threshold at 4000 Hz (22). Thus the age-corrected threshold shift would be 17 dB (as opposed to a threshold shift of 20 dB without age correction).

Print-friendly version of Table F-1 (WEB Image)

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Table F-1--Age Correction Values in Decibels for Males

	Audiometric Test Frequencies (Hz)				
Years	1000	2000	3000	4000	6000
20 or younger	5	3	4	5	8
21	5	3	4	5	8
22	5	3	4	5	8
23	5	3	4	6	9
24	5	3	5	6	9
25	5	3	5	7	10
26	5	4	5	7	10
27	5	4	6	7	11
28	6	4	6	8	11
29	6	4	6	8	12
30	6	4	6	9	12
31	6	4	7	9	13
32	6	5	7	10	14
33	6	5	7	10	14
34	6	5	8	11	15
35	7	5	8	11	

					15
36	7	5	9	12	16
37	7	6	9	12	17
38	7	6	9	13	17
39	7	6	10	14	18
40	7	6	10	14	19
41	7	6	10	14	20
42	8	7	11	16	20
43	8	7	12	16	21
44	8	7	12	17	22
45	8	7	13	18	23
46	8	8	13	19	24
47	8	8	14	19	24
48	9	8	14	20	25
49	9	9	15	21	26
50	9	9	16	22	27
51	9	9	16	23	28
52	9	10	17	24	29
53	9	10	18	25	30
54	10	10	18	26	31
55	10	11	19	27	32
56	10	11	20	28	34
57	10	11	21	29	35
58	10	12	22	31	36
59	11	12	22	32	37
60 or older	11	13	23	33	38

Print-friendly version of Table F-2 (WEB Image)

Table F-2--Age Correction Values in Decibels for Females

Years	Audiometric Test Frequencies (Hz) 1000	2000	3000	4000	6000
20 or younger	7	4	3	3	6
21	7	4	4	3	6
22	7	4	4	4	6
23	7	5	4	4	7
24	7	5	4	4	7
25	8	5	4	4	7
26	8	5	5	4	8
27	8	5	5	5	8
28	8	5	5	5	8
29	8	5	5	5	9
30	8	6	5	5	9
31	8	6	6	5	9
32	9	6	6	6	10
33	9	6	6	6	10
34	9	6	6	6	10
35	9	6	7	7	11
36	9	7	7	7	11
37	9	7	7	7	12
38	10	7	7	7	

					12
39	10	7	8	8	12
40	10	7	8	8	13
41	10	8	8	8	13
42	10	8	9	9	13
43	11	8	9	9	14
44	11	8	9	9	14
45	11	8	10	10	15
46	11	9	10	10	15
47	11	9	10	11	16
48	12	9	11	11	16
49	12	9	11	11	16
50	12	10	11	12	17
51	12	10	12	12	17
52	12	10	12	13	18
53	13	10	13	13	18
54	13	11	13	14	19
55	13	11	14	14	19
56	13	11	14	15	20
57	13	11	15	15	20
58	14	12	15	16	21
59	14	12	16	16	21
60 or older	14	12	16	17	22

Appendix G to §1910.95—Monitoring Noise Levels Non-Mandatory Informational Appendix

[Appendix G revised at 48 FR 9782, March 8, 1983; amended at 61 FR 9236, March 7, 1996]

This appendix provides information to help employers comply with the noise monitoring obligations that are part of the hearing conservation amendment.

What Is the Purpose of Noise Monitoring?

This revised amendment requires that employees be placed in a hearing conservation program if they are exposed to average noise levels of 85 dB or greater during an 8 hour workday. In order to determine if exposures are at or above this level, it may be necessary to measure or monitor the actual noise levels in the workplace and to estimate the noise exposure or "dose" received by employees during the workday.

When Is It Necessary to Implement a Noise Monitoring Program?

It is not necessary for every employer to measure workplace noise. Noise monitoring or measuring must be conducted only when exposures are at or above 85 dB. Factors which suggest that noise exposures in the workplace may be at this level include employee complaints about the loudness of noise, indications that employees are losing their hearing, or noisy conditions which make normal conversation difficult. The employer should also consider any information available regarding noise emitted from specific machines. In addition, actual workplace noise measurements can suggest whether or not a monitoring program should be initiated.

How Is Noise Measured?

Basically, there are two different instruments to measure noise exposures: the sound level meter and the dosimeter. A sound level meter is a device that measures the intensity of sound at a given moment. Since sound level meters provide a measure of sound intensity at only one point in time, it is generally necessary to take a number of measurements at different times during the day to estimate noise exposure over a workday. If noise levels fluctuate, the amount of time noise remains at each of the various measured levels must be determined.

To estimate employee noise exposures with a sound level meter it is also generally necessary to take several measurements at different locations within the workplace. After appropriate sound level meter readings are obtained, people sometimes draw "maps" of the sound levels within different areas of the workplace. By using a sound level "map" and information on employee locations throughout the day, estimates of individual exposure levels can be developed. This measurement method is generally referred to as *area* noise monitoring.

A dosimeter is like a sound level meter except that it stores sound level measurements and integrates these measurements over time, providing an average noise exposure reading for a given period of time, such as an 8-hour workday. With a dosimeter, a microphone is attached to the employee's clothing and the exposure measurement is simply read at the end of the desired time period. A reader may be used to read-out the dosimeter's measurements. Since the dosimeter is worn by the employee, it measures noise levels in those locations in which the employee travels. A sound level meter can also be positioned within the immediate vicinity of the exposed worker to obtain an individual exposure estimate. Such procedures are generally referred to as *personal* noise monitoring.

Area monitoring can be used to estimate noise exposure when the noise levels are relatively constant and employees are not mobile. In workplaces where employees move about in different areas or where the noise intensity tends to fluctuate over time, noise exposure is generally more accurately estimated by the personal monitoring approach.

In situations where personal monitoring is appropriate, proper positioning of the microphone is necessary to obtain accurate measurements. With a dosimeter, the microphone is generally located on the shoulder and remains in that position for the entire workday. With a sound level meter, the microphone is stationed near the employee's head, and the instrument is usually held by an individual who follows the employee as he or she moves about.

Manufacturer's instructions, contained in dosimeter and sound level meter operating manuals, should be followed for calibration and maintenance. To ensure accurate results, it is considered good professional practice to calibrate instruments before and after each use.

How Often Is It Necessary to Monitor Noise Levels?

The amendment requires that when there are significant changes in machinery or production processes that may result in increased noise levels, remonitoring must be conducted to determine whether additional employees need to be included in the hearing conservation program. Many companies choose to remonitor periodically (once every year or two) to ensure that all exposed employees are included in their hearing conservation programs.

Where Can Equipment and Technical Advice Be Obtained?

Noise monitoring equipment may be either purchased or rented. Sound level meters cost about $500 to $1,000, while dosimeters range in price from about $750 to $1,500. Smaller companies may find it more economical to rent equipment rather than to purchase it. Names of equipment suppliers may be found in the telephone book (Yellow Pages) under headings such as: "Safety Equipment," "Industrial Hygiene," or "Engineers-Acoustical." In addition to providing information on obtaining noise monitoring equipment, many companies and individuals included under such listings can provide professional advice on how to conduct a valid noise monitoring program. Some audiological testing firms and industrial hygiene firms also provide noise monitoring services. Universities with audiology, industrial hygiene, or acoustical engineering departments may also provide information or may be able to help employers meet their obligations under this amendment.

Free, on-site assistance may be obtained from OSHA-supported state and private consultation organizations. These safety and health consultative entities generally give priority to the needs of small businesses.

Appendix H to §1910.95—Availability of Referenced Documents

[Appendix H revised at 48 FR 9784, March 8, 1983; amended at 61 FR 9236, March 7, 1996]

Paragraphs (c) through (o) of 29 CFR 1910.95 and the accompanying appendices contain provisions which *incorporate publications* by reference. Generally, the publications provide criteria for instruments to be used in monitoring and audiometric testing. These criteria are intended to be mandatory when so indicated in the applicable paragraphs of §1910.95 and appendices.

It should be noted that OSHA does not require that employers purchase a copy of the referenced publications. Employers, however, may desire to obtain a copy of the referenced publications for their own information.

The designation of the paragraph of the standard in which the referenced publications appear, the titles of the publications, and the availability of the publications are as follows:

Print-friendly version of Appendix H table (WEB Image)

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Paragraph designation	Referenced publication	Available from
Appendix B........	'List of Personal Hearing Protectors and Attenuation Data,' HEW Pub. No. 76-120, 1975. NTIS-PB267461.	National Technical Information Service, Port Royal Road, Springfield, VA 22161.
Appendix D........	'Specification for Sound Level Meters,' S1.4-1971 (R1976).	American National Standards Institute, Inc., 1430 Broadway, New York, NY 10018.
§1910.95(k)(2), appendix E........	'Specifications for Audiometers,' S3.6-1969.	American National Standards Institute, Inc., 1430 Broadway, New York, NY 10018.
Appendix D........	'Specification for Octave, Half-Octave and Third-Octave Band Filter Sets,' S1.11-1971 (R1976).	Back Numbers Department, Dept. STD, American Institute of Physics, 333 E. 45th St., New York, NY 10017; American National Standards Institute, Inc., 1430 Broadway, New

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           |                                    |  York, NY 10018.              |
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The referenced publications (or a micro-fiche of the publications) are available for review at many universities and public libraries throughout the country. These publications may also be examined at the OSHA Technical Data Center, Room N2439, United States Department of Labor, 200 Constitution Avenue, NW., Washington, DC 20210, (202) 219-7500 or at any OSHA Regional Office (see telephone directories under United States Government—Labor Department).

Appendix I to §1910.95—Definitions

[Appendix I revised at 48 FR 9785, March 8, 1983]

These definitions apply to the following terms as used in paragraphs (c) through (n) of 29 CFR 1910.95.

Action level—An 8-hour time-weighted average of 85 decibels measured on the A-scale, slow response, or equivalently, a dose of fifty percent.

Audiogram—A chart, graph, or table resulting from an audiometric test showing an individual's hearing threshold levels as a function of frequency.

Audiologist—A professional, specializing in the study and rehabilitation of hearing, who is certified by the American Speech-Language-Hearing Association or licensed by a state board of examiners.

Baseline audiogram—The audiogram against which future audiograms are compared.

Criterion sound level—A sound level of 90 decibels.

Decibel (dB)—Unit of measurement of sound level.

Hertz (Hz)—Unit of measurement of frequency, numerically equal to cycles per second.

Medical pathology—A disorder or disease. For purposes of this regulation, a condition or disease affecting the ear, which should be treated by a physician specialist.

Noise dose—The ratio, expressed as a percentage, of (1) the time integral, over a stated time or event, of the 0.6 power of the measured SLOW exponential time-averaged, squared A-weighted sound pressure and (2) the product of the criterion duration (8 hours) and the 0.6 power of the squared sound pressure corresponding to the criterion sound level (90 dB).

Noise dosimeter—An instrument that integrates a function of sound pressure over a period of time in such a manner that it directly indicates a noise dose.

Otolaryngologist—A physician specializing in diagnosis and treatment of disorders of the ear, nose and throat.

Representative exposure—Measurements of an employee's noise dose or 8-hour time-weighted average sound level that the employers deem to be representative of the exposures of other employees in the workplace.

Sound level—Ten times the common logarithm of the ratio of the square of the measured A-weighted sound pressure to the square of the standard reference pressure of 20 micropascals. Unit: decibels (dB). For use with this regulation, SLOW time response, in accordance with ANSI S1.4-1971 (R1976), is required.

Sound level meter—An instrument for the measurement of sound level.

Time-weighted average sound level—That sound level, which if constant over an 8-hour exposure, would result in the same noise dose as is measured.

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Section 9: Confined Space Entry Procedures

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Section 9: Confined Space Entry Procedures

1.0 Purpose

The purpose of this plan is to establish a program and procedures for the safe entry into confined spaces by Barr Engineering Company employees. All entry to confined spaces require a confined space entry permit (CSEP). Barr's confined space entry program prohibits entry to confined spaces with inert atmospheres and when immediately dangerous to life and health (IDLH) conditions are present.

This program supports compliance with Occupational Safety and Health Administration Permit Required Confined Space Entry Program as found in 29 CFR 1910.146 and Minnesota OSHA Rule 5205. However, since Minnesota OSHA Rule 5205 still regulates construction confined-space entry, some requirements differ. See Barr Health and Safety staff for further information. This plan applies to all Company employees. Employees working at a contracting authority (hereafter referred to as Client) will also adhere to the Client's procedures for confined space entry and will be expected to follow all requirements.

2.0 Definitions

2.1 Confined Space

Confined space means a space that:

1) Is large enough and so configured that an employee can bodily enter and perform assigned work.

2) Has limited or restricted means for entry or exit (for example, tanks, vessels, silos, storage bins, hoppers, vaults, and pits are spaces that may have limited means of entry).

3) Is not designated for continuous employee occupancy.

2.2 Permit-Required Confined Space

According to the OSHA Standard, this is a space which meets all of the above conditions and has one or more of the following hazards:

- *Hazardous atmospheric hazards,* which can be asphyxiating, toxic, flammable or explosive.

- Engulfment hazards, which occur when someone is trapped or enveloped by a dry, bulk material such as grains, soil or powdered cement.

- Configuration hazards, in which the size or shape of the space can trap an employee or make escape or rescue difficult.

- Energy hazards, which can happen if there is contact with electrical equipment, steam or other sources of heat inside the space.

- Other serious hazards, such as falls, burns, or high noise levels.

2.3 Entry Into a Confined Space

OSHA defines entry as any part of an employee's body going through the opening into the space. Even just a hand going into the space is considered confined space entry.

3.0 Types of Confined Spaces

The following list provides examples of confined spaces. Barr Health and Safety staff should be contacted to assess potential hazards for each confined space and to determine safety procedures.

- Manholes: gauging stations, storm sewers, sanitary sewers, other utilities

- Lift Stations: storm sewers, sanitary sewers

- Drainage/Waste Pipes: storm sewer (under construction/operable), sanitary sewer (under construction/operable)

- Excavations/Trenches: contaminated soils (see also Barr Excavation Entry program)

- Vessels: new vessels, used vessels (cleaned/purged), vessels with unknown contents, tanks

4.0 Responsibilities

4.1 Program Administrator

Barr's Health and Safety Manager is responsible for issuing and administering this program and making sure that the program satisfies the requirements of applicable Federal, State, or Local confined space entry requirements. This person is also responsible for reviewing entry operations where the measures taken may not have adequately protected employees and for revising the program to correct deficiencies found to exist before subsequent entries are authorized. Annually, this person will review the permit space program, including canceled permits for the previous 12-month period.

4.2 Project Manager

Project Specific Manager — This person is responsible for verifying the purpose for each entry into a confined space and for Barr's day-to-day safety management responsibilities for a given project. These responsibilities include the following:

- Ensuring that all assigned entrants have current training in the procedures and precautions for work to be performed.
- Informing subcontractors of the Company's confined space entry program requirements and of any known potential hazards of each confined space to be entered.

4.3 Entry Supervisor

Project Manager and/or Senior Barr Employee On-site — This on-site person is responsible for issuing permits to protect entrants who have been assigned to perform work. The permit will be issued according to the permit procedures listed in the Program Activities section of this Program. This person is also responsible for the following:

- Knowing the hazards that may be faced during entry, including information on mode, signs, or symptoms, and consequences of exposure;
- Verifying, by checking that the appropriate entries have been made on the permit, that tests specified by the permit have been conducted and that procedures and equipment specified by the permit are in place before endorsing the permit and allowing entry to begin;

- Terminating the entry and canceling the permit when entry operations covered by the entry permit have been completed; or when a condition that is not allowed under the entry permit arises in or near the permit space;

- Arranging for the removal of unauthorized individuals who enter or who attempt to enter the permit space during entry operations; and

- Whenever responsibility for a permit space entry operation is transferred and at intervals dictated by the hazards and operations performed within the permit space, determining that entry operations remain consistent with terms of the entry permit and that acceptable entry conditions are maintained.

- Verifying that appropriate entry equipment is available, maintained and/or calibrated according to the manufacturer's specifications and the Company's preventive maintenance procedures.

- Verifying that rescue services are available and that the means for summoning them are operable.

4.4 Authorized Entrants

Project team members as designated on confined space entry permit — These people are responsible for:

- Understanding the hazards that may be faced during entry, including information on how hazardous exposure may occur, and the signs, symptoms, and severity of overexposure.

- Properly using any equipment needed to safely enter the permit space.

- Maintaining communication with the attendant outside of the permit space, following warnings given by the attendant and exiting the permit space immediately when told to do so.

- Performing air monitoring as specified in confined space entry permit. This monitoring will occur prior to confined space entry and continuously for the duration of confined space entry.

- Verifying that conditions specified on confined space entry permit are acceptable for entry during its duration.
- Exiting the permit space when requested by the attendant or the entry supervisor, or when conditions render evacuation.

4.5 Attendant

Project team member or Client representative as designated on confined space entry permit — This person is assigned to monitor the entrants from outside the permit space while the entrants are working in the permit space for the duration of entry operations, and is responsible for:

- Understanding the hazards that may be faced during the entry.
- Knowing signs, symptoms and health effects if overexposure occurs.
- Alerting the entrant of dangerous situations or prohibited conditions.
- Ordering the entrants to evacuate the permit space if the attendant detects a new hazard or unusual behavior in the entrants.
- Maintaining an accurate count of the number of authorized entrants in the permit space.
- Remaining outside the permit space during entry operations until relieved by another attendant.
- Maintaining communication with authorized entrants to monitor their work activities and to alert them if evacuation becomes necessary.
- Calling for rescue and other emergency services as soon as the attendant recognizes that the entrants may need assistance to escape from the permit space.
- Keeping unauthorized persons form entering the permit space or interfering with the entry or rescue process, advising the unauthorized entrants that they must exit immediately if they have entered the permit space, and informing the authorized entrants and the entry supervisor if unauthorized persons have entered the permit space.
- Initiating or performing non-entry rescues.

- Performing no other activities to the extent that they may interfere with the primary job of monitoring the safety and condition of those people inside the confined space.

- Maintaining that only one confined space is entered at a time or, in the event that several confined spaces need to be entered simultaneously, assuring that there is an attendant at each entry to each confined space.

- Performing air monitoring as specified in confined space entry permit.

4.6 Air Monitor Technician

The Equipment Coordinator is responsible for:

- Knowing how to calibrate and operate air monitoring equipment.

- Understanding what airborne hazards exist or have the potential to exist at various sites.

- Identifying equipment and methods for testing at the site.

- Determining when equipment is malfunctioning.

- Providing appropriate equipment maintenance.

This person will not be on-site during confined space entry. On-site air monitoring responsibilities will be performed by the authorized attendant and entrant.

5.0 Program Activities

5.1 Identifying Confined Spaces

- Confined spaces requiring permit and the hazards involved are identified in the confined space entry form. This form will be completed by Barr's Health and Safety staff with the assistance of a member of the confined space entry team. The permit will be authorized by the Entry Supervisor, and will be kept on-site throughout the duration of the confined space entry.

- All client identified confined spaces will be marked with signs indicating confined space. All other confined spaces will be identified through the posting of the confined space entry permit outside the confined space.

- Employees will be trained on how to identify confined spaces during confined space entry training.

- Types of Confined Spaces: Minnesota OSHA classified confined spaces as Class I, II or III. Each class of confined space requires different levels of safety procedures. The Confined Space Entry Permit (CSEP) will indicate appropriate requirements for each class of entry.

5.2 Hazard Testing Before Entry into Confined Space

- All confined spaces will be tested before entry, using properly calibrated and approved equipment.

- If the hazard level cannot be determined by testing, an Immediately Dangerous to Life and Health situation shall be assumed.

- The air will be tested for toxic substances, oxygen levels, and flammable gases and vapors.

- Authorized entrants and their representatives are given the opportunity to observe air monitoring and review equipment calibration data.

- If changes have occurred in the confined space, additional air monitoring will be conducted.

5.3 Eliminating Hazards

- Mechanical ventilation (forced air ventilation) will be provided when natural ventilation is insufficient in eliminating atmospheric hazards.

- Protective equipment and respirators are to be used only when normal cleaning and ventilating procedures fail to reduce the hazard to safe levels.

5.4 Confined Space Entry Permit

- A Confined Space Entry Permit (CSEP) will be completed prior to the entry of any confined space. A copy of this permit is attached (Attachment I-1).
- The CSEP will specify the following:
    - Acceptable entry conditions throughout duration of authorized entry
    - Isolation Methods for confined space such as lockout/tagout procedures
    - Purging, cleaning, inerting or flushing of confined space to control atmospheric hazards
    - Ventilating confined space to eliminate atmospheric hazards
    - Pedestrian, vehicle or other barriers to protect entrants from external hazards
- The CSEP will specify the following equipment:
    - Atmospheric monitoring equipment
    - Ventilation equipment
    - Communication equipment
    - Personal Protective Equipment where feasible engineering and work practice controls do not adequately protect employees
    - Lighting Equipment to enable employees to see well enough to work safely and to exit confined space quickly in an emergency
    - Barriers/Shields
    - Equipment, such as ladders needed for safe ingress and egress
    - Rescue and emergency equipment for Self-Rescue and Non-Entry Rescue
- Other equipment determined necessary for safe entry and rescue from permit spaces

- The CSEP will be prepared by Barr Health and Safety staff with the assistance of a member of the confined space entry team. The CSEP may also be prepared by the Entry Supervisor.

- The CSEP will be issued by the Entry Supervisor who will sign the CSEP, authorizing entry. The CSEP will be available on-site and be reviewed prior to confined space entry.

- The CSEP will be used on-site by the Authorized Entrants and Authorized Attendants and will be returned to the Barr Health and Safety staff upon completion of entry.

- Each CSEP will be authorized for entry for a duration, not to exceed one work shift. After the time indicated on the CSEP, authorization for confined space entry using that permit will be canceled. If Barr staff expect to work past one work shift, another CSEP will be issued for additional work shifts.

- Upon completion of the confined space entry, one copy of the CSEP will be returned to the Barr Health and Safety staff, and the other copy will be filed in the Project File.

- The Minnesota OSHA standard allows for an "annual permit" to be issued for entry to Class I Confined Spaces where routine entry is required. Annual permits will be completed by Barr Health and Safety staff.

5.5 Confined Space Entry Team

- During a confined space entry, there will always be a minimum of one attendant and one entrant.

- During Class III (Minnesota OSHA) Confined Space Entry, one attendant must be first aid/CPR trained.

5.6 Self-Rescue and Non-Entry Rescue

- Authorized entrants will initiate self-rescue whenever atmospheric testing equipment indicates that atmospheric conditions are unacceptable for continued entry.

- Authorized entrants will initiate self-rescue whenever conditions change within the confined space that affect the safety of continued entry.

- Self-Rescue is conducted by contacting the Authorized Attendant and performing egress.

- A safety harness and lifeline may be used for self-rescue during confined space entry where there are slippery walking conditions, falling hazards from climbing, or when working in flowing/standing water and where practical.

- During Non-Entry Rescue, a hoist or other mechanical device for personnel removal may be used for confined spaces where it may be difficult to rescue the entrant.

- A hoist or other mechanical device for personnel removal will be used during entry to below ground vessels or manholes where fall protection is required. For Class III (Minnesota OSHA) Confined Space Entry, this equipment is required.

- First aid and any necessary rescue equipment shall be readily available at the site.

- Coordination will be made with local rescue and emergency services to be summoned in the event of an emergency. The Authorized Attendant will summon local rescue and emergency services and will implement emergency procedures to fit the situation until emergency services arrive on-site.

- Cellular phone or other communication device will be present on-site during confined space entry in the event of an emergency.

5.7 Rescue Services

- Rescue services will be obtained when self-rescue and non-entry rescue is not sufficient for confined space entry.

- Rescues services will be contracted with **Rescue One Rescue Resources**, operated by Kurt Gesner. Contact phone numbers are 612-680-6360 (pager) and 612-369-6021 (cellular phone).

- **Rescue One Rescue Resources** will prepare a contract for their services in providing on-site, stand-by rescue support for each project.

5.8 Lockout/Tagout

- Connecting process pipelines will be blanked off or separated prior to entry by the client.

- All lockout/tagout procedures shall be followed in securing electrical systems, machinery, pressure systems, and rotating equipment. These procedures will be initiated by the client and confirmed by Barr employees prior to confined space entry.

- Barr staff will use Barr locks on any equipment that is being locked out for safe confined space entry. Refer to *Section J: Lockout/tagout Program*.

5.9 Other

- If welding or cutting is to be performed in a confined space, local exhaust ventilation will be provided. A hot work permit will be obtained from the Client and will be attached to the confined space entry permit.

- The MSDS for hazardous materials being used in a confined space will be incorporated in the confined space entry permit.

- Explosion-proof lighting shall be used in confined spaces unless atmospheric tests have proven that the space is non-explosive.

- Barriers will be set up around confined space in areas of pedestrian or vehicle traffic to protect from hazards created by confined space entry.

- During confined space entry, when other employers are working in the same confined space, Barr staff will meet with each employer to coordinate entry operations. In the event that other employers are creating unsafe conditions for continued entry, Barr staff will leave the confined space and contact the Project Manager.

5.10 Training

- Training will be provided for all employees involved with confined space entries and will be conducted by a competent person in recognizing hazards associated with working in confined spaces or restricted spaces, and performing the worker’s duties in a safe and healthful manner.. Training will be conducted prior to initial confined space entry and prior to change in assigned responsibilities. If known special hazards exist for a confined space, additional training will be provided prior to such confined space entry.

- Training will be updated annually and as necessary to provide for safe entries.
- Training records will be kept in the Barr health and safety administrative files.
- Training records will include employee name, trainer signature, and date of training. These records are available to Barr employees and their authorized representative.

5.11 Review

- In the event that confined space entry measures may not have adequately protected employees during entry, the specific entry procedures will be reviewed and this program will be revised to correct any deficiencies before subsequent entries are authorized.
- Annually, this program will be reviewed, by using canceled permits for the previous 12-month period. Copies of CSEP maintained by Barr Health and Safety staff will be retained for 12 months following the confined space entry. Project file copies of the CSEP will remain with the project file. Appropriate modifications to this program will be made at that time.

ATTACHMENT 1
Confined Space Entry Permit

Barr Engineering Co. – Confined Space Entry Permit

Project Name: ______________________ Project Number: ____________

Project Manager: ______________________ Principle In Charge: ____________

Space to be Entered: ______________________

Purpose of Entry: ______________________

History of Confined Space Entry: ______________________

Effective Date/Time of Permit: ____________ Cancellation Date/Time of Permit: ____________

Authorized Entrants:

Authorized Attendants (Standby person):

Permit Space Hazards (*Check all that apply*)

☐ Oxygen Deficiency (<19.5%)
☐ Oxygen Enrichment (>23.0%)
☐ Flammable Gases or Vapors (>10% LEL)
☐ Toxic Gases or Vapors (> than action level)
☐ Electrical Hazards
☐ Other:
☐ Engulfment
☐ Excavation Entry
☐ Flowing/Standing Water
☐ Heat/Cold Stress
☐ Low Light Conditions
☐ Materials Harmful to Skin
☐ Mechanical Hazards
☐ Overhead Hazards
☐ Slippery Walking Conditions
☐ Tripping/Falling Hazards

Communication Procedures (*Check all that apply*)

☐ Cellular Telephone
☐ 2-Way Radio
☐ Other: ____
☐ Direct Verbal Contact
☐ Visual

Atmospheric Monitoring Equipment (*Check all that apply*)

☐ 4-Gas Meter
☐ H_2S Meter
☐ Other: ____
☐ CO Meter
☐ Other: ____

Personal Protective Equipment (*Check all that apply*)

☐ Gloves
☐ Hard Hat
☐ Hearing Protection
☐ High Visibility Vest
☐ Respirator
☐ Other:
☐ Safety Glasses
☐ Steel Toe Boots
☐ Safety Harness
☐ Coveralls ____
☐ Waders

Safety Equipment (*Check all that apply*)

☐ Barricade/Shields
☐ First Aid Kit
☐ Fire Extinguisher
☐ Flagging
☐ Flash Lights
☐ Other: ____
☐ Hard Hat Light
☐ Hoisting Device
☐ Isolation Methods
☐ Ladder
☐ Ventilation

Emergency Service 911 – Yes – No

	Phone Number:
Fire	____
Police	____
Ambulance	____

Rescue Equipment

☐ Self Rescue
☐ Safety Harness with Lifeline
☐ Hoisting Device
☐ Subcontractor

Atmospheric Checks:	Initial Reading	Continuous Reading	Continuous Reading	Continuous Reading	Continuous Reading	Continuous Reading	Continuous Reading	Continuous Reading
Tester Initials								
Time								
Oxygen >19.5%, <23.0%								
Flammability <10% LEL								
H_2S <5 ppm								
CO <25 ppm								
SO_2 <1 ppm								
Other:								

PERMIT PREPARED BY:

Printed Name ____ Signature ____ Title ____ Date/Time ____

AUTHORIZATION BY PROJECT MANAGER/PRINCIPLE IN CHARGE

I certify that (1) the above conditions are accurate and validate the entry only for the stated purpose, time, and identified employees listed above; and (2) all required precautions have been taken and necessary equipment is provided for safe entry and work in this confined space.

Printed Name ____ Signature ____ Title ____ Date/Time ____

Return original to project file; send copy to Barr Health and Safety Coordinator

Section 10: Lockout/Tagout Program

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Section 10 Lockout/Tagout Program

1.0 Purpose

The purpose of this program is to establish procedures for the safe control of energy through locking and tagging of equipment and machinery at Client Facilities. Lockout/tagout is required when the unexpected start-up of machines or equipment or the release of stored energy could cause injury to Barr staff.

Barr staff may need to work around equipment at a Client's facility and depending upon the work task, this equipment may need to be de-energized before the work can be safety performed. This is accomplished through lockout/tagout procedures. If Barr staff are only observing the work and are not performing any work on the equipment, they would be considered 'Affected Employees", as defined in the following section.

This program is designed to complement a Client's Lockout/Tagout Program. Barr staff should obtain and review a copy of the Client's written Lockout/Tagout program prior to work start-up. Additionally, Barr staff are also advised to review the Client's Energy Control program for specific information on energy isolation locations that will require lockout/tagout.

2.0 Definitions

Affected Employee: An employee whose job requires him/her to work near a machine or equipment on which service or maintenance is being performed under lockout/tagout, or whose job requires him/her to work in an area in which such service or maintenance is being performed. Affected employees must be informed when lockout/tagout is being performed.

Authorized Employee: A person who locks and tags machines or equipment in order to perform service or take measurements on that machine or equipment.

Energy Isolating Device: A mechanical device that physically prevents the transmission or release of energy, including a manually operating electrical circuit breaker, a disconnect switch, a line valve, a block and any similar device used to block or isolate energy.

Energy Source: Any source of electrical, mechanical, hydraulic, pneumatic, chemical, thermal, or other energy.

Lockout: The process used to identify, cut off and secure all energy sources before beginning repairs, adjustments or maintenance. A lockout device is used to secure equipment or machinery in the off position, ensuring that the equipment or machinery cannot be operated.

Lockout Device: A device that utilizes a lock (either key or combination type) that holds an energy isolating device in a safe position and prevents the machine or equipment from energizing. If an energy source cannot be locked out, a tagout system shall be utilized.

Servicing and/or Maintenance: Workplace activities that require lockout/tagout on the equipment before beginning the activity because employees may be exposed to the unexpected energization or startup of the equipment or the release of hazardous energy. Servicing and/or maintenance includes constructing, installing, setting up, adjusting, inspecting, modifying, taking measurements, lubricating, cleaning or unjamming and making tool changes.

Tagout: Attaching a tag to the lock on the power source that has been shut off, indicating the time, reason for the lockout and the name of the person doing the work. The tag acts as a warning not to restore energy to the equipment or machinery.

Tagout Device: A warning tag (weather and chemical resistant) standardized in size, color and with a hazardous energy warning such as “Do Not Start”, “Do Not Open”, “Do Not Close”, “Do Not Energize” or “Do Not Operate”.

3.0 Lockout/Tagout Activities

When working a Client’s facility, Barr staff will follow the lockout/tagout procedure developed by the Client. Each Barr staff person on-site, working around equipment that will require lockout, will have a lock for each identified energy source. Although Barr may be working closely alongside the client, Barr staff are required to place their own locks on all equipment requiring lockout/tagout, as required by OSHA. When an energy-isolating device cannot accept multiple locks and tags, a multiple lockout device may be used.

During a shift change or personnel change, exiting Barr staff are required to meet oncoming personnel at the lockout/tagout device. The oncoming authorized personnel should place his/her lock or tag on the energy isolating device before the exiting authorized personnel removes his/her lock or tag. If this is not possible, the oncoming authorized personnel should place his/her lock or tag on the energy isolating device immediately after the exciting authorized personnel removes his/her lock or tag. Exiting Barr staff will inform oncoming personnel of any problems or concerns regarding the service and maintenance of machinery or equipment.

If Barr staff are only observing the work and are not performing any work on the equipment, they would be considered ‘Affected Employees” and are not required to perform lockout/tagout operations. These staff should be informed when lockout/tagout is being performed and should be advised on how to maintain a safe distance from the work being performed.

3.1 Project Managers are expected to make arrangements for the following:

- All employees who are authorized to service equipment within a Client’s Facility have received training on appropriate lockout/tagout procedures and energy control plans. Data on employee safety training status is available from the safety staff.
- Only authorized employees service/maintain/take measurements on equipment and machinery in a Client’s Facility.
- The Client’s Lockout/Tagout Plan is reviewed for specific pieces of equipment or processes within the facility prior to the start-up of on-site project work.
- Appropriate energy isolation devices are incorporated for affected equipment that will require lockout/tagout for specific project tasks or processes within the Client’s Facility.
- Subcontractor activities that may affect lockout/tagout and energy control procedures at a Client’s Facility are coordinated with appropriate Client and Barr staff.

3.2 Barr staff are required to follow the below procedure for application of energy control, in sequence:

- Before an authorized or affected Barr staff turns off a machine or equipment, they are required to have knowledge of the type and magnitude of the energy, the hazards of the energy to be controlled, and the methods or means to control the energy.
- Barr staff will follow the client’s safety procedures and refer to the manufacturer’s instructions before turning off or shutting down any machine or equipment.

- Barr staff must make sure all energy isolating devices that are needed to control the energy or equipment are located and operated in such a manner as to isolate the machine or equipment from the energy source. Barr staff will verify that the main breaker or control switch has been shut off, all valves have been closed, and all process lines have been disconnected.

- Barr staff will attach lock and tag devices, with the name of the individual(s) placing the device, for each Barr staff onsite.

- Following the application of lockout or tagout devices to energy isolating devices, Barr staff will verify that the electrical capacitance has been bled, all pressure or hydraulic lines from work areas have been vented or isolated, tanks have been drained, switches or levers that could be moved into the start position have been blocked, clamped, or chained, and all lines containing process materials that are toxic, hot or corrosive or asphyxiating are cleared.

- Lastly, Barr staff will verify that the energy state is zero by making sure the switches on the equipment have been tested, pressure gauges have been checked to insure that the lines are depressurized, electrical circuits have been checked to verify that voltage is at zero energy and that blanks, used to block feed chemicals, are secure and not leaking.

3.3 The following procedure must be followed in sequence by Barr staff for safety testing machines or equipment when a lockout or tagout device must be temporarily removed:

- Clear the machines or equipment of tools and materials.

- Remove employees from the machine or equipment area.

- Remove the lockout or tagout devices as specified.

- Energize and proceed with testing.

- Deenergize all systems, isolate the machine or equipment from the energy source, reapply control measures and reapply lockout or tagout devices as specified.

- Barr staff shall document the procedure, including the name of who performs and verifies the procedure (see “Safe Startup Checklist,” Figure J-2).

3.4 The following guidelines are provided to assist in the lockout/tagout procedure:

- Review the Client’s Lockout/Tagout Program.
- Identify potential energy sources that will need to isolated for work project.
- Identify lockout/tagout locations for each energy source. Confirm with client on use of client’s valve covers, switch covers, lockout hasps, circuit breaker lockout, etc.
- Obtain appropriate number of locks and covers from Equipment Coordinator.
- Perform lockout/tagout in conformance with Client’s Energy Control Program.

Lockout/tagout checklists (Figures J-1 and J-2) provide a summary for Lockout/Tagout procedure and equipment start-up.

4.0 Training

All Barr employees whose work involves working in close proximity to operating equipment that requires lockout/tagout will receive training in lockout/tagout procedures. Barr staff are required to receive retraining when there is a change in job assignments, in machines, a change in the energy control procedures, or a new hazard is introduced. Additionally, all Barr staff are expected to receive training on Client-specific lockout/tagout procedures.

5.0 Evaluation

Periodically, project staff will be asked to perform a self-evaluation on lockout/tagout procedures. Figure J-3 provides a format for this evaluation.

6.0 Recordkeeping

- The Barr Equipment Coordinator will maintain a record of all locks distributed to Barr staff.
- The Project Lockout/Tagout Checklists will be filed with project files.

- Training records and completed evaluation forms will be maintained by Safety and will be maintained in Human Resources file cabinet. Barr documents training and/or retraining with the employee’s name and dates of training

Figure 1

Lockout/Tagout Checklist

Step 1: Before Beginning to Perform Work Near Equipment	**Yes**	**No**	**NA**
Have the type and amount of energy source on the equipment been identified?	☐	☐	☐
Have the possible dangers related to the energy source being controlled been identified?	☐	☐	☐
Are the steps necessary to control the energy source understood?	☐	☐	☐
Have all affected employees been notified when the equipment will be shut off for service?	☐	☐	☐
Step 2: Shut Down Equipment			
Have the client’s safety procedures been followed?	☐	☐	☐
Have the manufacturer’s instructions been referred to?	☐	☐	☐
Step 3: Isolate the Machine or Equipment			
Has the main breaker or control switch been shut off?	☐	☐	☐
Have valves been closed?	☐	☐	☐
Have process lines been disconnected?	☐	☐	☐
Step 4: Attach Lock and Tag			
Have the lock and tag devices been attached for each Barr staff on-site?	☐	☐	☐
Have the lock and tag devices included the name of the individual(s) placing the device?	☐	☐	☐
Step 5: Control Stored Energy			
Has the electrical capacitance been bled?	☐	☐	☐
Have pressure or hydraulic lines from the work area been vented or isolated?	☐	☐	☐
Have tanks been drained?	☐	☐	☐
Are switches or levers that could be moved into the start position blocked, clamped, or chained?	☐	☐	☐
Are lines containing process materials that are toxic, hot, cold, corrosive or asphyxiating cleared?	☐	☐	☐
Step 6: Verify That the Energy State is at Zero			
Have the start switches on the equipment been tested?	☐	☐	☐
Have pressure gauges been checked to insure that lines are depressurized?	☐	☐	☐
Have electrical circuits been checked to verify that voltage is at zero energy?	☐	☐	☐
Are blanks, used to block feed chemicals, secure and not leaking?	☐	☐	☐
Step 7: If you have answered yes to the above steps, begin working.			

Figure 2

Safe Startup Checklist

Name ______________________________ Date __________________________

Evaluator Name ______________________________

Step 1: Inspect the Area	**Yes**	**No**	**NA**
Are all machine components operational?	☐	☐	☐
Are all safety guards in place?	☐	☐	☐
Have all tools been removed and cleared away from the machine?	☐	☐	☐
Have employees been removed from the machine or equipment area?	☐	☐	☐
Have all braces, pins, blocks and chains been removed?	☐	☐	☐
Are all pressure tubing, pipes and hoses connected with valves closed?	☐	☐	☐
Is the work area clear for mechanical operation?	☐	☐	☐
Step 2: Remove Lockout Devices and Tags	☐	☐	☐
Step 3: Notify Affected Employees			
Is the work area cleared before starting up the equipment?	☐	☐	☐
Has the servicing been completed and the locks and tags removed?	☐	☐	☐

Step 4: If you answered yes to all the above, start up the equipment.

Figure 3

Annual Lockout/Tagout Evaluation Form

Client ______________________________ Date ______________________________
Evaluator Name ______________________________ Title ______________________________

Describe the job being evaluated:

____
____
____

Names of persons working on the job:	Check the persons being interviewed
	☐
	☐
	☐
	☐
	☐
	☐

	Yes	No	Comments
Did authorized employees understand their responsibilities under the Lockout/Tagout Program?			
Were locks and tags in place?			
Were affected employees notified?			
Was the Lockout/Tagout checklist completed?			
Were all company safety procedures being followed?			

Section 11 Excavation Safety Procedures

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Section 11: Excavation Safety Procedures

1.0 Introduction

Barr personnel shall not enter any excavation for work purposes without a clearly defined need. All work around excavations and all excavation entry will be performed in accordance with the OSHA Construction Excavation Standard (29 CFR 1926 Subpart P).

Prior to any work around excavations, an inspection and, if necessary, excavation entry approval is required. This inspection should be performed by a Barr Competent Person, in situations where Barr controls the site, or an Excavation Safety-Trained Barr Employee, in situations where Barr does not control the site. The inspection will determine if it is safe to work around or to enter into the excavation, and will identify hazards to be corrected. The site's Competent Person (a Barr employee, when Barr controls the site, or the competent person employed by the owner or the contractor when Barr does not control the site) must approve excavation entry and complete the Excavation Safety Checklist.

Excavation entry must also be approved by Barr's PM, PIC, designated alternate or Barr's geotechnical expert, except when the depth of the excavation is less than four (4) feet, when the excavation's side slopes are flatter than 4H:1V and the excavation depth is less than 20 feet, or when the excavation is a "wide excavation" as defined herein.

2.0 Definitions

2.1 Excavation

An excavation is any man-made cut, cavity, trench, or depression formed in the earth's surface by an earth removal or earth moving process for purposes of construction or site investigation.

2.2 Control of the Site

The entity with control of the site has the authority to direct the activities of the workers performing earth removal or earth moving operations. During typical site investigation activities where Barr's subcontractors are performing excavation activities, Barr is considered in control of the site. During typical construction observation activities involving one or more of the Owner's contractors, the contractor or the Owner is considered in control of the site. However, other contractual situations can also occur that may modify control of the site for either investigation or construction observation activities. Barr considers control of site an important determination whether one can qualify as a competent person—see following definition.

2.3 Competent Person

A Competent Person is an individual who:

- Is capable of identifying existing and predictable hazards or working conditions which are hazardous, unsanitary or dangerous to employees, and

- Has the authority (i.e., through control of site) to take prompt corrective measures, or to direct that prompt corrective measures be implemented, to eliminate or control these hazards and conditions.

When Barr has control of the site, the Competent Person will be a designated Barr staff person who meets the above criteria and who is an Excavation Safety-Trained Barr Employee (see definition below). When Barr does not have control of the site, the Competent Person will be an Owner's designated employee or a designated employee of Owner's contractor.

2.4 Excavation Safety-Trained Barr Employee

An Excavation Safety-Trained Barr Employee is a staff member who has received training that includes the following items:

- The requirements of the excavation entry procedures.

- The requirements of the OSHA Excavation Standard.

- Properties of soils and methods to classify soils in accordance with the requirements of the OSHA Excavation Standard.

- Construction methods including determination of inclination of side slopes and common uses of shoring, sheeting, trench boxes, benched excavations, and excavation machinery.

- Construction site health and safety.

2.5 Side Slopes

Side slopes are vertical or inclined earth surfaces formed as a result of the excavation work.

2.6 Slopes 1.5H:1V or Flatter

Side slopes that are sloped at an angle not steeper than one and one-half units horizontally to one unit vertically (34° from horizontal).

2.7 Slopes 4H:1V or Flatter

Side slopes that are sloped at an angle not steeper than four units horizontally to one unit vertically (14° from horizontal).

2.8 Wide Excavations

Wide Excavations have length and width dimensions such that there is a portion of the area within the limits of the excavation in which Barr staff may safely perform their work without further regard for PM/PIC excavation entry approval. The area excluded from PM/PIC excavation entry approval should be at least at a horizontal distance (as measured from the base of the slope) of twice the vertical height of the sloped portion. Certain excavations may be designated as a Wide Excavation upon inspection by an Excavation Safety-Trained Barr Employee (when others control the site) or Barr Competent Person (when Barr controls the site).

2.9 PM

Barr’s project manager for the project.

2.10 PIC

Barr’s principal in charge for the project.

2.11 Barr Geotechnical Expert

One of several designated Barr staff who have geotechnical expertise. The geotechnical expert will be available for consultation with project teams and onsite staff during project planning and implementation.

2.12 Confined Space

A space large enough and configured so employees can bodily enter to perform work, has limited or restricted means of entry or exit, and is not designed for continuous occupancy.

3.0 Excavation Entry Procedures

3.1 PM/PIC Excavation Entry Approval

It is the policy of the Company to avoid entry into excavations unless it is necessary. Therefore, no Barr employee shall enter an excavation unless it has been clearly demonstrated that entry is necessary to perform a work task. Careful consideration should be given to developing alternative methods of accomplishing the work without entering the excavation. Excavation entry should be considered the method of last choice for performance of any work task. Only when it is demonstrated that entry into an excavation is necessary to perform a work task, and the Competent Person onsite, and either the PM, PIC, alternate PM/PIC, or the geotechnical expert, agrees that it is necessary to perform that work task, the excavation entry authorization procedures described below will be implemented.

Barr encourages the project team to anticipate the need for excavation entry and the development of alternatives to excavation entry. Approval for excavation entry from the PM or PIC can be obtained before the project begins or during the project through a memorandum. This memorandum should describe the work authorized, potential alternatives to excavation entry, and contingencies which would require daily PM/PIC approval and this documentation requires signature of both the PM and PIC. For projects where this pre-planning has not occurred, daily PM/PIC approval is required.

Any cut, cavity, trench, or depression that is less than four (4) feet in depth, has side slopes of approximately 4H:1V or flatter (up to a depth of 20 feet), or a “wide excavation,” do not require PM/PIC approval prior to excavation entry.

3.2 Control of the Site by Barr

When Barr has control of the site, Barr’s Competent Person may authorize excavation entry, whether by Barr staff, the employees of Barr’s subcontractors, or anyone else including the Owner and representatives of any regulatory agency, only when:

- It has been demonstrated that excavation entry is necessary to perform a specific work task.

- The Competent Person performs an inspection of the excavation.
- The Competent Person completes the Excavation Safety Checklist.
- The Competent Person concludes that the excavation complies with the requirements of the OSHA Excavation Standard.
- Approval for excavation entry has been obtained from either the PM, PIC, alternate PM/PIC, or the Barr geotechnical expert (see above). This prior approval is not required for Wide Excavations, for excavations less than 4 feet deep, for excavations less than 20 feet deep with side slopes flatter than 4H:1V, and for inactive excavations for which the Excavation Safety Checklist documents that there have been no changes in the conditions in the excavation, but where Barr's Competent Person has determined that the excavation is safe for entry.

Active excavations require inspection and authorization by the Competent Person prior to each and every entry to the excavation. Entry to inactive excavations requires inspection and authorization by a Competent Person on at least a daily basis.

3.3 Control of the Site by Others

An Excavation Safety-Trained Barr Employee may authorize excavation entry by Barr staff only when:

- Entry is necessary to perform a work task.
- The Excavation Safety-Trained Barr Employee has met with the Competent Person representing the entity that has control of the site and that person has confirmed that the excavation complies with the requirements of OSHA Excavation Standard for entry. If the excavation is shored, shielded, or benched, the Competent Person will also furnish the Excavation Safety-Trained Barr Employee with design drawings (prepared and certified by a Registered Professional Engineer when required) of shoring, shielding, or benching.
- The Excavation Safety-Trained Barr Employee performs an inspection of any sloping, shielding, shoring, or benching; determines that it is in a good state of repair; and finds that it conforms with drawings furnished by Competent Person.
- The Excavation Safety-Trained Barr Employee performs an inspection of the excavation.

- The Excavation Safety-Trained Barr Employee completes the Excavation Safety Checklist.
- The Excavation Safety-Trained Barr Employee concludes that the excavation complies with the requirements of the OSHA Excavation Standard.
- Approval for excavation entry has been obtained from either the PM, PIC, alternate PM/PIC, or the Barr geotechnical expert. This prior approval is not required for most Wide Excavations for excavations less than 4 feet deep, for excavations less than 20 feet deep with side slopes flatter than 4H:1V, and for inactive excavations for which the Excavation Safety Checklist documents that there have been no changes in the conditions in the excavation, but where the Competent Person representing the entity that has control of the site has determined that the excavation is safe for entry.

The Excavation Safety-Trained Barr Employee should be prepared to discuss the reason that the entry is required and be able to describe the current conditions of the excavation.

4.0 Other Considerations

4.1 Hazardous Atmosphere

Monitoring of the atmosphere is required if the excavation is being conducted in contaminated soils, or if the excavation is suspected to have the potential to create a hazardous atmosphere in the area adjacent to the excavation or in the excavation itself. Monitoring for toxic substances, oxygen content, and combustible gases will be conducted as required in the PHASP. The atmosphere shall be presumed to be potentially hazardous if the excavation is taking place at an identified hazardous waste site, if the excavation contains any pipeline carrying hazardous materials, or if the excavation is at a facility where hazardous materials are used or stored and soil contamination is expected.

4.2 Confined Space Entry Permit

If there is a reasonable possibility that hazardous atmospheres may be encountered during the entry to the excavation, a Confined Space Entry Permit, will also be required prior to entry.

4.3 Shielding and Shoring

A shield or shield system is a structure that is able to withstand a cave-in. Shields can be permanent or portable. Shields can be premanufactured or job-built in accordance with 29 CFR 1926.652, (c)(3) or (c)(4). Shields used in trenches are commonly referred to as “trench boxes” or “trench shields.” Shields must be:

- Suitable for the depth of excavation in which they are to be used.
- Must be in good state of repair.
- Must include all structural elements shown on detailed drawings, whether premanufactured or job-built; and should not be modified in any manner not shown on the detailed drawings.

Shoring is a sheet pile, mechanical, or timber system that supports the sides of an excavation to prevent cave-ins. Shoring must be in a good state of repair and must include all structural elements of the size and material shown on detailed drawings.

When control of the site is by Barr, no Barr staff, employees of Barr’s subcontractors, representatives of the Owner, or representatives of regulatory agency shall be authorized to enter the excavation when a shield fails to meet these requirements or is for any reason deemed inadequate. When control of the site is by others, no Barr staff shall be authorized to enter the excavation when a shield fails to meet these requirements or is for any reason deemed inadequate.

4.4 Benching

Benching involves excavating the sides of an excavation to form a series of one or more horizontal levels or steps with vertical or sloped surfaces between levels. The requirements for benching will be determined on a case-by-case basis by Barr’s PM, PIC, or geotechnical expert.

4.5 Excavations Over 20 Feet Deep

Sloping, benching, or shoring for excavations shall be designed and certified by a Professional Engineer (P.E.) registered in the state in which the excavation is being performed.

Control of the Site by Barr:

The sloping, benching, or shoring must be designed and certified by a Barr Registered Professional Engineer who is experienced in geotechnical and structural engineering or by a subconsultant retained by Barr (not retained by Barr’s subcontractor) for the purpose of preparing and certifying the design. Barr’s representatives will continuously monitor sloping, benching, or shoring for conformance with the design drawings and for any required maintenance. No employee of Barr nor any of Barr's subcontractors or others, including representatives of the Owner and regulatory agencies, shall be authorized to enter the excavation under any circumstances whatsoever unless the excavation complies with the design drawings (and all other requirements for excavation entry are met).

Control of the Site by Others:

The sloping, benching, or shoring must be designed and certified by a Registered Professional Engineer employed by or retained by the entity that has control of the site. No Barr employee may be authorized to enter the excavation until the Excavation Safety Checklist has been completed by the Excavation Safety-Trained Barr Employee on the site.

4.6 Wide Excavations

Wide Excavations have length and width dimensions such that there is a portion of the area within the limits of the excavation in which Barr staff may safely perform their work without further regard for excavation entry approval. The area excluded from excavation entry approval should be at least at a horizontal distance (as measured from the base of the slope) of twice the vertical height of the sloped portion. Certain excavations may be designated as a Wide Excavation upon inspection by an Excavation Safety-Trained Barr Employee (when others control the site) or Barr Competent Person (when Barr controls the site).

Wide Excavations must also have routes of ingress and egress which are on-grade or involve slopes not greater than 4H:1V. These routes shall be inspected by an Excavation Safety-Trained Barr Employee/Competent Person and be otherwise safe for entry according to the Excavation Safety Checklist. The designation of a Wide Excavation should be documented by an Excavation Safety-Trained Barr Employee/Competent Person.

The Excavation Safety-Trained Barr Employee designating the Wide Excavation shall also designate those portions of such Wide Excavation which Barr staff cannot enter without obtaining PM/PIC excavation entry approval. The limits of the routes of ingress and egress and the area within which Barr staff may perform their work tasks without daily PM/PIC approval will be delineated in the field using fencing, tape, lathe, spray paint, or any other physical marker. Wide Excavations should be inspected at least daily by an Excavation Safety-Trained Barr Employee/Competent Person to verify that conditions within such Wide Excavation do not require a revision of delineated limits. The delineation shall be maintained at least daily. The daily inspection and maintenance of delineated limits should be documented by an Excavation Safety-Trained Barr Employee/Competent Person.

5.0 Reporting of Excavation Safety Deficiencies

5.1 Control of the Site by Barr

Barr staff working with any Barr subcontractor that is conducting excavation activities that are unsafe should immediately direct subcontractor's site superintendent to comply with the requirements of the contract and to correct any deficiencies without delay and before proceeding with the work. Barr staff and Barr's subcontractor will not be authorized entry into the excavation until the identified deficiencies are corrected. After directing Barr's subcontractor, Barr's staff shall also report all deficient excavation entry practices by Barr's subcontractor to the PM or PIC. Prior to going into the field, each Barr employee shall obtain from the PM or PIC a list of alternate PMs and PICs to be contacted in the event that neither the PM or PIC are available.

The PM, PIC, or a designated alternate shall determine whether Barr's subcontractor's response to the Barr employee's direction has been adequate to correct the deficient excavation entry practices. If the response is not adequate, the PM, PIC, or designated alternate should suspend Barr's subcontractor's work until Barr's subcontractor agrees to correct the deficient conditions and acts to correct those conditions.

5.2 Control of the Site by Others

Barr staff, serving as construction observers, should report any obviously deficient excavation entry practices immediately to the PM, PIC, or a designated alternate. After appropriate consultation with the PM, PIC, or designated alternate, the PM, PIC or alternate will determine whether to call deficient entry practices to the attention of the Owner, the Owner's contractor, or both.

5.3 Unauthorized Excavation Entry by Barr Staff

Any Barr employee observing another Barr employee entering an excavation without the authorization required by these Excavation Entry Procedures shall:

1. Immediately inform the other Barr employee that further entry should not occur until authorized.

2. Notify the PM or PIC of the circumstances and identity of the employee involved, if the employee does not leave the excavation.

Repeated excavation entry by a Barr employee without the required authorization will be cause for disciplinary action by Barr.

6.0 Excavation Safety Checklist

In addition to other requirements, an Excavation Safety Checklist (Form K-1) will be completed prior to excavation entry. The Excavation Safety Checklist is presented in decision tree format in Figure K-1. The elements of the checklist (and decision tree) are described in the following paragraphs.

6.1 Control of the Site

Barr staff should obtain this information from the PM or PIC before going to the site.

6.2 Confer with Competent Person

The Excavation Safety-Trained Barr Employee has met with the Competent Person representing the entity that has control of the site and said Competent Person has confirmed that in his/her opinion the excavation complies with the requirements of OSHA Excavation Standard for entry.

6.3 Side Slopes 4H:1V or Flatter

For any cut, cavity, trench, or depression formed in the earth’s surface has side slopes of approximately 4H:1V or flatter, and for which the Competent Person has approved entry, the PM/PIC does not need to additionally approve entry.

6.4 Less Than Four (4) Feet Deep

For any cut, cavity, trench, or depression formed in the earth’s surface has a depth of less than four (4) feet, and the Competent Person has approved entry, the PM/PIC does not need to additionally approve entry.

6.5 Hazardous Atmosphere

Monitoring for toxic substances, oxygen content, and combustible gases will be conducted if a hazardous atmosphere is suspected.

6.6 Complete CSE Permit

A Confined Space Entry (CSE) Permit is required for entry if there is a reasonable possibility that hazardous substances may be encountered during entry.

6.7 Obtain Drawings of Shielding, Shoring, or Benching

If the excavation is sloped, shored, shielded, and/or benched, the Competent Person representing the entity that has control of the site has furnished the Excavation Safety-Trained Barr Employee with design drawings (prepared by and certified by a Registered Professional Engineer when required by regulation or specification) of sloping, shoring, shielding, and/or benching.

6.8 Greater Than 20 Feet Deep

Excavations that are greater than 20 feet deep are required to be designed by a Registered Professional Engineer. The excavation must, however, comply with the requirements of the OSHA Excavation Standard before entry can be approved.

6.9 Design by Professional Engineer

Sloping, shielding, benching, or shoring systems for excavations greater than 20 feet deep shall be designed by a Professional Engineer (P.E.) registered in the state in which the excavation is located.

6.10 Slopes 1.5H:1V or Flatter

The side slopes of the excavation must be sloped at an angle that is flatter than one and one-half horizontal to one vertical (34 from horizontal).

6.11 Soil Classified and Allowable Slope Documented

Soils should be classified using the visual and manual soil classification methods described in the OSHA Excavation Standard (29 CFR 1926 Subpart P) to determine the maximum allowable slope.

Results of this classification and the allowable slope shall be documented in the Project Field or Safety Diary or on the Daily Safety Report form in the PHASP.

6.12 Inspect Sloping, Shielding, Shoring, and/or Benching

Verify that sloped portions of the excavation:

- are 1.5H:1V or flatter; or
- are flatter than the maximum allowable slope; or
- comply with the requirements of the Registered Professional Engineer’s certified design.

For excavations that include shielding, shoring, and/or benching systems, verify that the shielding, shoring, and/or benching systems are in good state of repair and comply with the relevant drawings (certified by Registered Professional Engineer for excavations more than 20 feet deep).

Inspection shall verify that sloping, shielding, shoring, and/or benching systems conform to all requirements and details before excavation entry can be approved.

6.13 Encumbrances Stabilized

Any surface or subsurface obstruction (such as pipes, utilities, cables, towers, trees, boulders, etc.) that creates a potential hazard to employees must be removed, protected, or stabilized to make them safe before excavation entry can be approved.

6.14 Good Egress Within 25 Feet/Fall Protection

In trench excavations, an easily-used, structurally-sound means of exit (stairway, ladder, ramp, or other safe means) must be provided within 25 feet of the work area before excavation entry can be approved. Fall protection will be provided at crossings and walkways over the excavation.

6.15 Protection From Falling Hazards/Vehicular Traffic

Examples of falling hazards include:

- Loads handled by lifting or excavating equipment.
- Construction material stored adjacent to excavation.

- Material falling from vehicles being loaded and unloaded.
- Mobile equipment.

The following protective measures from falling hazards and vehicular traffic must be implemented before excavation entry can be approved:

- Prohibiting employees from being under loads handled by lifting and excavating equipment.
- Requiring all employees to wear high-visibility vests.
- Standing away from vehicles being loaded and unloaded.
- Provision of warning systems such as barricades.
- Reducing the slope of the spoil pile adjacent to the excavation.

6.16 Protection From Accumulating Water

Precautions to protect employees from the hazards posed by water accumulation include:

- Observe for instabilities related to water seeping into excavation.
- Use of special support or shield systems (cave-in prevention).
- Availability and use of water removal systems in the event that water enters the excavation.
- Sloping the soil at the edge of the excavation away from the excavation.

Such measures must be provided for before excavation entry can be approved.

6.17 Protection From Loose Rock and Soil

Protection from loose rock, soil, or other material or equipment that may fall or roll into the excavation from the excavation face or edge includes:

- Scaling to remove loose material (scaling means use of excavation equipment to remove loose material from excavation sides).
- Keeping equipment at least two (2) feet from excavation edge.

- The excavation must be safe from loose rock and soil before excavation entry can be approved.

6.18 Excavation Complies

The Barr's Competent Person onsite (when site is controlled by Barr) or the Excavation Safety-Trained Barr Employee (when site is controlled by others) concludes that the excavation complies with the requirements of the OSHA Excavation Standard. If there are any questions with regard to compliance with the OSHA Excavation Standard or safety of the excavation, Barr'' on-call geotechnical expert should be consulted before proceeding.

6.19 Confer With Barr's PM or PIC

When the site is controlled by others, the Excavation Safety-Trained Barr Employee will confer with Barr's PM or PIC regarding the procedure followed and the Excavation Safety-Trained Barr Employee's observations and conclusions.

6.20 Entry Approval by Barr's PM or PIC

When the site is controlled by others, the Excavation Safety-Trained Barr Employee will receive specific approval from Barr's PM or PIC to authorize excavation entry.

6.21 Barr's Competent Person Onsite Approves

When the site is controlled by Barr, Barr's Competent Person onsite will authorize each and every excavation entry.

6.22 Procedure Documented in Writing

The procedure followed, the conditions observed, and specific written authorization for the excavation entry will be documented prior to each excavation entry.

7.0 Training

Barr will provide excavation and trench safety training to employees. This training includes, as a minimum:

- The requirements of the OSHA Excavation Standard and Barr's Excavation Safety Program.

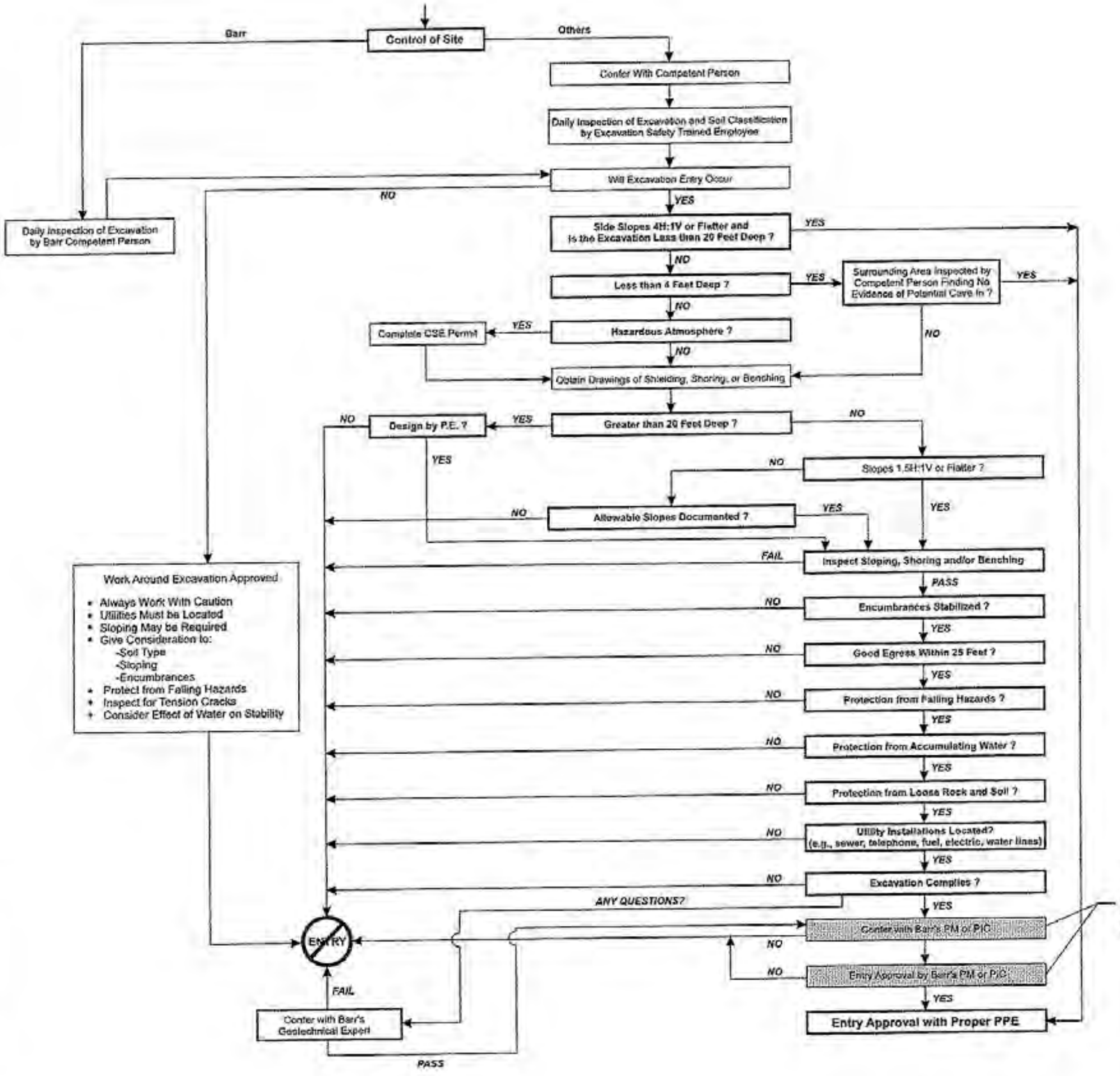
- Construction site safety and personal protective equipment and clothing.

In addition, Barr will provide additional training to Barr staff to be designated as Excavation Safety-Trained Barr Employees or as a Competent Person. This training includes, as a minimum:

- Properties of soils and methods to classify soils in accordance with the requirements of the OSHA Excavation Standard.
- Construction methods, including common uses of shielding (such as trench boxes), shoring, benching, and excavation machinery.
- Field training.

8.0 OSHA Excavation Entry Standard

The OSHA Excavation Standard contains information on: soil classification, sloping and benching, and selection of a protection system. The OSHA Excavation Standard should be referred to prior to excavation entry.



NOTE:
Pre-Project Planning and Documentation can Replace these Steps.
Proper Inspection, Maintenance, and Documentation of Wide Excavation can Replace these Steps.

Figure K-1

EXCAVATION SAFETY CHECKLIST

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Form 1

Barr Engineering Company
Daily Excavation Safety Checklist
(To be completed by Barr Competent Person or Excavation Safety Trained Barr Employee)

Project Name:		Project Number:
Site Location:		Checklist Completed by:
Date:	Time:	
Control of Site: (check one) Barr________ Others ________		
Competent Person Onsite:		
Soil Classification (Attach form):		
Excavation Depth:	Excavation Width:	
Type of Protective System Used:		

(Check each item: Yes – No – and Read Comment. If yes, Continue with Checklist. If no, continue as directed or Skip to Line D2.)	**Yes**	**No**	**Comment**
A) Site Control/Will Excavation Entry Occur?			
1. Is Barr in Control of the Site?			If no, skip to line A3.
2. Are you Barr's Competent Person for this project?			If no, have Barr's Competent Person complete this checklist. If yes, skip to line A8.
3. Have you conferred with the Competent Person for the site?			
4. Have you completed inspection of the excavation and surrounding area?			
5. Does the Competent Person have the authority to take prompt corrective measures (remove employees from the excavation immediately if needed)?			
6. Has Competent Person conducted daily inspections of excavations, adjacent areas, and protective systems?			
7. Does the Competent Person confirm that, in their opinion, the excavation complies with the OSHA Standard?			
8. Will a Barr Employee or Barr Subcontractor enter the excavation? If no: Always work with caution around excavations, whether or not the excavation is entered. Utilities must be located for all excavation work (call first before you dig). Some soils may require sloping to work safely on the surface adjacent to excavations. Work around excavations (without entry) may require consideration of soil type and sloping, encumbrances, protection from falling hazards, inspection for tension cracks, and consideration of the effects water on the stability of the excavation. Checklist is complete.			If no, excavation entry cannot occur without completing the rest of the checklist. If yes, continue with the rest of the checklist.
B) General Inspection of Jobsite:			
1. Are sideslopes 4H:1V or flatter and is the excavation less than 20 feet deep?			If yes, checklist is complete and Excavation complies. Go to line C1. If no, continue.
2. Is the excavation less than 4-feet deep and has the surrounding area been inspected by finding no evident of potential cave-in?			If yes, checklist is complete and Excavation complies. Go to line C1. If no, continue.

(Check each item: Yes – No – and Read Comment. If yes, Continue with Checklist. If no, continue as directed or Skip to Line D2.)	**Yes**	**No**	**Comment**
3. Is there a known hazardous atmosphere or potential to create a hazardous atmosphere? - The atmosphere within the excavation must be tested when there is a reasonable possibility of an oxygen deficiency, combustible, or other harmful contaminant exposing employees to a hazard. - Confined space entry procedures must be followed to protect employees from exposure to an atmosphere containing less than 19.5% oxygen, greater than 20% of the LEL, and/or to other hazardous atmosphere. - Ventilation may have to be provided to prevent employee exposure to oxygen deficiency, combustible or other hazardous atmospheres - Employees must be trained in confined space entry, use of personal protective equipment, and the use of other rescue equipment.			If no, continue to line B4. If yes, complete confined space entry permit and continue.
4. If used, obtain drawings of shielding, shoring or benching.			Go to next line.
5. Is the excavation greater than 20 feet deep?			If yes, the answer to B6 must also be yes. If no, skip to line B7.
6. Has a Professional Engineer designed the excavation, and do you possess copies of the signed design drawings?			If yes, skip to line B9.
7. Are the side slopes 1.5:1V or flatter?			If yes, skip to line B9.
8. Have the soils been classified and has the allowable slope been determined in accordance with the OSHA Excavation Standard and documented?			If no, perform the classification, determination, and documentation before proceeding.
9. Inspect sloping, shielding, shoring and/or benching. Have these protective systems been found to be in good state of repair and, if applicable, been found to conform to the certified design drawings?			
10. Have surface encumbrances been removed, protected, or stabilized? - Surface encumbrances are any surface or subsurface obstruction located so as to create a hazard to employees.			
11. Inspect access and egress. Is there good access and egress? - A stairway, ladder, ramp or other safe means of egress shall be located in trench excavations that are greater than 4-feet deep as to require no more than 25 feet of lateral travel for employees. - Ladders used in excavations must be secured and extend 3 feet above the edge of the trench. - Structural ramps used by employees must be designed by a Competent Person. - Structural ramps used for equipment must be designed by a Registered Professional Engineer (RPE). - Employees must be protected from cave-ins when entering or exiting the excavation. - Walkways and bridges over excavations 4 feet or more in depth must be equipped with standard guardrails and toeboards.			
12. Have protective measures from falling hazards been adopted or implemented? - Employees are prohibited from going under suspended loads and equipment. - Employees are prohibited from working on the faces of sloped or benched excavations above other employees.			

(Check each item: Yes – No – and Read Comment. If yes, Continue with Checklist. If no, continue as directed or Skip to Line D2.)	**Yes**	**No**	**Comment**
13. If there is accumulating water in the excavation, have precautions been taken to protect employees? Water in the excavation, whether accumulating or accumulated, requires adequate precautions. • Surface water runoff should be diverted or controlled to prevent accumulation in the excavation. • Inspections of the excavation should be made after every rainstorm (or after any other hazard-increasing occurrence).			
14. Is there protection from loose rock or soil or other material or equipment that may fall or roll from the face or edge of the excavation?			
15. Have utility companies been contacted and/or have utilities been located? • Location of utilities must be marked. • Underground installations must be protected, supported, or removed when excavation is open.			
C) Barr PM/PIC Approval			
1. Can it be concluded that the excavation complied with the requirements of the OSHA Excavation Standard?			If there are any questions about conditions, call Barr geotechnical expert before continuing.
2. Has Barr's Competent Person onsite given approval for the excavation entry?			
3. Have you conferred with Barr's PM or the PIC regarding your observations and conclusions and the need to enter excavation?			
4. Has Barr's PM or the PIC given their approval for the excavation entry?			
5. Have you documented the procedures followed, the conditions observed, and the specific authorization for the excavation entry?			
D) Excavation Approval			
1. Excavation entry is **APPROVED** consistent with proper personal protection equipment.	Excavation Entry Approved		
2. Excavation entry is **NOT APPROVED** and under no circumstances shall the excavation be entered by: • Any Barr employee, employee of Barr's subcontractor(s), or other such as representatives of owner or regulatory agency where the site is controlled by Barr. • Any Barr employee where the site is controlled by others.	Excavation Entry **NOT** Approved		

Form 2

Barr Engineering Company
Soils Classification Checklist

This checklist must be completed when soil analysis is made to determine the soil type(s) present in the excavation. A separate analysis must be performed if the excavation (trench) is stretched over a distance where soil type changes.

Site Location:		
Date:	**Time:**	**Competent Person:**
Where was the sample taken from:		
Excavation Depth:	**Excavation Width:**	**Excavation Length:**

Visual Test

Particle type: Fine grained (cohesive) ___________________ Granular (sand/silt or gravel) ___________

Water conditions: Wet _________ Dry __________ Seeping water _______
Surface water present _______ Submerged _________

Previously disturbed soils: Yes _________ No __________

Underground utilities: Yes _________ No __________

If yes, what type?

Layered soils? **Note:** *The less stable layer controls soil type.* Yes _________ No __________

Layered soils dipping into excavation: Yes _________ No __________
Unknown ________

Excavation exposed to vibrations: Yes _________ No __________

If yes, from what?

Crack like openings or spalling observed: Yes _________ No __________

Conditions that may create a hazardous atmosphere: Yes _________ No __________

If yes, identify condition and source:

Surface encumbrances: If yes, what type?	Yes _________	No __________
Work to be performed near public vehicular traffic:	Yes _________	No __________
Possible confined space exposure:	Yes _________	No __________

Manual Test		
Plasticity:	Cohesive ___________	Non-cohesive _____________
Dry strength:	Granular (crumbles easily) __________	Cohesive (broken with difficulty)____________
Wet shake:	Water comes to surface (granular material)	_______
	Surface remains dry (clay material)	_______

Note: The following unconfined compressive strength tests should be performed on undisturbed soils.

Thumb Test used to estimate unconfined compressive strength of cohesive soil:

Test performed:	Yes _________	No _______
___	Type A – soil indented by thumb with very great effort.	
___	Type B – soil indented by thumb with some effort.	
___	Type C – soil easily penetrated several inches by thumb with little or no effort. If soil is submerged, seeping water, subjected to surface water, runoff, exposed to wetting.	

Penetrometer or Shearvane used to estimate unconfined compressive strength of cohesive soils:			
Test performed:	Yes___	No____	Device used:
___	Type A – soil with unconfined compressive strength of 1.5 tsf or greater.		
___	Type B – soil with unconfined compressive strength greater than 0.5 tsf and less than 1.5 tsf.		
___	Type C – soil with unconfined compressive strength of 0.5 tsf or less. If soil is submerged, seeping water, subjected to surface water, runoff, exposed to wetting.		

Note: Type A – no soil is type A if soil is fissured, subject to vibration, previously disturbed, layered dipping into excavation on a slope of 4H:1V.

Soil Classification			
Stable Rock______	Type A _______	Type B _______	Type C _______

Selection of Protective System (29 CFR 1926, Subpart P, Appendix F)			
Protective System: _______	Sloping (29 CFR 1926, Subpart P, Appendix B)		Specify angle ___
_______	Timber shoring (29 CFR 1926, Subpart P, Appendix C)		
_______	Aluminum hydraulic shoring (29 CFR 1926, Subpart P, Appendix D)		
_______	Trench shield	Maximum depth in this soil	_______

ATTACHMENT 1
OSHA Excavation Entry Standard

ATTACHMENT K–1

If it is necessary to stand at the outboard or inboard edge of the deckload where less than 24 inches of bulwark, rail, coaming, or other protection exists, all employees shall be provided with a suitable means of protection against falling from the deckload.

(d) *First-aid and lifesaving equipment.* (1) Provisions for rendering first aid and medical assistance shall be in accordance with subpart D of this part.

(2) The employer shall ensure that there is in the vicinity of each barge in use at least one U.S. Coast Guard-approved 30-inch lifering with not less than 90 feet of line attached, and at least one portable or permanent ladder which will reach the top of the apron to the surface of the water. If the above equipment is not available at the pier, the employer shall furnish it during the time that he is working the barge.

(3) Employees walking or working on the unguarded decks of barges shall be protected with U.S. Coast Guard-approved work vests or buoyant vests.

(e) *Commercial diving operations.* Commercial diving operations shall be subject to subpart T of part 1910, §§ 1910.401–1910.441, of this chapter.

[39 FR 22801, June 24, 1974, as amended at 42 FR 37674, July 22, 1977]

§ 1926.606 Definitions applicable to this subpart.

(a) *Apron*—The area along the waterfront edge of the pier or wharf.

(b) *Bulwark*—The side of a ship above the upper deck.

(c) *Coaming*—The raised frame, as around a hatchway in the deck, to keep out water.

(d) *Jacob's ladder*—A marine ladder of rope or chain with wooden or metal rungs.

(e) *Rail*, for the purpose of § 1926.605, means a light structure serving as a guard at the outer edge of a ship's deck.

Subpart P—Excavations

AUTHORITY: Sec. 107, Contract Worker Hours and Safety Standards Act (Construction Safety Act) (40 U.S.C. 333); Secs. 4, 6, 8, Occupational Safety and Health Act of 1970 (29 U.S.C. 653, 655, 657); Secretary of Labor's Order No. 12–71 (36 FR 8754), 8–76 (41 FR 25059), or 9–83 (48 FR 35736), as applicable, and 29 CFR part 1911.

SOURCE: 54 FR 45959, Oct. 31, 1989, unless otherwise noted.

§ 1926.650 Scope, application, and definitions applicable to this subpart.

(a) *Scope and application.* This subpart applies to all open excavations made in the earth's surface. Excavations are defined to include trenches.

(b) *Definitions applicable to this subpart.*

Accepted engineering practices means those requirements which are compatible with standards of practice required by a registered professional engineer.

Aluminum Hydraulic Shoring means a pre-engineered shoring system comprised of aluminum hydraulic cylinders (crossbraces) used in conjunction with vertical rails (uprights) or horizontal rails (walers). Such system is designed, specifically to support the sidewalls of an excavation and prevent cave-ins.

Bell-bottom pier hole means a type of shaft or footing excavation, the bottom of which is made larger than the cross section above to form a belled shape.

Benching (Benching system) means a method of protecting employees from cave-ins by excavating the sides of an excavation to form one or a series of horizontal levels or steps, usually with vertical or near-vertical surfaces between levels.

Cave-in means the separation of a mass of soil or rock material from the side of an excavation, or the loss of soil from under a trench shield or support system, and its sudden movement into the excavation, either by falling or sliding, in sufficient quantity so that it could entrap, bury, or otherwise injure and immobilize a person.

Competent person means one who is capable of identifying existing and predictable hazards in the surroundings, or working conditions which are unsanitary, hazardous, or dangerous to employees, and who has authorization to take prompt corrective measures to eliminate them.

Cross braces mean the horizontal members of a shoring system installed perpendicular to the sides of the excavation, the ends of which bear against either uprights or wales.

Excavation means any man-made cut, cavity, trench, or depression in an earth surface, formed by earth removal.

Faces or *sides* means the vertical or inclined earth surfaces formed as a result of excavation work.

Failure means the breakage, displacement, or permanent deformation of a structural member or connection so as to reduce its structural integrity and its supportive capabilities.

Hazardous atmosphere means an atmosphere which by reason of being explosive, flammable, poisonous, corrosive, oxidizing, irritating, oxygen deficient, toxic, or otherwise harmful, may cause death, illness, or injury.

Kickout means the accidental release or failure of a cross brace.

Protective system means a method of protecting employees from cave-ins, from material that could fall or roll from an excavation face or into an excavation, or from the collapse of adjacent structures. Protective systems include support systems, sloping and benching systems, shield systems, and other systems that provide the necessary protection.

Ramp means an inclined walking or working surface that is used to gain access to one point from another, and is constructed from earth or from structural materials such as steel or wood.

Registered Professional Engineer means a person who is registered as a professional engineer in the state where the work is to be performed. However, a professional engineer, registered in any state is deemed to be a "registered professional engineer" within the meaning of this standard when approving designs for "manufactured protective systems" or "tabulated data" to be used in interstate commerce.

Sheeting means the members of a shoring system that retain the earth in position and in turn are supported by other members of the shoring system.

Shield (Shield system) means a structure that is able to withstand the forces imposed on it by a cave-in and thereby protect employees within the structure. Shields can be permanent structures or can be designed to be portable and moved along as work progresses. Additionally, shields can be either premanufactured or job-built in accordance with § 1926.652 (c)(3) or (c)(4). Shields used in trenches are usually referred to as "trench boxes" or "trench shields."

Shoring (Shoring system) means a structure such as a metal hydraulic, mechanical or timber shoring system that supports the sides of an excavation and which is designed to prevent cave-ins.

Sides. See "Faces."

Sloping (Sloping system) means a method of protecting employees from cave-ins by excavating to form sides of an excavation that are inclined away from the excavation so as to prevent cave-ins. The angle of incline required to prevent a cave-in varies with differences in such factors as the soil type, environmental conditions of exposure, and application of surcharge loads.

Stable rock means natural solid mineral material that can be excavated with vertical sides and will remain intact while exposed. Unstable rock is considered to be stable when the rock material on the side or sides of the excavation is secured against caving-in or movement by rock bolts or by another protective system that has been designed by a registered professional engineer.

Structural ramp means a ramp built of steel or wood, usually used for vehicle access. Ramps made of soil or rock are not considered structural ramps.

Support system means a structure such as underpinning, bracing, or shoring, which provides support to an adjacent structure, underground installation, or the sides of an excavation.

Tabulated data means tables and charts approved by a registered professional engineer and used to design and construct a protective system.

Trench (Trench excavation) means a narrow excavation (in relation to its length) made below the surface of the ground. In general, the depth is greater than the width, but the width of a trench (measured at the bottom) is not greater than 15 feet (4.6 m). If forms or other structures are installed or constructed in an excavation so as to reduce the dimension measured from the forms or structure to the side of the excavation to 15 feet (4.6 m) or less (measured at the bottom of the excavation), the excavation is also considered to be a trench.

Trench box. See "Shield."

Trench shield. See "Shield."

Uprights means the vertical members of a trench shoring system placed in contact with the earth and usually positioned so that individual members do not contact each other. Uprights placed so that individual members are closely spaced, in contact with or interconnected to each other, are often called "sheeting."

Wales means horizontal members of a shoring system placed parallel to the excavation face whose sides bear against the vertical members of the shoring system or earth.

§ 1926.651 Specific excavation requirements.

(a) *Surface encumbrances*. All surface encumbrances that are located so as to create a hazard to employees shall be removed or supported, as necessary, to safeguard employees.

(b) *Underground installations*. (1) The estimated location of utility installations, such as sewer, telephone, fuel, electric, water lines, or any other underground installations that reasonably may be expected to be encountered during excavation work, shall be determined prior to opening an excavation.

(2) Utility companies or owners shall be contacted within established or customary local response times, advised of the proposed work, and asked to establish the location of the utility underground installations prior to the start of actual excavation. When utility companies or owners cannot respond to a request to locate underground utility installations within 24 hours (unless a longer period is required by state or local law), or cannot establish the exact location of these installations, the employer may proceed, provided the employer does so with caution, and provided detection equipment or other acceptable means to locate utility installations are used.

(3) When excavation operations approach the estimated location of underground installations, the exact location of the installations shall be determined by safe and acceptable means.

(4) While the excavation is open, underground installations shall be protected, supported or removed as necessary to safeguard employees.

(c) *Access and egress*—(1) *Structural ramps*. (i) Structural ramps that are used solely by employees as a means of access or egress from excavations shall be designed by a competent person. Structural ramps used for access or egress of equipment shall be designed by a competent person qualified in structural design, and shall be constructed in accordance with the design.

(ii) Ramps and runways constructed of two or more structural members shall have the structural members connected together to prevent displacement.

(iii) Structural members used for ramps and runways shall be of uniform thickness.

(iv) Cleats or other appropriate means used to connect runway structural members shall be attached to the bottom of the runway or shall be attached in a manner to prevent tripping.

(v) Structural ramps used in lieu of steps shall be provided with cleats or other surface treatments on the top surface to prevent slipping.

(2) *Means of egress from trench excavations*. A stairway, ladder, ramp or other safe means of egress shall be located in trench excavations that are 4 feet (1.22 m) or more in depth so as to require no more than 25 feet (7.62 m) of lateral travel for employees.

(d) *Exposure to vehicular traffic*. Employees exposed to public vehicular traffic shall be provided with, and shall wear, warning vests or other suitable garments marked with or made of reflectorized or high-visibility material.

(e) *Exposure to falling loads*. No employee shall be permitted underneath loads handled by lifting or digging equipment. Employees shall be required to stand away from any vehicle being loaded or unloaded to avoid being struck by any spillage or falling materials. Operators may remain in the cabs of vehicles being loaded or unloaded when the vehicles are equipped, in accordance with § 1926.601(b)(6), to provide adequate protection for the operator during loading and unloading operations.

(f) *Warning system for mobile equipment.* When mobile equipment is operated adjacent to an excavation, or when such equipment is required to approach the edge of an excavation, and the operator does not have a clear and direct view of the edge of the excavation, a warning system shall be utilized such as barricades, hand or mechanical signals, or stop logs. If possible, the grade should be away from the excavation.

(g) *Hazardous atmospheres*—(1) *Testing and controls.* In addition to the requirements set forth in subparts D and E of this part (29 CFR 1926.50–1926.107) to prevent exposure to harmful levels of atmospheric contaminants and to assure acceptable atmospheric conditions, the following requirements shall apply:

(i) Where oxygen deficiency (atmospheres containing less than 19.5 percent oxygen) or a hazardous atmosphere exists or could reasonably be expected to exist, such as in excavations in landfill areas or excavations in areas where hazardous substances are stored nearby, the atmospheres in the excavation shall be tested before employees enter excavations greater than 4 feet (1.22 m) in depth.

(ii) Adequate precautions shall be taken to prevent employee exposure to atmospheres containing less than 19.5 percent oxygen and other hazardous atmospheres. These precautions include providing proper respiratory protection or ventilation in accordance with subparts D and E of this part respectively.

(iii) Adequate precaution shall be taken such as providing ventilation, to prevent employee exposure to an atmosphere containing a concentration of a flammable gas in excess of 20 percent of the lower flammable limit of the gas.

(iv) When controls are used that are intended to reduce the level of atmospheric contaminants to acceptable levels, testing shall be conducted as often as necessary to ensure that the atmosphere remains safe.

(2) *Emergency rescue equipment.* (i) Emergency rescue equipment, such as breathing apparatus, a safety harness and line, or a basket stretcher, shall be readily available where hazardous atmospheric conditions exist or may reasonably be expected to develop during work in an excavation. This equipment shall be attended when in use.

(ii) Employees entering bell-bottom pier holes, or other similar deep and confined footing excavations, shall wear a harness with a life-line securely attached to it. The lifeline shall be separate from any line used to handle materials, and shall be individually attended at all times while the employee wearing the lifeline is in the excavation.

(h) *Protection from hazards associated with water accumulation.* (1) Employees shall not work in excavations in which there is accumulated water, or in excavations in which water is accumulating, unless adequate precautions have been taken to protect employees against the hazards posed by water accumulation. The precautions necessary to protect employees adequately vary with each situation, but could include special support or shield systems to protect from cave-ins, water removal to control the level of accumulating water, or use of a safety harness and lifeline.

(2) If water is controlled or prevented from accumulating by the use of water removal equipment, the water removal equipment and operations shall be monitored by a competent person to ensure proper operation.

(3) If excavation work interrupts the natural drainage of surface water (such as streams), diversion ditches, dikes, or other suitable means shall be used to prevent surface water from entering the excavation and to provide adequate drainage of the area adjacent to the excavation. Excavations subject to runoff from heavy rains will require an inspection by a competent person and compliance with paragraphs (h)(1) and (h)(2) of this section.

(i) *Stability of adjacent structures.* (1) Where the stability of adjoining buildings, walls, or other structures is endangered by excavation operations, support systems such as shoring, bracing, or underpinning shall be provided to ensure the stability of such structures for the protection of employees.

(2) Excavation below the level of the base or footing of any foundation or retaining wall that could be reasonably

expected to pose a hazard to employees shall not be permitted except when:

(i) A support system, such as underpinning, is provided to ensure the safety of employees and the stability of the structure; or

(ii) The excavation is in stable rock; or

(iii) A registered professional engineer has approved the determination that the structure is sufficently removed from the excavation so as to be unaffected by the excavation activity; or

(iv) A registered professional engineer has approved the determination that such excavation work will not pose a hazard to employees.

(3) Sidewalks, pavements, and appurtenant structure shall not be undermined unless a support system or another method of protection is provided to protect employees from the possible collapse of such structures.

(j) *Protection of employees from loose rock or soil.* (1) Adequate protection shall be provided to protect employees from loose rock or soil that could pose a hazard by falling or rolling from an excavation face. Such protection shall consist of scaling to remove loose material; installation of protective barricades at intervals as necessary on the face to stop and contain falling material; or other means that provide equivalent protection.

(2) Employees shall be protected from excavated or other materials or equipment that could pose a hazard by falling or rolling into excavations. Protection shall be provided by placing and keeping such materials or equipment at least 2 feet (.61 m) from the edge of excavations, or by the use of retaining devices that are sufficient to prevent materials or equipment from falling or rolling into excavations, or by a combination of both if necessary.

(k) *Inspections.* (1) Daily inspections of excavations, the adjacent areas, and protective systems shall be made by a competent person for evidence of a situation that could result in possible cave-ins, indications of failure of protective systems, hazardous atmospheres, or other hazardous conditions. An inspection shall be conducted by the competent person prior to the start of work and as needed throughout the shift. Inspections shall also be made after every rainstorm or other hazard increasing occurrence. These inspections are only required when employee exposure can be reasonably anticipated.

(2) Where the competent person finds evidence of a situation that could result in a possible cave-in, indications of failure of protective systems, hazardous atmospheres, or other hazardous conditions, exposed employees shall be removed from the hazardous area until the necessary precautions have been taken to ensure their safety.

(l) Walkways shall be provided where employees or equipment are required or permitted to cross over excavations. Guardrails which comply with §1926.502(b) shall be provided where walkways are 6 feet (1.8 m) or more above lower levels.

[54 FR 45959, Oct. 31, 1989, as amended by 59 FR 40730, Aug. 9, 1994]

§1926.652 Requirements for protective systems.

(a) *Protection of employees in excavations.* (1) Each employee in an excavation shall be protected from cave-ins by an adequate protective system designed in accordance with paragraph (b) or (c) of this section except when:

(i) Excavations are made entirely in stable rock; or

(ii) Excavations are less than 5 feet (1.52m) in depth and examination of the ground by a competent person provides no indication of a potential cave-in.

(2) Protective systems shall have the capacity to resist without failure all loads that are intended or could reasonably be expected to be applied or transmitted to the system.

(b) *Design of sloping and benching systems.* The slopes and configurations of sloping and benching systems shall be selected and constructed by the employer or his designee and shall be in accordance with the requirements of paragraph (b)(1); or, in the alternative, paragraph (b)(2); or, in the alternative, paragraph (b)(3), or, in the alternative, paragraph (b)(4), as follows:

(1) *Option (1)—Allowable configurations and slopes.* (i) Excavations shall be sloped at an angle not steeper than one and one-half horizontal to one vertical

(34 degrees measured from the horizontal), unless the employer uses one of the other options listed below.

(ii) Slopes specified in paragraph (b)(1)(i) of this section, shall be excavated to form configurations that are in accordance with the slopes shown for Type C soil in Appendix B to this subpart.

(2) *Option (2)—Determination of slopes and configurations using Appendices A and B.* Maximum allowable slopes, and allowable configurations for sloping and benching systems, shall be determined in accordance with the conditions and requirements set forth in appendices A and B to this subpart.

(3) *Option (3)—Designs using other tabulated data.* (i) Designs of sloping or benching systems shall be selected from and be in accordance with tabulated data, such as tables and charts.

(ii) The tabulated data shall be in written form and shall include all of the following:

(A) Identification of the parameters that affect the selection of a sloping or benching system drawn from such data;

(B) Identification of the limits of use of the data, to include the magnitude and configuration of slopes determined to be safe;

(C) Explanatory information as may be necessary to aid the user in making a correct selection of a protective system from the data.

(iii) At least one copy of the tabulated data which identifies the registered professional engineer who approved the data, shall be maintained at the jobsite during construction of the protective system. After that time the data may be stored off the jobsite, but a copy of the data shall be made available to the Secretary upon request.

(4) *Option (4)—Design by a registered professional engineer.* (i) Sloping and benching systems not utilizing Option (1) or Option (2) or Option (3) under paragraph (b) of this section shall be approved by a registered professional engineer.

(ii) Designs shall be in written form and shall include at least the following:

(A) The magnitude of the slopes that were determined to be safe for the particular project;

(B) The configurations that were determined to be safe for the particular project; and

(C) The identity of the registered professional engineer approving the design.

(iii) At least one copy of the design shall be maintained at the jobsite while the slope is being constructed. After that time the design need not be at the jobsite, but a copy shall be made available to the Secretary upon request.

(c) *Design of support systems, shield systems, and other protective systems.* Designs of support systems shield systems, and other protective systems shall be selected and constructed by the employer or his designee and shall be in accordance with the requirements of paragraph (c)(1); or, in the alternative, paragraph (c)(2); or, in the alternative, paragraph (c)(3); or, in the alternative, paragraph (c)(4) as follows:

(1) *Option (1)—Designs using appendices A, C and D.* Designs for timber shoring in trenches shall be determined in accordance with the conditions and requirements set forth in appendices A and C to this subpart. Designs for aluminum hydraulic shoring shall be in accordance with paragraph (c)(2) of this section, but if manufacturer's tabulated data cannot be utilized, designs shall be in accordance with appendix D.

(2) *Option (2)—Designs Using Manufacturer's Tabulated Data.* (i) Design of support systems, shield systems, or other protective systems that are drawn from manufacturer's tabulated data shall be in accordance with all specifications, recommendations, and limitations issued or made by the manufacturer.

(ii) Deviation from the specifications, recommendations, and limitations issued or made by the manufacturer shall only be allowed after the manufacturer issues specific written approval.

(iii) Manufacturer's specifications, recommendations, and limitations, and manufacturer's approval to deviate from the specifications, recommendations, and limitations shall be in written form at the jobsite during construction of the protective system. After that time this data may be stored off the jobsite, but a copy shall be made available to the Secretary upon request.

(3) *Option (3)—Designs using other tabulated data.* (i) Designs of support systems, shield systems, or other protective systems shall be selected from and be in accordance with tabulated data, such as tables and charts.

(ii) The tabulated data shall be in written form and include all of the following:

(A) Identification of the parameters that affect the selection of a protective system drawn from such data;

(B) Identification of the limits of use of the data;

(C) Explanatory information as may be necessary to aid the user in making a correct selection of a protective system from the data.

(iii) At least one copy of the tabulated data, which identifies the registered professional engineer who approved the data, shall be maintained at the jobsite during construction of the protective system. After that time the data may be stored off the jobsite, but a copy of the data shall be made available to the Secretary upon request.

(4) *Option (4)—Design by a registered professional engineer.* (i) Support systems, shield systems, and other protective systems not utilizing Option 1, Option 2 or Option 3, above, shall be approved by a registered professional engineer.

(ii) Designs shall be in written form and shall include the following:

(A) A plan indicating the sizes, types, and configurations of the materials to be used in the protective system; and

(B) The identity of the registered professional engineer approving the design.

(iii) At least one copy of the design shall be maintained at the jobsite during construction of the protective system. After that time, the design may be stored off the jobsite, but a copy of the design shall be made available to the Secretary upon request.

(d) *Materials and equipment.* (1) Materials and equipment used for protective systems shall be free from damage or defects that might impair their proper function.

(2) Manufactured materials and equipment used for protective systems shall be used and maintained in a manner that is consistent with the recommendations of the manufacturer, and in a manner that will prevent employee exposure to hazards.

(3) When material or equipment that is used for protective systems is damaged, a competent person shall examine the material or equipment and evaluate its suitability for continued use. If the competent person cannot assure the material or equipment is able to support the intended loads or is otherwise suitable for safe use, then such material or equipment shall be removed from service, and shall be evaluated and approved by a registered professional engineer before being returned to service.

(e) *Installation and removal of support*—(1) *General.* (i) Members of support systems shall be securely connected together to prevent sliding, falling, kickouts, or other predictable failure.

(ii) Support systems shall be installed and removed in a manner that protects employees from cave-ins, structural collapses, or from being struck by members of the support system.

(iii) Individual members of support systems shall not be subjected to loads exceeding those which those members were designed to withstand.

(iv) Before temporary removal of individual members begins, additional precautions shall be taken to ensure the safety of employees, such as installing other structural members to carry the loads imposed on the support system.

(v) Removal shall begin at, and progress from, the bottom of the excavation. Members shall be released slowly so as to note any indication of possible failure of the remaining members of the structure or possible cave-in of the sides of the excavation.

(vi) Backfilling shall progress together with the removal of support systems from excavations.

(2) *Additional requirements for support systems for trench excavations.* (i) Excavation of material to a level no greater than 2 feet (.61 m) below the bottom of the members of a support system shall be permitted, but only if the system is designed to resist the forces calculated for the full depth of the trench, and

there are no indications while the trench is open of a possible loss of soil from behind or below the bottom of the support system.

(ii) Installation of a support system shall be closely coordinated with the excavation of trenches.

(f) *Sloping and benching systems.* Employees shall not be permitted to work on the faces of sloped or benched excavations at levels above other employees except when employees at the lower levels are adequately protected from the hazard of falling, rolling, or sliding material or equipment.

(g) *Shield systems*—(1) *General.* (i) Shield systems shall not be subjected to loads exceeding those which the system was designed to withstand.

(ii) Shields shall be installed in a manner to restrict lateral or other hazardous movement of the shield in the event of the application of sudden lateral loads.

(iii) Employees shall be protected from the hazard of cave-ins when entering or exiting the areas protected by shields.

(iv) Employees shall not be allowed in shields when shields are being installed, removed, or moved vertically.

(2) *Additional requirement for shield systems used in trench excavations.* Excavations of earth material to a level not greater than 2 feet (.61 m) below the bottom of a shield shall be permitted, but only if the shield is designed to resist the forces calculated for the full depth of the trench, and there are no indications while the trench is open of a possible loss of soil from behind or below the bottom of the shield.

APPENDIX A TO SUBPART P—SOIL CLASSIFICATION

(a) *Scope and application*—(1) *Scope.* This appendix describes a method of classifying soil and rock deposits based on site and environmental conditions, and on the structure and composition of the earth deposits. The appendix contains definitions, sets forth requirements, and describes acceptable visual and manual tests for use in classifying soils.

(2) *Application.* This appendix applies when a sloping or benching system is designed in accordance with the requirements set forth in §1926.652(b)(2) as a method of protection for employees from cave-ins. This appendix also applies when timber shoring for excavations is designed as a method of protection from cave-ins in accordance with appendix C to subpart P of part 1926, and when aluminum hydraulic shoring is designed in accordance with appendix D. This Appendix also applies if other protective systems are designed and selected for use from data prepared in accordance with the requirements set forth in §1926.652(c), and the use of the data is predicated on the use of the soil classification system set forth in this appendix.

(b) *Definitions.* The definitions and examples given below are based on, in whole or in part, the following: American Society for Testing Materials (ASTM) Standards D653-85 and D2488; The Unified Soils Classification System, The U.S. Department of Agriculture (USDA) Textural Classification Scheme; and The National Bureau of Standards Report BSS-121.

Cemented soil means a soil in which the particles are held together by a chemical agent, such as calcium carbonate, such that a hand-size sample cannot be crushed into powder or individual soil particles by finger pressure.

Cohesive soil means clay (fine grained soil), or soil with a high clay content, which has cohesive strength. Cohesive soil does not crumble, can be excavated with vertical sideslopes, and is plastic when moist. Cohesive soil is hard to break up when dry, and exhibits significant cohesion when submerged. Cohesive soils include clayey silt, sandy clay, silty clay, clay and organic clay.

Dry soil means soil that does not exhibit visible signs of moisture content.

Fissured means a soil material that has a tendency to break along definite planes of fracture with little resistance, or a material that exhibits open cracks, such as tension cracks, in an exposed surface.

Granular soil means gravel, sand, or silt, (coarse grained soil) with little or no clay content. Granular soil has no cohesive strength. Some moist granular soils exhibit apparent cohesion. Granular soil cannot be molded when moist and crumbles easily when dry.

Layered system means two or more distinctly different soil or rock types arranged in layers. Micaceous seams or weakened planes in rock or shale are considered layered.

Moist soil means a condition in which a soil looks and feels damp. Moist cohesive soil can easily be shaped into a ball and rolled into small diameter threads before crumbling. Moist granular soil that contains some cohesive material will exhibit signs of cohesion between particles.

Plastic means a property of a soil which allows the soil to be deformed or molded without cracking, or appreciable volume change.

Saturated soil means a soil in which the voids are filled with water. Saturation does not require flow. Saturation, or near saturation, is necessary for the proper use of instruments such as a pocket penetrometer or sheer vane.

Soil classification system means, for the purpose of this subpart, a method of categorizing soil and rock deposits in a hierarchy of Stable Rock, Type A, Type B, and Type C, in decreasing order of stability. The categories are determined based on an analysis of the properties and performance characteristics of the deposits and the environmental conditions of exposure.

Stable rock means natural solid mineral matter that can be excavated with vertical sides and remain intact while exposed.

Submerged soil means soil which is underwater or is free seeping.

Type A means cohesive soils with an unconfined compressive strength of 1.5 ton per square foot (tsf) (144 kPa) or greater. Examples of cohesive soils are: clay, silty clay, sandy clay, clay loam and, in some cases, silty clay loam and sandy clay loam. Cemented soils such as caliche and hardpan are also considered Type A. However, no soil is Type A if:

(i) The soil is fissured; or

(ii) The soil is subject to vibration from heavy traffic, pile driving, or similar effects; or

(iii) The soil has been previously disturbed; or

(iv) The soil is part of a sloped, layered system where the layers dip into the excavation on a slope of four horizontal to one vertical (4H:1V) or greater; or

(v) The material is subject to other factors that would require it to be classified as a less stable material.

Type B means:

(i) Cohesive soil with an unconfined compressive strength greater than 0.5 tsf (48 kPa) but less than 1.5 tsf (144 kPa); or

(ii) Granular cohesionless soils including: angular gravel (similar to crushed rock), silt, silt loam, sandy loam and, in some cases, silty clay loam and sandy clay loam.

(iii) Previously disturbed soils except those which would otherwise be classed as Type C soil.

(iv) Soil that meets the unconfined compressive strength or cementation requirements for Type A, but is fissured or subject to vibration; or

(v) Dry rock that is not stable; or

(vi) Material that is part of a sloped, layered system where the layers dip into the excavation on a slope less steep than four horizontal to one vertical (4H:1V), but only if the material would otherwise be classified as Type B.

Type C means:

(i) Cohesive soil with an unconfined compressive strength of 0.5 tsf (48 kPa) or less; or

(ii) Granular soils including gravel, sand, and loamy sand; or

(iii) Submerged soil or soil from which water is freely seeping; or

(iv) Submerged rock that is not stable, or

(v) Material in a sloped, layered system where the layers dip into the excavation or a slope of four horizontal to one vertical (4H:1V) or steeper.

Unconfined compressive strength means the load per unit area at which a soil will fail in compression. It can be determined by laboratory testing, or estimated in the field using a pocket penetrometer, by thumb penetration tests, and other methods.

Wet soil means soil that contains significantly more moisture than moist soil, but in such a range of values that cohesive material will slump or begin to flow when vibrated. Granular material that would exhibit cohesive properties when moist will lose those cohesive properties when wet.

(c) *Requirements*—(1) *Classification of soil and rock deposits*. Each soil and rock deposit shall be classified by a competent person as Stable Rock, Type A, Type B, or Type C in accordance with the definitions set forth in paragraph (b) of this appendix.

(2) *Basis of classification*. The classification of the deposits shall be made based on the results of at least one visual and at least one manual analysis. Such analyses shall be conducted by a competent person using tests described in paragraph (d) below, or in other recognized methods of soil classification and testing such as those adopted by the America Society for Testing Materials, or the U.S. Department of Agriculture textural classification system.

(3) *Visual and manual analyses*. The visual and manual analyses, such as those noted as being acceptable in paragraph (d) of this appendix, shall be designed and conducted to provide sufficient quantitative and qualitative information as may be necessary to identify properly the properties, factors, and conditions affecting the classification of the deposits.

(4) *Layered systems*. In a layered system, the system shall be classified in accordance with its weakest layer. However, each layer may be classified individually where a more stable layer lies under a less stable layer.

(5) *Reclassification*. If, after classifying a deposit, the properties, factors, or conditions affecting its classification change in any way, the changes shall be evaluated by a competent person. The deposit shall be reclassified as necessary to reflect the changed circumstances.

(d) *Acceptable visual and manual tests*.—(1) *Visual tests*. Visual analysis is conducted to determine qualitative information regarding the excavation site in general, the soil adjacent to the excavation, the soil forming the sides of the open excavation, and the soil taken as samples from excavated material.

(i) Observe samples of soil that are excavated and soil in the sides of the excavation. Estimate the range of particle sizes and the relative amounts of the particle sizes. Soil that is primarily composed of fine-grained material is cohesive material. Soil composed primarily of coarse-grained sand or gravel is granular material.

(ii) Observe soil as it is excavated. Soil that remains in clumps when excavated is cohesive. Soil that breaks up easily and does not stay in clumps is granular.

(iii) Observe the side of the opened excavation and the surface area adjacent to the excavation. Crack-like openings such as tension cracks could indicate fissured material. If chunks of soil spall off a vertical side, the soil could be fissured. Small spalls are evidence of moving ground and are indications of potentially hazardous situations.

(iv) Observe the area adjacent to the excavation and the excavation itself for evidence of existing utility and other underground structures, and to identify previously disturbed soil.

(v) Observe the opened side of the excavation to identify layered systems. Examine layered systems to identify if the layers slope toward the excavation. Estimate the degree of slope of the layers.

(vi) Observe the area adjacent to the excavation and the sides of the opened excavation for evidence of surface water, water seeping from the sides of the excavation, or the location of the level of the water table.

(vii) Observe the area adjacent to the excavation and the area within the excavation for sources of vibration that may affect the stability of the excavation face.

(2) *Manual tests.* Manual analysis of soil samples is conducted to determine quantitative as well as qualitative properties of soil and to provide more information in order to classify soil properly.

(i) *Plasticity.* Mold a moist or wet sample of soil into a ball and attempt to roll it into threads as thin as ⅛-inch in diameter. Cohesive material can be successfully rolled into threads without crumbling. For example, if at least a two inch (50 mm) length of ⅛-inch thread can be held on one end without tearing, the soil is cohesive.

(ii) *Dry strength.* If the soil is dry and crumbles on its own or with moderate pressure into individual grains or fine powder, it is granular (any combination of gravel, sand, or silt). If the soil is dry and falls into clumps which break up into smaller clumps, but the smaller clumps can only be broken up with difficulty, it may be clay in any combination with gravel, sand or silt. If the dry soil breaks into clumps which do not break up into small clumps and which can only be broken with difficulty, and there is no visual indication the soil is fissured, the soil may be considered unfissured.

(iii) *Thumb penetration.* The thumb penetration test can be used to estimate the unconfined compressive strength of cohesive soils. (This test is based on the thumb penetration test described in American Society for Testing and Materials (ASTM) Standard designation D2488—"Standard Recommended Practice for Description of Soils (Visual—Manual Procedure).") Type A soils with an unconfined compressive strength of 1.5 tsf can be readily indented by the thumb; however, they can be penetrated by the thumb only with very great effort. Type C soils with an unconfined compressive strength of 0.5 tsf can be easily penetrated several inches by the thumb, and can be molded by light finger pressure. This test should be conducted on an undisturbed soil sample, such as a large clump of spoil, as soon as practicable after excavation to keep to a miminum the effects of exposure to drying influences. If the excavation is later exposed to wetting influences (rain, flooding), the classification of the soil must be changed accordingly.

(iv) *Other strength tests.* Estimates of unconfined compressive strength of soils can also be obtained by use of a pocket penetrometer or by using a hand-operated shearvane.

(v) *Drying test.* The basic purpose of the drying test is to differentiate between cohesive material with fissures, unfissured cohesive material, and granular material. The procedure for the drying test involves drying a sample of soil that is approximately one inch thick (2.54 cm) and six inches (15.24 cm) in diameter until it is thoroughly dry:

(A) If the sample develops cracks as it dries, significant fissures are indicated.

(B) Samples that dry without cracking are to be broken by hand. If considerable force is necessary to break a sample, the soil has significant cohesive material content. The soil can be classified as a unfissured cohesive material and the unconfined compressive strength should be determined.

(C) If a sample breaks easily by hand, it is either a fissured cohesive material or a granular material. To distinguish between the two, pulverize the dried clumps of the sample by hand or by stepping on them. If the clumps do not pulverize easily, the material is cohesive with fissures. If they pulverize easily into very small fragments, the material is granular.

APPENDIX B TO SUBPART P—SLOPING AND BENCHING

(a) *Scope and application.* This appendix contains specifications for sloping and benching when used as methods of protecting employees working in excavations from cave-ins. The requirements of this appendix apply when the design of sloping and benching protective systems is to be performed in accordance with the requirements set forth in § 1926.652(b)(2).

(b) *Definitions.*

Actual slope means the slope to which an excavation face is excavated.

Distress means that the soil is in a condition where a cave-in is imminent or is likely to occur. Distress is evidenced by such phenomena as the development of fissures in the face of or adjacent to an open excavation; the subsidence of the edge of an excavation; the slumping of material from the face or the bulging or heaving of material from the bottom of an excavation; the spalling of material from the face of an excavation; and ravelling, i.e., small amounts of material such as pebbles or little clumps of material suddenly separating from the face of an excavation and trickling or rolling down into the excavation.

Maximum allowable slope means the steepest incline of an excavation face that is acceptable for the most favorable site conditions as protection against cave-ins, and is expressed as the ratio of horizontal distance to vertical rise (H:V).

Short term exposure means a period of time less than or equal to 24 hours that an excavation is open.

(c) *Requirements*—(1) *Soil classification.* Soil and rock deposits shall be classified in accordance with appendix A to subpart P of part 1926.

(2) *Maximum allowable slope.* The maximum allowable slope for a soil or rock deposit shall be determined from Table B-1 of this appendix.

(3) *Actual slope.* (i) The actual slope shall not be steeper than the maximum allowable slope.

(ii) The actual slope shall be less steep than the maximum allowable slope, when there are signs of distress. If that situation occurs, the slope shall be cut back to an actual slope which is at least ½ horizontal to one vertical (½H:1V) less steep than the maximum allowable slope.

(iii) When surcharge loads from stored material or equipment, operating equipment, or traffic are present, a competent person shall determine the degree to which the actual slope must be reduced below the maximum allowable slope, and shall assure that such reduction is achieved. Surcharge loads from adjacent structures shall be evaluated in accordance with § 1926.651(i).

(4) *Configurations.* Configurations of sloping and benching systems shall be in accordance with Figure B-1.

TABLE B-1

MAXIMUM ALLOWABLE SLOPES

SOIL OR ROCK TYPE	MAXIMUM ALLOWABLE SLOPES (H:V) [1] FOR EXCAVATIONS LESS THAN 20 FEET DEEP [3]
STABLE ROCK	VERTICAL (90°)
TYPE A [2]	3/4 : 1 (53°)
TYPE B	1:1 (45°)
TYPE C	1¼ : 1 (34°)

NOTES:

1. Numbers shown in parentheses next to maximum allowable slopes are angles expressed in degrees from the horizontal. Angles have been rounded off.
2. A short-term maximum allowable slope of 1/2H:1V (63°) is allowed in excavations in Type A soil that are 12 feet (3.67 m) or less in depth. Short-term maximum allowable slopes for excavations greater than 12 feet (3.67 m) in depth shall be 3/4H:1V (53°).
3. Sloping or benching for excavations greater than 20 feet deep shall be designed by a registered professional engineer.

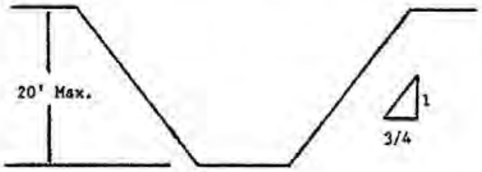
Figure B-1

Slope Configurations

(All slopes stated below are in the horizontal to vertical ratio)

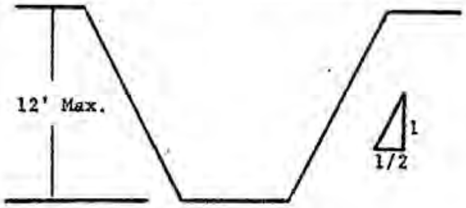
B-1.1 Excavations made in Type A soil.

1. All simple slope excavation 20 feet or less in depth shall have a maximum allowable slope of ¾:1.



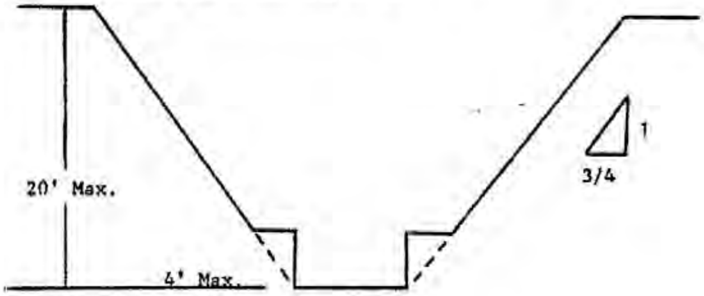
SIMPLE SLOPE—GENERAL

Exception: Simple slope excavations which are open 24 hours or less (short term) and which are 12 feet or less in depth shall have a maximum allowable slope of ½:1.

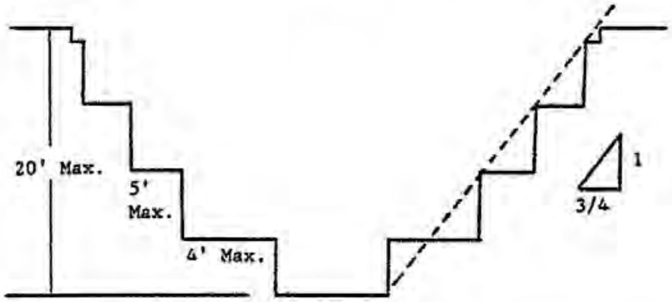


SIMPLE SLOPE—SHORT TERM

2. All benched excavations 20 feet or less in depth shall have a maximum allowable slope of ¾ to 1 and maximum bench dimensions as follows:

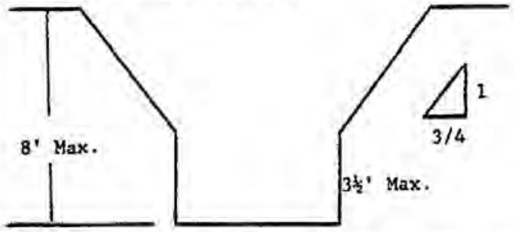


SIMPLE BENCH



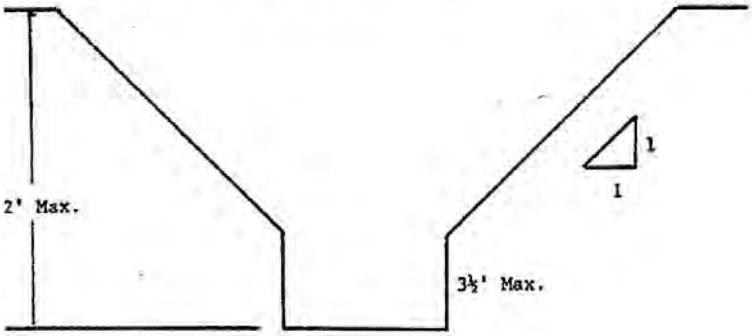
MULTIPLE BENCH

3. All excavations 8 feet or less in depth which have unsupported vertically sided lower portions shall have a maximum vertical side of 3½ feet.



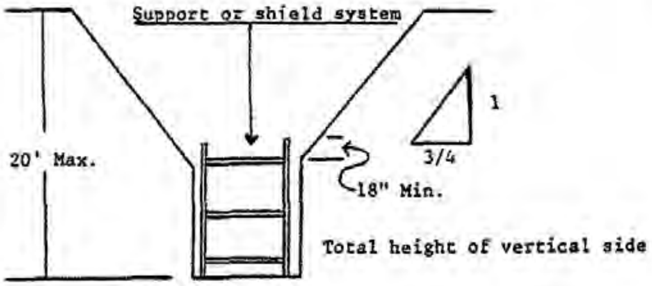
UNSUPPORTED VERTICALLY SIDED LOWER PORTION—MAXIMUM 8 FEET IN DEPTH

All excavations more than 8 feet but not more than 12 feet in depth which unsupported vertically sided lower portions shall have a maximum allowable slope of 1:1 and a maximum vertical side of 3½ feet.



UNSUPPORTED VERTICALLY SIDED LOWER PORTION—MAXIMUM 12 FEET IN DEPTH

All excavations 20 feet or less in depth which have vertically sided lower portions that are supported or shielded shall have a maximum allowable slope of ¾:1. The support or shield system must extend at least 18 inches above the top of the vertical side.

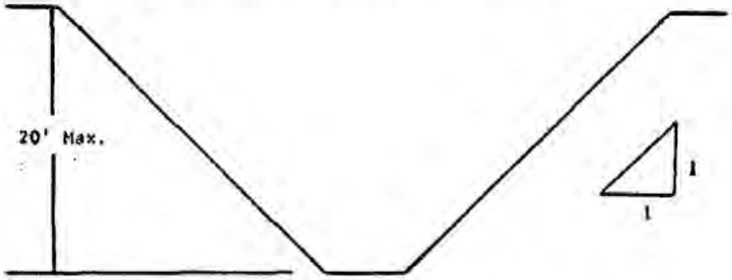


SUPPORTED OR SHIELDED VERTICALLY SIDED LOWER PORTION

4. All other simple slope, compound slope, and vertically sided lower portion excavations shall be in accordance with the other options permitted under § 1926.652(b).

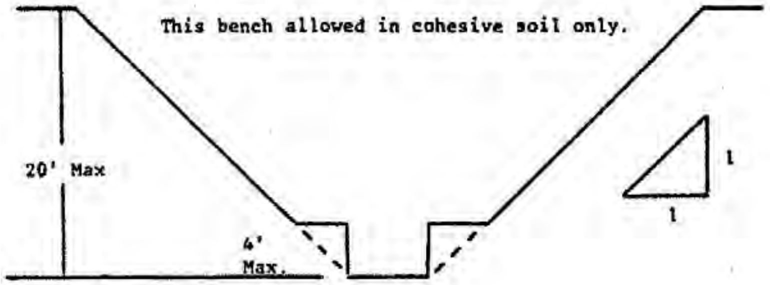
B-1.2 Excavations Made in Type B Soil

1. All simple slope excavations 20 feet or less in depth shall have a maximum allowable slope of 1:1.

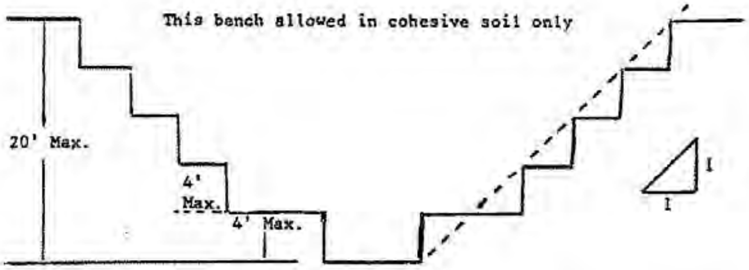


SIMPLE SLOPE

2. All benched excavations 20 feet or less in depth shall have a maximum allowable slope of 1:1 and maximum bench dimensions as follows:

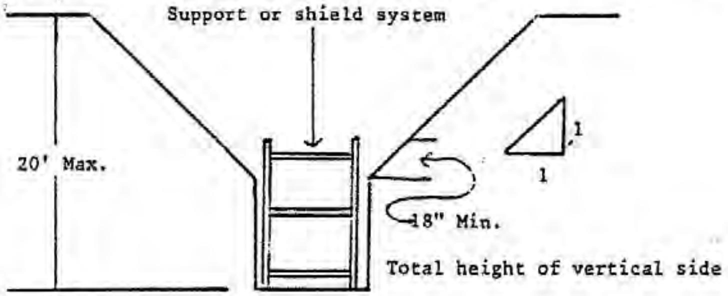


SINGLE BENCH



MULTIPLE BENCH

3. All excavations 20 feet or less in depth which have vertically sided lower portions shall be shielded or supported to a height at least 18 inches above the top of the vertical side. All such excavations shall have a maximum allowable slope of 1:1.

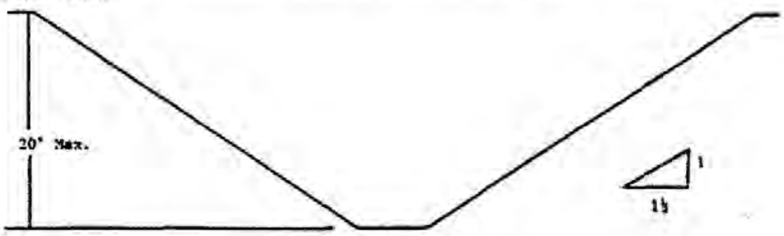


VERTICALLY SIDED LOWER PORTION

4. All other sloped excavations shall be in accordance with the other options permitted in §1926.652(b).

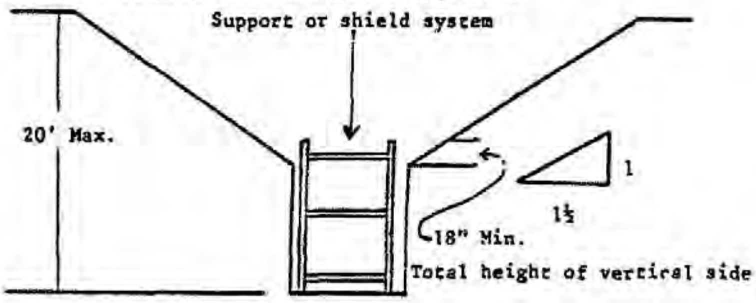
B–1.3 EXCAVATIONS MADE IN TYPE C SOIL

1. All simple slope excavations 20 feet or less in depth shall have a maximum allowable slope of 1½:1.



SIMPLE SLOPE

2. All excavations 20 feet or less in depth which have vertically sided lower portions shall be shielded or supported to a height at least 18 inches above the top of the vertical side. All such excavations shall have a maximum allowable slope of 1½:1.

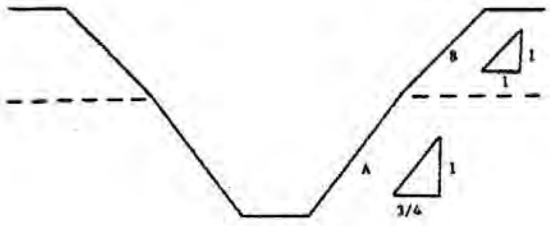


VERTICAL SIDED LOWER PORTION

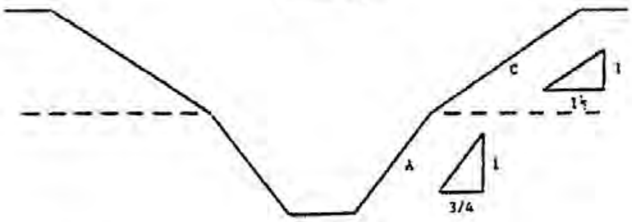
3. All other sloped excavations shall be in accordance with the other options permitted in § 1926.652(b).

B–1.4 Excavations Made in Layered Soils

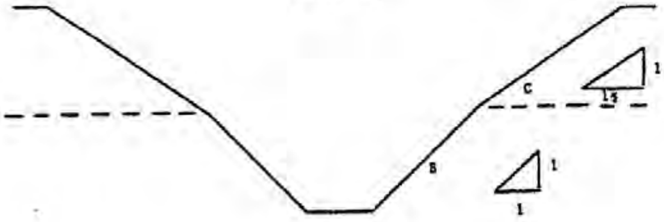
1. All excavations 20 feet or less in depth made in layered soils shall have a maximum allowable slope for each layer as set forth below.



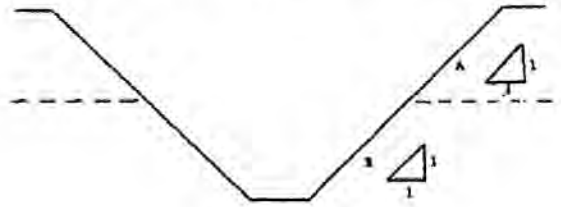
B OVER A



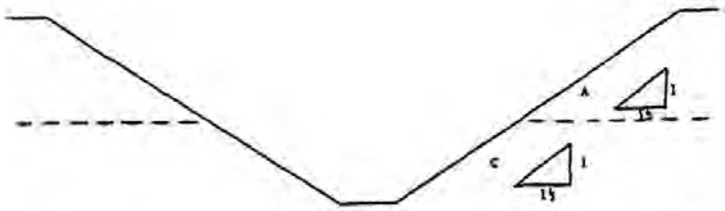
C OVER A



C OVER B



A OVER B



A OVER C

B OVER C

2. All other sloped excavations shall be in accordance with the other options permitted in §1926.652(b).

APPENDIX C TO SUBPART P—TIMBER SHORING FOR TRENCHES

(a) *Scope.* This appendix contains information that can be used timber shoring is provided as a method of protection from cave-ins in trenches that do not exceed 20 feet (6.1 m) in depth. This appendix must be used when design of timber shoring protective systems is to be performed in accordance with §1926.652(c)(1). Other timber shoring configurations; other systems of support such as hydraulic and pneumatic systems; and other protective systems such as sloping, benching, shielding, and freezing systems must be designed in accordance with the requirements set forth in §1926.652(b) and §1926.652(c).

(b) *Soil Classification.* In order to use the data presented in this appendix, the soil type or types in which the excavation is made must first be determined using the soil classification method set forth in appendix A of subpart P of this part.

(c) *Presentation of Information.* Information is presented in several forms as follows:

(1) Information is presented in tabular form in Tables C-1.1, C-1.2, and C-1.3, and Tables C-2.1, C-2.2 and C-2.3 following paragraph (g) of the appendix. Each table presents the minimum sizes of timber members to use in a shoring system, and each table contains data only for the particular soil type in which the excavation or portion of

the excavation is made. The data are arranged to allow the user the flexibility to select from among several acceptable configurations of members based on varying the horizontal spacing of the crossbraces. Stable rock is exempt from shoring requirements and therefore, no data are presented for this condition.

(2) Information concerning the basis of the tabular data and the limitations of the data is presented in paragraph (d) of this appendix, and on the tables themselves.

(3) Information explaining the use of the tabular data is presented in paragraph (e) of this appendix.

(4) Information illustrating the use of the tabular data is presented in paragraph (f) of this appendix.

(5) Miscellaneous notations regarding Tables C–1.1 through C–1.3 and Tables C–2.1 through C–2.3 are presented in paragraph (g) of this Appendix.

(d) *Basis and limitations of the data.*—(1) *Dimensions of timber members.* (i) The sizes of the timber members listed in Tables C–1.1 through C–1.3 are taken from the National Bureau of Standards (NBS) report, "Recommended Technical Provisions for Construction Practice in Shoring and Sloping of Trenches and Excavations." In addition, where NBS did not recommend specific sizes of members, member sizes are based on an analysis of the sizes required for use by existing codes and on empirical practice.

(ii) The required dimensions of the members listed in Tables C–1.1 through C–1.3 refer to actual dimensions and not nominal dimensions of the timber. Employers wanting to use nominal size shoring are directed to Tables C–2.1 through C–2.3, or have this choice under §1926.652(c)(3), and are referred to The Corps of Engineers, The Bureau of Reclamation or data from other acceptable sources.

(2) *Limitation of application.* (i) It is not intended that the timber shoring specification apply to every situation that may be experienced in the field. These data were developed to apply to the situations that are most commonly experienced in current trenching practice. Shoring systems for use in situations that are not covered by the data in this appendix must be designed as specified in §1926.652(c).

(ii) When any of the following conditions are present, the members specified in the tables are not considered adequate. Either an alternate timber shoring system must be designed or another type of protective system designed in accordance with §1926.652.

(A) When loads imposed by structures or by stored material adjacent to the trench weigh in excess of the load imposed by a two-foot soil surcharge. The term "adjacent" as used here means the area within a horizontal distance from the edge of the trench equal to the depth of the trench.

(B) When vertical loads imposed on cross braces exceed a 240-pound gravity load distributed on a one-foot section of the center of the crossbrace.

(C) When surcharge loads are present from equipment weighing in excess of 20,000 pounds.

(D) When only the lower portion of a trench is shored and the remaining portion of the trench is sloped or benched unless: The sloped portion is sloped at an angle less steep than three horizontal to one vertical; or the members are selected from the tables for use at a depth which is determined from the top of the overall trench, and not from the toe of the sloped portion.

(e) *Use of Tables.* The members of the shoring system that are to be selected using this information are the cross braces, the uprights, and the wales, where wales are required. Minimum sizes of members are specified for use in different types of soil. There are six tables of information, two for each soil type. The soil type must first be determined in accordance with the soil classification system described in appendix A to subpart P of part 1926. Using the appropriate table, the selection of the size and spacing of the members is then made. The selection is based on the depth and width of the trench where the members are to be installed and, in most instances, the selection is also based on the horizontal spacing of the crossbraces. Instances where a choice of horizontal spacing of crossbracing is available, the horizontal spacing of the crossbraces must be chosen by the user before the size of any member can be determined. When the soil type, the width and depth of the trench, and the horizontal spacing of the crossbraces are known, the size and vertical spacing of the crossbraces, the size and vertical spacing of the wales, and the size and horizontal spacing of the uprights can be read from the appropriate table.

(f) *Examples to Illustrate the Use of Tables C–1.1 through C–1.3.*

(1) *Example 1.*

A trench dug in Type A soil is 13 feet deep and five feet wide.

From *Table C–1.1*, for acceptable arrangements of timber can be used.

Arrangement #B1

Space 4×4 crossbraces at six feet horizontally and four feet vertically.

Wales are not required.

Space 3×8 uprights at six feet horizontally. This arrangement is commonly called "skip shoring."

Arrangement #B2

Space 4×6 crossbraces at eight feet horizontally and four feet vertically.

Space 8×8 wales at four feet vertically.

Space 2x6 uprights at four feet horizontally.

Arrangement #B3

Space 6x6 crossbraces at 10 feet horizontally and four feet vertically.

Space 8x10 wales at four feet vertically.

Space 2x6 uprights at five feet horizontally.

Arrangement #B4

Space 6x6 crossbraces at 12 feet horizontally and four feet vertically.

Space 10x10 wales at four feet vertically.

Spaces 3x8 uprights at six feet horizontally.

(2) *Example 2.*

A trench dug in Type B soil in 13 feet deep and five feet wide. From Table C-1.2 three acceptable arrangements of members are listed.

Arrangement #B1

Space 6x8 crossbraces at six feet horizontally and five feet vertically.

Space 8x8 wales at five feet vertically.

Space 2x6 uprights at two feet horizontally.

Arrangement #B2

Space 6x8 crossbraces at eight feet horizontally and five feet vertically.

Space 10x10 wales at five feet vertically.

Space 2x6 uprights at two feet horizontally.

Arrangement #B3

Space 8x8 crossbraces at 10 feet horizontally and five feet vertically.

Space 10x12 wales at five feet vertically.

Space 2x6 uprights at two feet vertically.

(3) *Example 3.*

A trench dug in Type C soil is 13 feet deep and five feet wide.

From Table C-1.3 two acceptable arrangements of members can be used.

Arrangement #B1

Space 8x8 crossbraces at six feet horizontally and five feet vertically.

Space 10x12 wales at five feet vertically.

Position 2x6 uprights as closely together as possible.

If water must be retained use special tongue and groove uprights to form tight sheeting.

Arrangement #B2

Space 8x10 crossbraces at eight feet horizontally and five feet vertically.

Space 12x12 wales at five feet vertically.

Position 2x6 uprights in a close sheeting configuration unless water pressure must be resisted. Tight sheeting must be used where water must be retained.

(4) *Example 4.*

A trench dug in Type C soil is 20 feet deep and 11 feet wide. The size and spacing of members for the section of trench that is over 15 feet in depth is determined using Table C-1.3. Only one arrangement of members is provided.

Space 8x10 crossbraces at six feet horizontally and five feet vertically.

Space 12x12 wales at five feet vertically.

Use 3x6 tight sheeting.

Use of Tables C-2.1 through C-2.3 would follow the same procedures.

(g) *Notes for all Tables.*

1. Member sizes at spacings other than indicated are to be determined as specified in §1926.652(c), "Design of Protective Systems."

2. When conditions are saturated or submerged use Tight Sheeting. Tight Sheeting refers to the use of specially-edged timber planks (e.g., tongue and groove) at least three inches thick, steel sheet piling, or similar construction that when driven or placed in position provide a tight wall to resist the lateral pressure of water and to prevent the loss of backfill material. Close Sheeting refers to the placement of planks side-by-side allowing as little space as possible between them.

3. All spacing indicated is measured center to center.

4. Wales to be installed with greater dimension horizontal.

5. If the vertical distance from the center of the lowest crossbrace to the bottom of the trench exceeds two and one-half feet, uprights shall be firmly embedded or a mudsill shall be used. Where uprights are embedded, the vertical distance from the center of the lowest crossbrace to the bottom of the trench shall not exceed 36 inches. When mudsills are used, the vertical distance shall not exceed 42 inches. Mudsills are wales that are installed at the toe of the trench side.

6. Trench jacks may be used in lieu of or in combination with timber crossbraces.

7. Placement of crossbraces. When the vertical spacing of crossbraces is four feet, place the top crossbrace no more than two feet below the top of the trench. When the vertical spacing of crossbraces is five feet, place the top crossbrace no more than 2.5 feet below the top of the trench.

TABLE C-1.1

TIMBER TRENCH SHORING -- MINIMUM TIMBER REQUIREMENTS *

SOIL TYPE A $P_a = 25 \times H + 72$ psf (2 ft Surcharge)

DEPTH OF TRENCH (FEET)	SIZE (ACTUAL) AND SPACING OF MEMBERS **													
	CROSS BRACES							WALES		UPRIGHTS				
	HORIZ. SPACING (FEET)	WIDTH OF TRENCH (FEET)					VERT. SPACING (FEET)	SIZE (IN)	VERT. SPACING (FEET)	MAXIMUM ALLOWABLE HORIZONTAL SPACING (FEET)				
		UP TO 4	UP TO 6	UP TO 9	UP TO 12	UP TO 15				CLOSE	4	5	6	8
5 TO 10	UP TO 6	4X4	4X4	4X6	6X6	6X6	4	Not Req'd	---				2X6	
	UP TO 8	4X4	4X4	4X6	6X6	6X6	4	Not Req'd	---					2X8
	UP TO 10	4X6	4X6	4X6	6X6	6X6	4	8X8	4			2X6		
	UP TO 12	4X6	4X6	6X6	6X6	6X6	4	8X8	4				2X6	
10 TO 15	UP TO 6	4X4	4X4	4X6	6X6	6X6	4	Not Req'd	---				3X8	
	UP TO 8	4X6	4X6	6X6	6X6	6X6	4	8X8	4		2X6			
	UP TO 10	6X6	6X5	6X6	6X8	6X8	4	8X10	4			2X6		
	UP TO 12	6X6	6X6	6X6	6X8	6X8	4	10X10	4				3X8	
15 TO 20	UP TO 6	6X6	6X6	6X6	6X8	6X8	4	6X8	4	3X6				
	UP TO 8	6X6	6X6	6X6	6X8	6X8	4	8X8	4	3X6				
	UP TO 10	8X8	8X8	8X8	8X8	8X10	4	8X10	4	3X6				
	UP TO 12	8X8	8X8	8X8	8X8	8X10	4	10X10	4	3X6				
OVER 20	SEE NOTE 1													

* Mixed oak or equivalent with a bending strength not less than 850 psi.
** Manufactured members of equivalent strength may by substituted for wood.

TABLE C-1.2

TIMBER TRENCH SHORING -- MINIMUM TIMBER REQUIREMENTS *

SOIL TYPE B P_a = 45 X H + 72 psf (2 ft. Surcharge)

DEPTH OF TRENCH (FEET)	SIZE (ACTUAL) AND SPACING OF MEMBERS**													
	CROSS BRACES							WALES		UPRIGHTS				
	HORIZ. SPACING (FEET)	WIDTH OF TRENCH (FEET)					VERT. SPACING (FEET)	SIZE (IN)	VERT. SPACING (FEET)	MAXIMUM ALLOWABLE HORIZONTAL SPACING (FEET)				
		UP TO 4	UP TO 6	UP TO 9	UP TO 12	UP TO 15				CLOSE	2	3		
5 TO 10	UP TO 6	4X6	4X6	6X6	6X6	6X6	5	6X8	5			2X6		
	UP TO 8	6X6	6X6	6X6	6X8	6X8	5	8X10	5			2X6		
	UP TO 10	6X6	6X6	6X6	6X8	6X8	5	10X10	5			2X6		
	See Note 1													
10 TO 15	UP TO 6	6X6	6X6	6X6	6X8	6X8	5	8X8	5		2X6			
	UP TO 8	6X8	6X8	6X8	8X8	8X8	5	10X10	5		2X6			
	UP TO 10	8X8	8X8	8X8	8X8	8X10	5	10X12	5		2X6			
	See Note 1													
15 TO 20	UP TO 6	6X8	6X8	6X8	8X8	8X8	5	8X10	5	3X6				
	UP TO 8	8X8	8X8	8X8	8X8	8X10	5	10X12	5	3X6				
	UP TO 10	8X10	8X10	8X10	8X10	10X10	5	12X12	5	3X6				
	See Note 1													
OVER 20	SEE NOTE 1													

* Mixed oak or equivalent with a bending strength not less than 850 psi.
** Manufactured members of equivalent strength may by substituted for wood.

TABLE C-1.3

TIMBER TRENCH SHORING -- MINIMUM TIMBER REQUIREMENTS *

SOIL TYPE C P_a = 80 X H + 72 psf (2 ft. Surcharge)

DEPTH OF TRENCH (FEET)	SIZE (ACTUAL) AND SPACING OF MEMBERS**														
	CROSS BRACES									UPRIGHTS					
	HORIZ. SPACING (FEET)	WIDTH OF TRENCH (FEET)					VERT. SPACING (FEET)	SIZE (IN)	VERT. SPACING (FEET)	MAXIMUM ALLOWABLE HORIZONTAL SPACING (FEET) (See Note 2)					
		UP TO 4	UP TO 6	UP TO 9	UP TO 12	UP TO 15				CLOSE					
5 TO 10	UP TO 6	6X8	6X8	6X8	8X8	8X8	5	8X10	5	2X6					
	UP TO 8	8X8	8X8	8X8	8X8	8X10	5	10X12	5	2X6					
	UP TO 10	8X10	8X10	8X10	8X10	10X10	5	12X12	5	2X6					
	See Note 1														
10 TO 15	UP TO 6	8X8	8X8	8X8	8X8	8X10	5	10X12	5	2X6					
	UP TO 8	8X10	8X10	8X10	8X10	10X10	5	12X12	5	2X6					
	See Note 1														
	See Note 1														
15 TO 20	UP TO 6	8X10	8X10	8X10	8X10	10X10	5	12X12	5	3X6					
	See Note 1														
	See Note 1														
	See Note 1														
OVER 20	SEE NOTE 1														

* Mixed Oak or equivalent with a bending strength not less than 850 psi.
** Manufactured members of equivalent strength may be substituted for wood.

TABLE C-2.1

TIMBER TRENCH SHORING -- MINIMUM TIMBER REQUIREMENTS *

SOIL TYPE A P_a = 25 X H ± 72 psf (2 ft. Surcharge)

DEPTH OF TRENCH (FEET)	SIZE (S4S) AND SPACING OF MEMBERS **													
	CROSS BRACES							WALES		UPRIGHTS				
	HORIZ. SPACING (FEET)	WIDTH OF TRENCH (FEET)					VERT. SPACING (FEET)	SIZE (IN)	VERT. SPACING (FEET)	MAXIMUM ALLOWABLE HORIZONTAL SPACING (FEET)				
		UP TO 4	UP TO 6	UP TO 9	UP TO 12	UP TO 15				CLOSE	4	5	6	8
5 TO 10	UP TO 6	4X4	4X4	4X4	4X4	4X6	4	Not Req'd	Not Req'd				4X6	
	UP TO 8	4X4	4X4	4X4	4X6	4X6	4	Not Req'd	Not Req'd					4X8
	UP TO 10	4X6	4X6	4X6	6X6	6X6	4	8X8	4			4X6		
	UP TO 12	4X6	4X6	4X6	6X6	6X6	4	8X8	4				4X6	
10 TO 15	UP TO 6	4X4	4X4	4X4	6X6	6X6	4	Not Req'd	Not Req'd				4X10	
	UP TO 8	4X6	4X6	4X6	6X6	6X6	4	6X8	4		4X6			
	UP TO 10	6X6	6X6	6X6	6X6	6X6	4	8X8	4			4X8		
	UP TO 12	6X6	6X6	6X6	6X6	6X6	4	8X10	4		4X6		4X10	
15 TO 20	UP TO 6	6X6	6X6	6X6	6X6	6X6	4	6X8	4	3X6				
	UP TO 8	6X6	6X6	6X6	6X6	6X6	4	8X8	4	3X6	4X12			
	UP TO 10	6X6	6X6	6X6	6X6	6X8	4	8X10	4	3X6				
	UP TO 12	6X6	6X6	6X6	6X8	6X8	4	8X12	4	3X6	4X12			
OVER 20	SEE NOTE 1													

* Douglas fir or equivalent with a bending strength not less than 1500 psi.

** Manufactured members of equivalent strength may be substituted for wood.

TABLE C-2.2

TIMBER TRENCH SHORING -- MINIMUM TIMBER REQUIREMENTS *

SOIL TYPE B P_a = 45 X H + 72 psf (2 ft. Surcharge)

DEPTH OF TRENCH (FEET)	SIZE (S4S) AND SPACING OF MEMBERS **													
	CROSS BRACES							WALES		UPRIGHTS				
	HORIZ. SPACING (FEET)	WIDTH OF TRENCH (FEET)					VERT. SPACING (FEET)	SIZE (IN)	VERT. SPACING (FEET)	MAXIMUM ALLOWABLE HORIZONTAL SPACING (FEET)				
		UP TO 4	UP TO 6	UP TO 9	UP TO 12	UP TO 15				CLOSE	2	3	4	6
5 TO 10	UP TO 6	4X6	4X6	4X6	6X6	6X6	5	6X8	5			3X12 4X8		4X12
	UP TO 8	4X6	4X6	6X6	6X6	6X6	5	8X8	5		3X8		4X8	
	UP TO 10	4X6	4X6	6X6	6X6	6X8	5	8X10	5			4X8		
	See Note 1													
10 TO 15	UP TO 6	6X6	6X6	6X6	6X8	6X8	5	8X8	5	3X6	4X10			
	UP TO 8	6X8	6X8	6X8	8X8	8X8	5	10X10	5	3X6	4X10			
	UP TO 10	6X8	6X8	8X8	8X8	8X8	5	10X12	5	3X6	4X10			
	See Note 1													
15 TO 20	UP TO 6	6X8	6X8	6X8	6X8	8X8	5	8X10	5	4X6				
	UP TO 8	6X8	6X8	6X8	8X8	8X8	5	10X12	5	4X6				
	UP TO 10	8X8	8X8	8X8	8X8	8X8	5	12X12	5	4X6				
	See Note 1													
OVER 20	SEE NOTE 1													

* Douglas fir or equivalent with a bending strength not less than 1500 psi.

** Manufactured members of equivalent strength may be substituted for wood.

TABLE C-2.3

TIMBER TRENCH SHORING -- MINIMUM TIMBER REQUIREMENTS *

SOIL TYPE C P_a = 80 X H + 72 psf (2 ft. Surcharge)

DEPTH OF TRENCH (FEET)	SIZE (S4S) AND SPACING OF MEMBERS **													
	CROSS BRACES							WALES		UPRIGHTS				
	HORIZ. SPACING (FEET)	WIDTH OF TRENCH (FEET)					VERT. SPACING (FEET)	SIZE (IN)	VERT. SPACING (FEET)	MAXIMUM ALLOWABLE HORIZONTAL SPACING (FEET)				
		UP TO 4	UP TO 6	UP TO 9	UP TO 12	UP TO 15				CLOSE				
5 TO 10	UP TO 6	6X6	6X6	6X6	6X6	8X8	5	8X8	5	3X6				
	UP TO 8	6X6	6X6	6X6	8X8	8X8	5	10X10	5	3X6				
	UP TO 10	6X6	6X6	8X8	8X8	8X8	5	10X12	5	3X6				
	See Note 1													
10 TO 15	UP TO 6	6X8	6X8	6X8	8X8	8X8	5	10X10	5	4X6				
	UP TO 8	8X8	8X8	8X8	8X8	8X8	5	12X12	5	4X6				
	See Note 1													
	See Note 1													
15 TO 20	UP TO 6	8X8	8X8	8X8	8X10	8X10	5	10X12	5	4X6				
	See Note 1													
	See Note 1													
	See Note 1													
OVER 20	SEE NOTE 1													

* Douglas fir or equivalent with a bending strength not less than 1500 psi.
** Manufactured members of equivalent strength may be substituted for wood.

APPENDIX D TO SUBPART P—ALUMINUM HYDRAULIC SHORING FOR TRENCHES

(a) *Scope.* This appendix contains information that can be used when aluminum hydraulic shoring is provided as a method of protection against cave-ins in trenches that do not exceed 20 feet (6.1m) in depth. This appendix must be used when design of the aluminum hydraulic protective system cannot be performed in accordance with §1926.652(c)(2).

(b) *Soil Classification.* In order to use data presented in this appendix, the soil type or types in which the excavation is made must first be determined using the soil classification method set forth in appendix A of subpart P of part 1926.

(c) *Presentation of Information.* Information is presented in several forms as follows:

(1) Information is presented in tabular form in Tables D–1.1, D–1.2, D–1.3 and E–1.4. Each table presents the maximum vertical and horizontal spacings that may be used with various aluminum member sizes and various hydraulic cylinder sizes. Each table contains data only for the particular soil type in which the excavation or portion of the excavation is made. Tables D–1.1 and D–1.2 are for vertical shores in Types A and B soil. Tables D–1.3 and D1.4 are for horizontal waler systems in Types B and C soil.

(2) Information concerning the basis of the tabular data and the limitations of the data is presented in paragraph (d) of this appendix.

(3) Information explaining the use of the tabular data is presented in paragraph (e) of this appendix.

(4) Information illustrating the use of the tabular data is presented in paragraph (f) of this appendix.

(5) Miscellaneous notations (footnotes) regarding Table D–1.1 through D–1.4 are presented in paragraph (g) of this appendix.

(6) Figures, illustrating typical installations of hydraulic shoring, are included just prior to the Tables. The illustrations page is entitled "Aluminum Hydraulic Shoring; Typical Installations."

(d) *Basis and limitations of the data.*

(1) Vertical shore rails and horizontal wales are those that meet the Section Modulus requirements in the D–1 Tables. Aluminum material is 6061–T6 or material of equivalent strength and properties.

(2) Hydraulic cylinders specifications. (i) 2-inch cylinders shall be a minimum 2-inch inside diameter with a minimum safe working capacity of no less than 18,000 pounds axial compressive load at maximum extension. Maximum extension is to include full range of cylinder extensions as recommended by product manufaturer.

(ii) 3-inch cylinders shall be a minimum 3-inch inside diameter with a safe working capacity of not less than 30,000 pounds axial compressive load at extensions as recommended by product manufacturer.

(3) Limitation of application.

(i) It is not intended that the aluminum hydraulic specification apply to every situation that may be experienced in the field. These data were developed to apply to the situations that are most commonly experienced in current trenching practice. Shoring systems for use in situations that are not covered by the data in this appendix must be otherwise designed as specified in §1926.652(c).

(ii) When any of the following conditions are present, the members specified in the Tables are not considered adequate. In this case, an alternative aluminum hydraulic shoring system or other type of protective system must be designed in accordance with §1926.652.

(A) When vertical loads imposed on cross braces exceed a 100 Pound gravity load distributed on a one foot section of the center of the hydraulic cylinder.

(B) When surcharge loads are present from equipment weighing in excess of 20,000 pounds.

(C) When only the lower portion or a trench is shored and the remaining portion of the trench is sloped or benched unless: The sloped portion is sloped at an angle less steep than three horizontal to one vertical; or the members are selected from the tables for use at a depth which is determined from the top of the overall trench, and not from the toe of the sloped portion.

(e) *Use of Tables D-1.1, D-1.2, D-1.3 and D-1.4.* The members of the shoring system that are to be selected using this information are the hydraulic cylinders, and either the vertical shores or the horizontal wales. When a waler system is used the vertical timber sheeting to be used is also selected from these tables. The Tables D–1.1 and D–1.2 for vertical shores are used in Type A and B soils that do not require sheeting. Type B soils that may require sheeting, and Type C soils that always require sheeting are found in the horizontal wale Tables D–1.3 and D–1.4. The soil type must first be determined in accordance with the soil classification system described in appendix A to subpart P of part 1926. Using the appropriate table, the selection of the size and spacing of the members is made. The selection is based on the depth and width of the trench where the members are to be installed. In these tables the vertical spacing is held constant at four feet on center. The tables show the maximum horizontal spacing of cylinders allowed for each size of wale in the waler system tables, and in the vertical shore tables, the hydraulic cylinder horizontal spacing is the same as the vertical shore spacing.

(f) *Example to Illustrate the Use of the Tables:*

(1) Example 1:

A trench dug in Type A soil is 6 feet deep and 3 feet wide. From Table D–1.1: Find vertical shores and 2 inch diameter cylinders spaced 8 feet on center (o.c.) horizontally and 4 feet on center (o.c.) vertically. (See Figures 1 & 3 for typical installations.)

(2) Example 2:

A trench is dug in Type B soil that does not require sheeting, 13 feet deep and 5 feet wide. From Table D–1.2: Find vertical shores and 2 inch diameter cylinders spaced 6.5 feet o.c. horizontally and 4 feet o.c. vertically. (See Figures 1 & 3 for typical installations.)

(3) A trench is dug in Type B soil that does not require sheeting, but does experience some minor raveling of the trench face. The

trench is 16 feet deep and 9 feet wide. From Table D-1.2: Find vertical shores and 2 inch diameter cylinder (with special oversleeves as designated by footnote #B2) spaced 5.5 feet o.c. horizontally and 4 feet o.c. vertically, plywood (per footnote (g)(7) to the D-1 Table) should be used behind the shores. (See Figures 2 & 3 for typical installations.)

(4) Example 4: A trench is dug in previously disturbed Type B soil, with characteristics of a Type C soil, and will require sheeting. The trench is 18 feet deep and 12 feet wide. 8 foot horizontal spacing between cylinders is desired for working space. From Table D-1.3: Find horizontal wale with a section modulus of 14.0 spaced at 4 feet o.c. vertically and 3 inch diameter cylinder spaced at 9 feet maximum o.c. horizontally. 3x12 timber sheeting is required at close spacing vertically. (See Figure 4 for typical installation.)

(5) Example 5: A trench is dug in Type C soil, 9 feet deep and 4 feet wide. Horizontal cylinder spacing in excess of 6 feet is desired for working space. From Table D-1.4: Find horizontal wale with a section modulus of 7.0 and 2 inch diameter cylinders spaced at 6.5 feet o.c. horizontally. Or, find horizontal wale with a 14.0 section modulus and 3 inch diameter cylinder spaced at 10 feet o.c. horizontally. Both wales are spaced 4 feet o.c. vertically. 3x12 timber sheeting is required at close spacing vertically. (See Figure 4 for typical installation.)

(g) *Footnotes, and general notes, for Tables D-1.1, D-1.2, D-1.3, and D-1.4.*

(1) For applications other than those listed in the tables, refer to § 1926.652(c)(2) for use of manufacturer's tabulated data. For trench depths in excess of 20 feet, refer to § 1926.652(c)(2) and § 1926.652(c)(3).

(2) 2 inch diameter cylinders, at this width, shall have structural steel tube (3.5x3.5x0.1875) oversleeves, or structural oversleeves of manufacturer's specification, extending the full, collapsed length.

(3) Hydraulic cylinders capacities. (i) 2 inch cylinders shall be a minimum 2-inch inside diameter with a safe working capacity of not less than 18,000 pounds axial compressive load at maximum extension. Maximum extension is to include full range of cylinder extensions as recommended by product manufacturer.

(ii) 3-inch cylinders shall be a minimum 3-inch inside diameter with a safe work capacity of not less than 30,000 pounds axial compressive load at maximum extension. Maximum extension is to include full range of cylinder extensions as recommended by product manufacturer.

(4) All spacing indicated is measured center to center.

(5) Vertical shoring rails shall have a minimum section modulus of 0.40 inch.

(6) When vertical shores are used, there must be a minimum of three shores spaced equally, horizontally, in a group.

(7) Plywood shall be 1.125 in. thick softwood or 0.75 inch. thick, 14 ply, arctic white birch (Finland form). Please note that plywood is not intended as a structural member, but only for prevention of local raveling (sloughing of the trench face) between shores.

(8) See appendix C for timber specifications.

(9) Wales are calculated for simple span conditions.

(10) See appendix D, item (d), for basis and limitations of the data.

ALUMINUM HYDRAULIC SHORING
TYPICAL INSTALLATIONS

FIGURE NO. 1
VERTICAL ALUMINUM
HYDRAULIC SHORING
(SPOT BRACING)

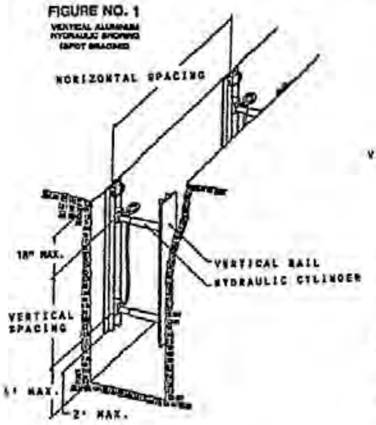


FIGURE NO. 2
VERTICAL ALUMINUM
HYDRAULIC SHORING
(WITH PLYWOOD)

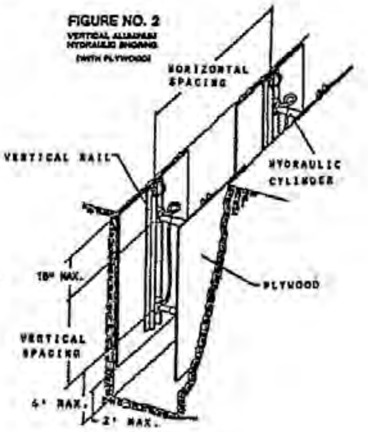


FIGURE NO. 3
VERTICAL ALUMINUM
HYDRAULIC SHORING
(STACKED)

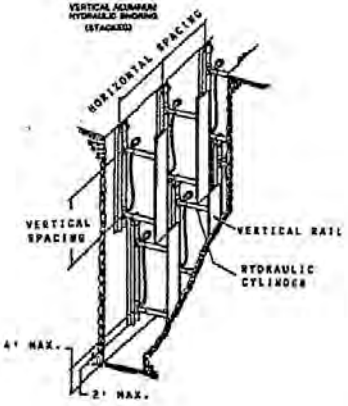


FIGURE NO. 4
ALUMINUM HYDRAULIC SHORING
WALER SYSTEM
(TYPICAL)

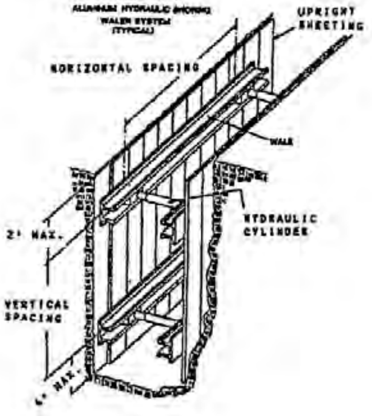


TABLE D - 1.1
ALUMINUM HYDRAULIC SHORING
VERTICAL SHORES
FOR SOIL TYPE A

DEPTH OF TRENCH (FEET)	HYDRAULIC CYLINDERS				
	MAXIMUM HORIZONTAL SPACING (FEET)	MAXIMUM VERTICAL SPACING (FEET)	WIDTH OF TRENCH (FEET)		
			UP TO 8	OVER 8 UP TO 12	OVER 12 UP TO 15
OVER 5 UP TO 10	8	4	2 INCH DIAMETER	2 INCH DIAMETER NOTE (2)	3 INCH DIAMETER
OVER 10 UP TO 15	8				
OVER 15 UP TO 20	7				
OVER 20	NOTE (1)				

Footnotes to tables, and general notes on hydraulic shoring, are found in Appendix D, Item (g)
Note (1): See Appendix D, Item (g) (1)
Note (2): See Appendix D, Item (g) (2)

TABLE D - 1.2
ALUMINUM HYDRAULIC SHORING
VERTICAL SHORES
FOR SOIL TYPE B

DEPTH OF TRENCH (FEET)	HYDRAULIC CYLINDERS				
	MAXIMUM HORIZONTAL SPACING (FEET)	MAXIMUM VERTICAL SPACING (FEET)	WIDTH OF TRENCH (FEET)		
			UP TO 8	OVER 8 UP TO 12	OVER 12 UP TO 15
OVER 5 UP TO 10	8	4	2 INCH DIAMETER	2 INCH DIAMETER NOTE (2)	3 INCH DIAMETER
OVER 10 UP TO 15	6.5				
OVER 15 UP TO 20	5.5				
OVER 20	NOTE (1)				

Footnotes to tables, and general notes on hydraulic shoring, are found in Appendix D, Item (g)
Note (1): See Appendix D, Item (g) (1)
Note (2): See Appendix D, Item (g) (2)

TABLE D - 1.3
ALUMINUM HYDRAULIC SHORING
WALER SYSTEMS
FOR SOIL TYPE B

DEPTH OF TRENCH	WALES		HYDRAULIC CYLINDERS						TIMBER UPRIGHTS		
			WIDTH OF TRENCH (FEET)						MAX.HORIZ.SPACING (ON CENTER)		
	VERTICAL SPACING	SECTION MODULUS *	UP TO 8		OVER 8 UP TO 12		OVER 12 UP TO15		SOLID SHEET	2 FT.	3 FT.
(FEET)	(FEET)	(IN^3)	HORIZ. SPACING	CYLINDER DIAMETER	HORIZ. SPACING	CYLINDER DIAMETER	HORIZ. SPACING	CYLINDER DIAMETER			
OVER 5 UP TO 10	4	3.5	8.0	2 IN	8.0	2 IN NOTE(2)	8.0	3 IN	—	—	3x12
		7.0	9.0	2 IN	9.0	2 IN NOTE(2)	9.0	3 IN			
		14.0	12.0	3 IN	12.0	3 IN	12.0	3 IN			
OVER 10 UP TO 15	4	3.5	6.0	2 IN	6.0	2 IN NOTE(2)	6.0	3 IN	—	3x12	—
		7.0	8.0	3 IN	8.0	3 IN	8.0	3 IN			
		14.0	10.0	3 IN	10.0	3 IN	10.0	3 IN			
OVER 15 UP TO 20	4	3.5	5.5	2 IN	5.5	2 IN NOTE(2)	5.5	3 IN	3x12	—	—
		7.0	6.0	3 IN	6.0	3 IN	6.0	3 IN			
		14.0	9.0	3 IN	9.0	3 IN	9.0	3 IN			
OVER 20	NOTE (1)										

Footnotes to tables, and general notes on hydraulic shoring, are found in Appendix D, Item (g)
Notes (1): See Appendix D, item (g) (1)
Notes (2): See Appendix D, Item (g) (2)
* Consult product manufacturer and/or qualified engineer for Section Modulus of available wales.

TABLE D - 1.4
ALUMINUM HYDRAULIC SHORING
WALER SYSTEMS
FOR SOIL TYPE C

DEPTH OF TRENCH	WALES		HYDRAULIC CYLINDERS						TIMBER UPRIGHTS		
			WIDTH OF TRENCH (FEET)						MAX.HORIZ SPACING (ON CENTER)		
	VERTICAL SPACING	* SECTION MODULUS	UP TO 8		OVER 8 UP TO 12		OVER 12 UP TO 15		SOLID SHEET	2 FT.	3 FT.
(FEET)	(FEET)	(IN^3)	HORIZ. SPACING	CYLINDER DIAMETER	HORIZ. SPACING	CYLINDER DIAMETER	HORIZ. SPACING	CYLINDER DIAMETER			
OVER 5 UP TO 10	4	3.5	6.0	2 IN	6.0	2 IN NOTE(2)	6.0	3 IN	3x12	—	—
		7.0	6.5	2 IN	6.5	2 IN NOTE(2)	6.5	3 IN			
		14.0	10.0	3 IN	10.0	3 IN	10.0	3 IN			
OVER 10 UP TO 15	4	3.5	4.0	2 IN	4.0	2 IN NOTE(2)	4.0	3 IN	3x12	—	—
		7.0	5.5	3 IN	5.5	3 IN	5.5	3 IN			
		14.0	8.0	3 IN	8.0	3 IN	8.0	3 IN			
OVER 15 UP TO 20	4	3.5	3.5	2 IN	3.5	2 IN NOTE(2)	3.5	3 IN	3x12	—	—
		7.0	5.0	3 IN	5.0	3 IN	5.0	3 IN			
		14.0	6.0	3 IN	6.0	3 IN	6.0	3 IN			
OVER 20	NOTE (1)										

Footnotes to tables, and general notes on hydraulic shoring, are found in Appendix D, Item (g)
Notes (1): See Appendix D, item (g) (1)
Notes (2): See Appendix D, Item (g) (2)
* Consult product manufacturer and/or qualified engineer for Section Modulus of available wales.

APPENDIX E TO SUBPART P—ALTERNATIVES TO TIMBER SHORING

Figure 1. Aluminum Hydraulic Shoring

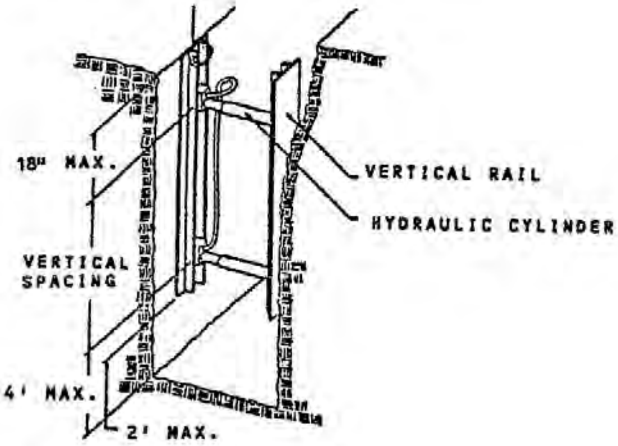


Figure 2. Pneumatic/hydraulic Shoring

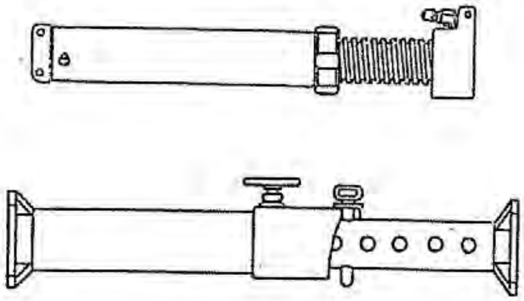


Figure 3. Trench Jacks (Screw Jacks)

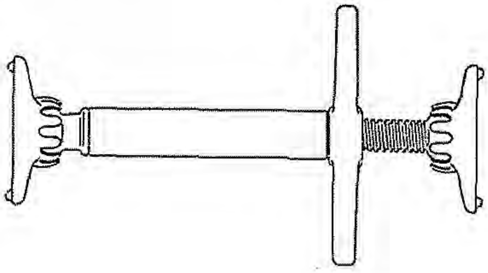
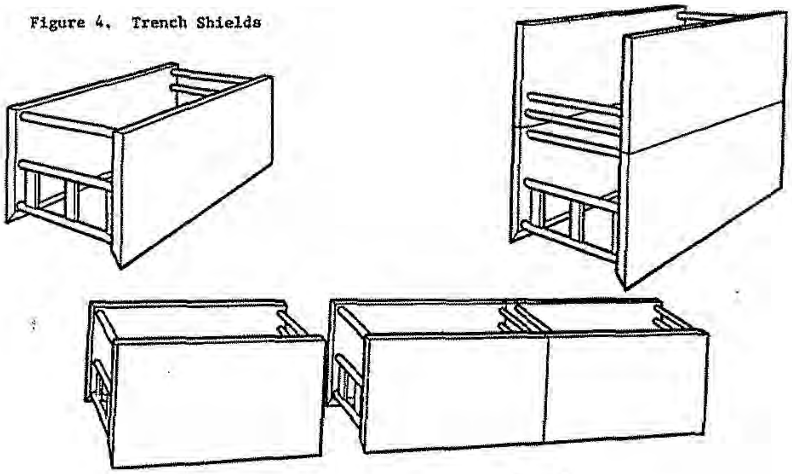


Figure 4. Trench Shields



Appendix F to Subpart P—Selection of Protective Systems

The following figures are a graphic summary of the requirements contained in subpart P for excavations 20 feet or less in depth. Protective systems for use in excavations more than 20 feet in depth must be designed by a registered professional engineer in accordance with § 1926.652 (b) and (c).

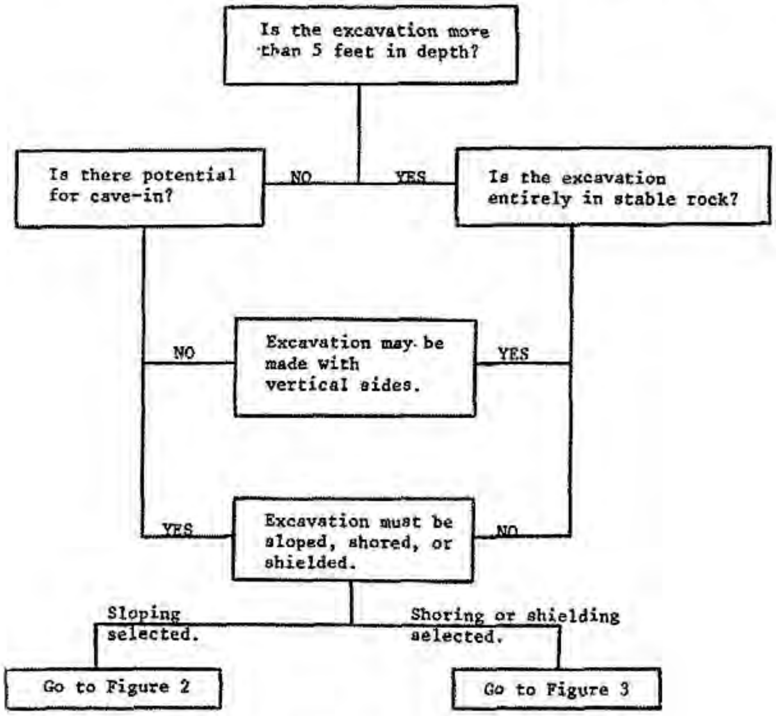


FIGURE 1 - PRELIMINARY DECISIONS

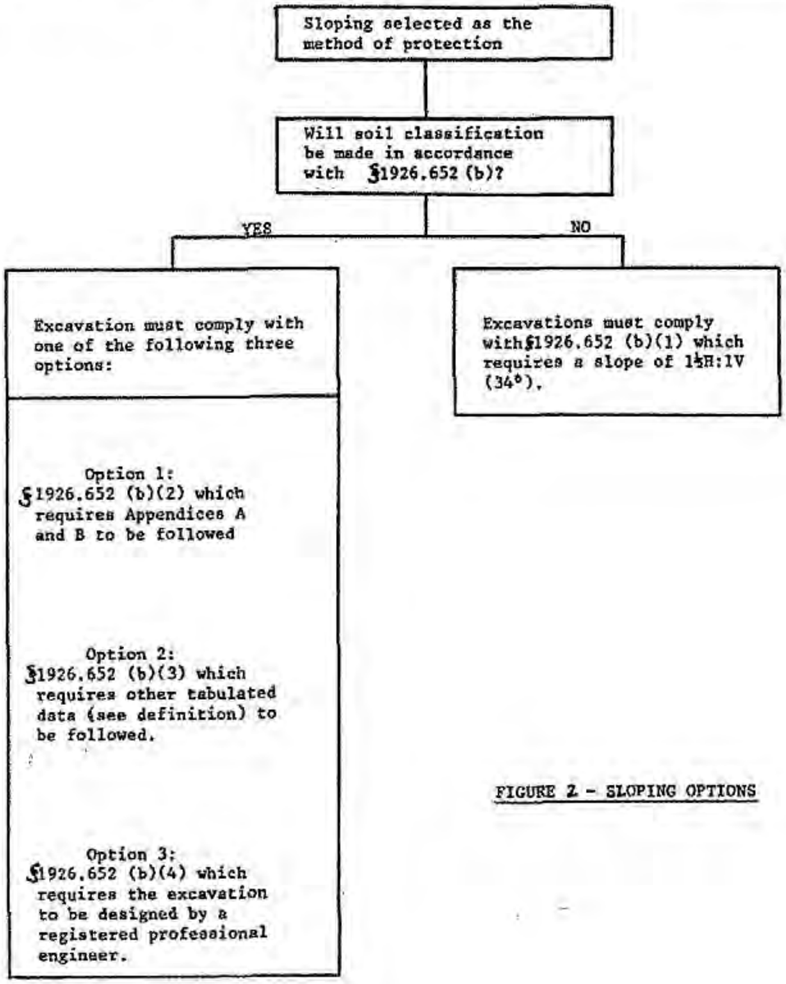
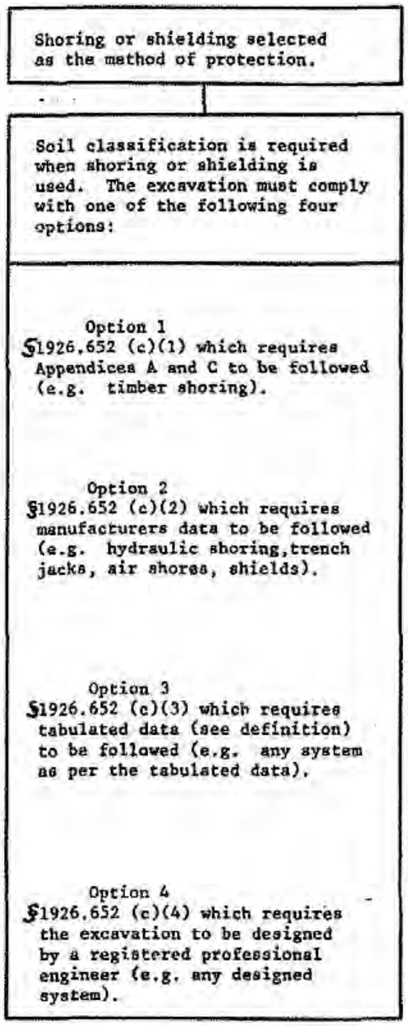


FIGURE 2 - SLOPING OPTIONS



Shoring or shielding selected as the method of protection.

Soil classification is required when shoring or shielding is used. The excavation must comply with one of the following four options:

Option 1
§1926.652 (c)(1) which requires Appendices A and C to be followed (e.g. timber shoring).

Option 2
§1926.652 (c)(2) which requires manufacturers data to be followed (e.g. hydraulic shoring, trench jacks, air shores, shields).

Option 3
§1926.652 (c)(3) which requires tabulated data (see definition) to be followed (e.g. any system as per the tabulated data).

Option 4
§1926.652 (c)(4) which requires the excavation to be designed by a registered professional engineer (e.g. any designed system).

FIGURE 3 - SHORING AND SHIELDING OPTIONS

Section 12: Water and Ice Safety Program

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Figures

Section 12: Water and Ice Safety Program

1.0 Introduction

The nature of Barr's work requires that, from time-to-time, Barr employees will have to work in and near lakes, streams, and wetlands. Work during winter months may also require that employees work on frozen water bodies. It is the policy of the company to provide for the safety of its employees who must work in such conditions through training, reference materials, careful project planning, providing proper equipment, and empowering its employees to make personal decisions regarding the safety of any specific work site. No Barr employee is expected to place him/herself or another person in an unsafe situation or a situation where they are unsure as to their safety regardless of the perceived importance of the work. Employees are expected to withdraw from any unsafe or uncertain circumstances and to contact the Project Manager, Principal in Charge, and/or the Company Health and Safety Manager to request assistance before proceeding further with the work.

2.0 Personal Floatation Devices (PFD) Requirements

Barr staff are required to wear a U.S. Coast Guard approved PFD (Type 1 PFD in Michigan) for work over or adjacent to water (i.e., work on or under bridges) where the danger of drowning exists and where Barr staff are not constantly protected from falling into the water. Barr staff working on or under bridges who are constantly protected by guardrail systems, net, or body harness systems are adequately protected from the danger of drowning and are NOT required to wear PFDs.

Additionally, PFDs may be required in certain cases of working in shallow water (less than four feet). This will be addressed on a site-specific basis with the project manager and will depend on water velocity and other site conditions. However, where tasks require staff to work on steep or slippery banks or where the potential to fall into shallow water and the danger of drowning exists, PFD use is required.

Only properly fitted PFDs may be worn and the PFD must be worn properly with zippers, straps and ties fastened and all loose ends tucked in to avoid snagging. Before being worn, the PFD will be inspected for defects that could alter its strength or buoyancy. Defective units will not be used and should be returned to the equipment maintenance technician.

3.0 Lifesaving Skiffs

At least one lifesaving skiff equipped with a method of propulsion effective for water conditions and a spare set of oars will be immediately available at the location where Barr staff are working over or adjacent to water (regardless of fall protection) and the possibility of drowning exists. The lifesaving skiff will be available to retrieve an employee from the water no more than three to four minutes from the time they enter the water. If there are additional hazards, such as very cold water or rapids that an employee could be swept into, the lifesaving skiff would have to able to retrieve an employee before they sustained injuries as a result of those additional hazards.

The lifesaving skiff will be in the water and capable of being quickly launched by one person. There will be at least one person present and specifically designated to respond to water emergencies and operate the skiff at all times when Barr staff are above water. A communication system, such as a walkie/ talkie, must be used to inform the skiff operator of an emergency and to inform the operator where the skiff is needed.

4.0 Ring Buoys

Ring buoys will be available when Barr staff are working near or above water where the danger of drowning exists. The ring buoys will have at least 90 feet of line and be readily available for emergency rescue operations. The distance between ring buoys will not exceed 200 feet and only US Coast Guard approved Type IV ring buoys may be used.

5.0 Other Safety Equipment

Body harnesses, lifelines and shock absorbing lanyards will be worn in conjunction with PFSs in situations where both falling hazards and drowning hazards are present. All body harnesses, lifelines and shock absorbing lanyards that are used must meet the criteria described in the Barr Fall Protection Program.

6.0 Buddy System Related to Water and Ice Safety

A "Buddy System" for purposes of water and ice safety means having another person nearby who can see you working, who is capable of and equipped to help you, and who has agreed to do so in an emergency. The person need not necessarily be another Barr employee. The need for a "Buddy" is determined by the specific site conditions and the nature of the work. Knowledge of conditions at the worksite is important in making such decisions.

Project managers are expected to obtain sufficient information to make decisions regarding the need for a "buddy" on a field assignment. Such information might be obtained from an initial field visit to the site, from calling the client to request their input or from sending an experienced Barr staff member to view the site as a part of planning the work. To avoid budget problems, such decisions ideally need to be made in the proposal and project scoping stage of the work. Barr staff responsible for carrying out the field assignment should request guidance on this issue from the project manager. If, when they arrive at the site, conditions do not match what was anticipated, and if they believe there is the need for a "buddy" to assist them, they are expected to call the project manager to request assistance in arranging for such help. They are not to proceed with such work until they receive proper assistance.

Use of the "Buddy System" also requires planning in terms of the skills and equipment needed to safely provide assistance. The "Buddy" is not expected to place him/herself in danger to provide such assistance. Preparing a plan of action ahead of time for addressing different potential emergency situations should enable him/her to provide such assistance safely. However, it is also important to have a backup strategy available including knowledge of emergency telephone numbers, locations for medical assistance, etc.

7.0 Working Alone In or Near Shallow Water

When project circumstances require a Barr employee to work in or near shallow water without a "buddy", other safety procedures should be followed. First, the site conditions must be known to the person performing the work. The initial site visit should be made in the company of a "buddy" if the employee must enter the water to verify site conditions. Secondly, Barr staff are encouraged to prepare a work itinerary and arrange a call-in schedule with the project manager or another Barr employee when working in these situations. If the person does not call-in within a pre-arranged window of time, a procedure will be implemented to find out what has happened. While this cannot likely summon help for a short-term emergency, the procedure can bring help in other situations.

Loud horns or alarms can also be used to summon help in areas where they can be heard by other people. Barr has such horns available. They are light-weight and can be attached to a belt. If a person will be working in a remote area, having a portable phone nearby is also advisable.

Barr staff who will be working alone in or near shallow water must have completed a training course in water safety. Barr will rely on the training, experience, and judgment of such staff members to prepare to do such work safely and to avoid situations that they regard to be unsafe.

8.0 Work in Shallow Water

The primary safety concerns associated with working in shallow water (less than four feet in depth) relate to slipping or falling, and from being carried in currents to deeper water and drowning. Barr staff are expected to anticipate the conditions they may encounter on such worksites and bring appropriate equipment with them to work safely. If site conditions are unknown, check with the project manager or principal in charge. If site information is not available, a reconnaissance visit to the site may be needed to properly plan the work.

In still waters like lakes, the condition of the bottom will likely be the determining factor regarding a hazard. An uneven bottom or a bottom with slippery rocks or drop offs can cause falls. A soft and muddy bottom, particularly with dense weeds, can also cause falls. Such hazards are also compounded by the need to carry equipment. With a solid bottom, waders may be appropriate. However, with a soft and weedy bottom, waders can be a hazard if the person falls. Weather permitting, a swimming suit or old pair of jeans along with some inexpensive tennis shoes may be a better choice. In colder weather, a wetsuit or drysuit may be needed. The same may apply to uneven or slippery areas. In many cases, a life jacket may be appropriate.

Moving water adds to the potential hazards described above. Streamflow, cross-currents and undertows can make work in even shallow water potentially dangerous. Work near culverts and storm drains can potentially be dangerous since vortex and other rotational flows near such structures can carry a person into areas where they can become trapped due to the forces involved. Areas downstream of dams and spillways can be particularly dangerous due to such rotational flows and undercurrents. Barr employees are not to work in such potentially hazardous areas without a special safety plan addressing the hazards and without prior approval by the principal in charge responsible for the work.

8.1 Water Velocity

For work in shallow streams in areas that are free of the above described hazards, Figure L-1 is presented as a guide to staff in deciding whether to enter a stream. As noted, this figure was obtained from a publication of the U.S. Department of Interior Bureau of Reclamation addressing concerns related to dam breaks. A curve has also been added to the figure representing the often referred to "rule of 9" (a rule of thumb indicating it is dangerous to be in water where the product of the depth times velocity equals 9). Note that this curve falls into what is called the "High Danger Zone". It should be viewed as a limit above which a person cannot reasonably stand in a stream and not as a guide for safety in working in the stream. As indicated, the middle shaded area refers to the "Judgment Zone". Barr staff are expected to use caution and good judgment in deciding to enter an area of a stream with depth and velocity in this zone. Again, bottom conditions and the amount of equipment to be carried will be a determining factor. Barr staff are expected to avoid working in portions of a stream with depth and velocity in the "High Danger zone" without preparation of a plan for safely doing so and prior discussion and approval of the PIC responsible for the work.

9.0 Work on Frozen Bodies of Water

Barr staff may periodically have to work on a frozen lake, marsh or stream. The strength or load bearing capacity of ice is quite variable and, therefore, caution is required to prevent accidents.

The Minnesota Department of Natural Resources (MDNR) has developed information concerning safety on frozen lakes and streams. Referencing research by the U.S. Army Cold Regions Research and Engineering Laboratory, the MDNR indicates that the following factors each influence the strength of ice:

- Ice thickness
- daily temperature
- snow cover
- water depth under ice
- size of water body
- age of ice
- how ice was formed
- distribution of loading
- water chemistry
- presence of decaying vegetation
- water current

Therefore, it is difficult to predict the strength of ice, particularly over a large area. Ice thickness can vary, due to site-specific conditions. Work on rivers and streams requires special attention to safety. Localized flows near bridges and other structures, around trees and "deadheads", and near streams or springs can cause thin ice. There is also concern related to falling through the ice in areas with under-ice currents. A copy of an MDNR brochure is available from the Health and Safety staff which provides more detailed information concerning ice properties and recommended procedures in the event of breaking through the ice.

The following guidelines and practices apply to Barr employees who must work on frozen water bodies:

1. When working on ice over water deeper than four feet, Barr staff are required to wear a U.S. Coast Guard approved PFD.
2. Use the "Buddy System" whenever required to work on ice unless the "known" water depth is less than four feet. Also use buddy system if working on ice over a stream with significant under ice current (1 fps or more). If working alone, follow the procedure as described above.
3. Before heading out onto ice, check with local people who are familiar with the water body (bait shop owners, ice fishermen, the local sheriff, police or fire department, etc.) Ask about any known hazards or areas to avoid.
4. When entering onto a frozen water body, check the ice depth as you proceed, using an ice chisel or ice auger. Do not proceed if:
    - the ice is less than three inches thick when walking alone on foot
    - the ice is less than five inches thick when using a snowmobile
    - there is standing water on the ice
    - the ice is visibly cracked, thawing or breaking up
5. It is Barr's practice that staff not drive cars or trucks onto frozen water bodies.
6. If you must carry a significant amount of equipment with you, consider pulling a toboggan. If walking to the work site is not practical, consider renting a snowmobile with an accompanying sled or toboggan or using the Barr ATV. Check the ice carefully along the planned route, and operate the snowmobile/ATV in accordance with all state and local laws. Snowmobile/ATV speed affects ice safety.
7. Anticipate the worst case (breaking through the ice), and bring along equipment, blankets and dry clothing to meet such emergencies. These items should not be brought out onto the water body, but rather left in the car or truck, assuming it is reasonably nearby in the event of an emergency. The MDNR also recommends that people carry two short lengths of sawed-off broom handle with sharpened nails on the ends, connected by a piece of nylon string. If a

person falls through the ice, the handles can be driven into the ice and used to pull him/herself forward and up onto safe ice. Rather than stand up at this point, the person is advised to roll away from the broken ice.

8. If a person falls through the ice, after assisting them to safety, help them to a warm dry place. Depending on the period of time they have been in the water, emergency medical care may be needed. Hypothermia is a dangerous and potentially life threatening condition. Additional information concerning hypothermia, expected survival times for different water temperatures, and related first aid is available from the Health and Safety staff.

10.0 Cofferdams

Although Barr does not operate cofferdams, when Barr staff work on or near cofferdams, they will be held responsible for the following OSHA requirements:

1. The cofferdam must be constructed and maintained in accordance with the engineering design.

2. If overtopping of the cofferdam by high waters is possible, then there must be a means to control flooding to the work area.

3. Emergency warning signals for the evacuation of employees must be developed and posted.

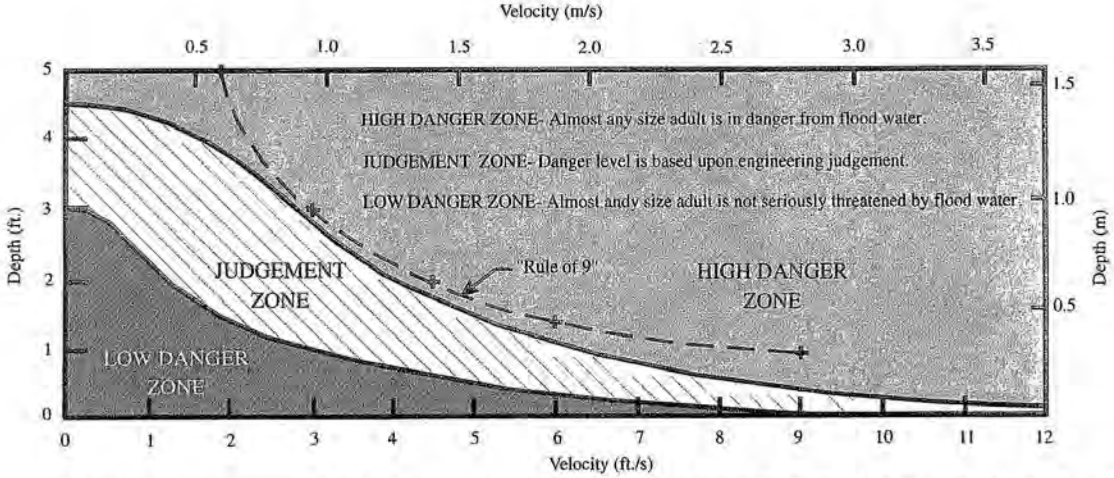
4. The cofferdam must have not less than two means of egress.

5. Runways, bridges, or ramps must be provided with guardrails as specified in OSHA construction standards.

6. If cofferdams are located close to navigable shipping channels, then warning devices that are visible to vessels in transit must be provided.

11.0 OSHA Regulations

Attached are several Federal and State OSHA regulations on work around water. Please refer to these prior to any water related field work.



From: Acer Technical Memorandum No. 11 Downstream Hazard Classification Guidelines U.S. Dept. of Interior-Bureau of Reclamation December, 1988

Figure L-1

DEPTH-VELOCITY FLOOD DANGER LEVEL RELATIONSHIP FOR ADULTS

Section 13 Boat Safety Program

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Forms

Section 13: Boat Safety Program

1.0 Introduction

The nature of Barr's business requires that Barr employees periodically work on rivers, lakes, and wetlands in boats and other watercraft. It is the policy of Barr to provide for the safety of employees who work on such projects through training, careful planning, providing equipment, and through empowering employees to make personal judgments as to the safety of their work situations. Barr employees working in boats and other watercraft must have completed a training course in boating safety. Employees are also expected to perform all such work in accordance with state and federal requirements related to boating. A boat safety checklist should be completed and reviewed with the project team prior to performing this work activity. Barr employees are not expected to place themselves, or another person, in an unsafe situation or a situation where they are unsure as to their safety, regardless of the perceived importance of the work.

2.0 Boat Safety Checklist

The Boat Safety Checklist (Form M-1) identifies a number of potential site hazards associated with working in watercraft. The checklist also asks an employee to identify ahead of time (to the best of his/her ability) the action to be taken in several potential emergency situations. The purpose of the checklist is to prompt the employee(s) involved in working on water to anticipate hazardous situations that could be encountered and to have an emergency response in mind if the condition develops. Individual copies of the Boat Safety Checklist are available from the Health and Safety Staff for use on individual projects.

Barr employees are encouraged to prepare a work itinerary and arrange a call-in schedule with the project manager or another Barr employee.

3.0 Buddy System Related to Boat Safety

A "Buddy System" for purposes of boat safety means having another person nearby who can see you working, who is capable of and equipped to help you, and who has agreed to do so in an emergency. The second person or "buddy" can either be in the boat or on shore. However, if the second person is to be on shore, he/she must have continuous communication with the person in the boat (e.g., walkie-talkie or close enough to talk and hear), and he/she must also have a clear view of the person, the boat, and the area around the boat (approximately 200 yards). The purpose is to enable the person on shore to keep the person in the boat informed as to what is occurring around him/her and warn them of any hazards. Depending upon the specific river environment and the potential hazards nearby, a third person may also be needed. The person need not necessarily by another Barr employee. The need for a "Buddy" is determined by the specific site conditions and the nature of the work. Knowledge of conditions at the worksite is important in making such decisions.

Project managers are expected to obtain sufficient information to make decisions regarding the need for a "buddy" on a field assignment. Such information might be obtained from an initial field visit to the site, from calling the client to request their input or from sending an experienced Barr employee to view the site as a part of planning the work. To avoid budget problems, such decisions ideally need to be made in the proposal and project scoping stage of the work. Barr employee responsible for carrying out the field assignment should request guidance on this issue from the project manager. If, when they arrive at the site, conditions do not match what was anticipated, and if they believe there is the need for a "buddy" to assist them, they are expected to call the project manager to request assistance in arranging for such help. They are not to proceed with such work until they receive proper assistance.

Use of the "Buddy System" also requires planning in terms of the skills and equipment needed to safely provide assistance. The "Buddy" is not expected to place him/herself in danger to provide such assistance. Preparing a plan of action ahead of time for addressing different potential emergency situations should enable him/her to provide such assistance safely. However, it is also important to have a backup strategy available including knowledge of emergency telephone numbers, locations for medical assistance, etc.

4.0 Personal Floatation Device (PFD) Requirements

Barr staff on board a boat or watercraft will wear a U.S. Coast Guard approved Type I, II or III PFD. For work on boats or watercraft in Michigan, only Type I PFDs are acceptable. Only properly fitted PFDs may be worn and the PFD must be worn properly with zippers, straps and ties fastened and all loose ends tucked in to avoid snagging. Before being worn, the PFD will be inspected for defects that could alter its strength or buoyancy. Defective units will not be used and should be returned to the equipment maintenance technician.

Barr staff are also required to wear a U.S. Coast Guard approved PFD (Type 1 PFD in Michigan) for work over or adjacent to water (i.e., work on or under bridges) where the danger of drowning exists and where Barr staff are not constantly protected from falling into the water. Barr staff working on or under bridges who are constantly protected by guardrail systems, net, or body harness systems are adequately protected from the danger of drowning and are not required to wear PFDs.

Additionally, PFDs may be required in certain cases of working in shallow water (less than four feet). This will be addressed on a site-specific basis with the project manager and will depend on water velocity and other site conditions. However, where tasks require staff to work on steep or slippery bands or where the potential to fall into shallow water where the danger of drowning exists, PFD use is required.

In addition, boats 16 feet or longer in length will have at least one U.S. Coast Guard approved throwable Type IV PFD. This may be either a buoyant cushion or a ring buoy.

5.0 Lifesaving Skiffs

At least one lifesaving skiff equipped with a method of propulsion effective for water conditions and a spare set of oars will be immediately available at the location where Barr staff are working over or adjacent to water (regardless of fall protection) and the possibility of drowning exists. The lifesaving skiff will be available to retrieve an employee from the water no more than three to four minutes from the time they enter the water. If there are additional hazards, such as very cold water or rapids that an employee could be swept into, the lifesaving skiff would have to able to retrieve an employee before they sustained injuries as a result of those additional hazards.

The lifesaving skiff will be in the water and capable of being quickly launched by one person. There will be at least one person present and specifically designated to respond to water emergencies and operate the skiff at all times when Barr staff are above water. A communication system, such as a walkie/ talkie, must be used to inform the skiff operator of an emergency and to inform the operator where the skiff is needed.

6.0 Ring Buoys

Ring buoys will be available when Barr staff working in a boat, in a lifesaving skiff, and as required when working near or above water where the danger of drowning exists. The ring buoys will have at least 90 feet of line and be readily available for emergency rescue operations. The distance between ring buoys will not exceed 200 feet and only US Coast Guard approved Type IV ring buoys may be used.

7.0 Navigation Requirements

- Navigation lights must be on from sunset to sunrise. They shall consist of:
    - Nonmotorized Boats: Whether underway or at anchor, the boat must have a white lantern or flashlight strong enough that other boats can see it from around the horizon at a distance of two miles or more.
    - Motorboats (less than 40 feet long): When underway, must have:
        - 225 degree combination red and green bow light
        - 360 degree white light
    - When at anchor, only one 360 degree white light is necessary.
- Motorboats less than 26 feet long require one B-I marine fire extinguisher.
    - All fire extinguishers must be Coast Guard approved, fully charged, and readily accessible. Two sizes of marine fire extinguishers are available: B-I and B-II.
- Motorboats 16 feet to less than 26 feet long.
    - A hand, mouth, or power-operated whistle or horn capable of producing a continuous sound for two seconds and audible for at least one-half mile is required.

8.0 Accidents

If involved in an accident or are a witness to one, follow these steps.

- The law requires that boaters stop and assist others in trouble if it can be done safely. Do not risk your life or the lives of others.
- Do not put yourself or others at risk in order to save equipment.
- Dial 911 or use a boat radio to summon help.
- The law requires that if involved in an accident with another watercraft, that information on names and boat numbers be exchanged with the other operator or owner.

- If the accident involves property damage exceeding $500 or if there is a personal injury or fatality, the law requires that the accident be promptly reported to the county sheriff.

9.0 Boating Restrictions

Some Minnesota waters have local restrictions as to type and size of watercraft or motor horsepower, boat speeds, times for use, and minimum distance between boats. Restrictions are usually posted at public access points.

10.0 Renting Watercraft

The rental agent is required to provide Coast Guard approved PFDs in serviceable condition as well as other required safety equipment such as navigation lights, fire extinguishers, and whistle or horns.

The watercraft must be in safe condition. All paddles and oars must be free of cracks, splits, and breaks.

All rental water craft must have enough buoyancy to support the craft if it capsizes.

The rental operator should explain how to operate the boat motor and how to troubleshoot if the motor will not start.

All licenses and boat stickers must be in order.

11.0 Waterway Markers

All official waterway markers such as signs, buoys, lights, etc., are designed to mark unsafe areas, direct traffic through safe channels, prevent accidents, and to protect resources. No private markers or buoys may be placed in Minnesota waters overnight without obtaining a permit from the county sheriff. The Health and Safety staff has available a small card prepared by the MDNR showing standard inland waterway markers.

12.0 Boat Trailers

- Dimensions

  The maximum length of a boat trailer, including its load and towing unit, is 65 feet. No trailer load may exceed 8.5 feet in width or 13.5 feet in height.

- Lights

  Tail lights are required. Signal and brake lamps are recommended on all trailers and required if the hand signals of the driver of the signals of the towing vehicle are not visible to the following driver.

- Driving

  The driver towing a trailer must maintain a distance of 500 feet between his or her vehicle and the vehicle ahead.

- Brakes, Hitch and Coupling

  The brakes must be in good condition. The hitch and coupling of the trailer must meet state standards. Safety chains are required.

- Eurasian Water Milfoil (EWM) and Other Weeds and Organisms

Aquatic plants and other organisms: Be sure to remove all aquatic plant fragments from trailer and boat prior to exiting boat launch area. Dispose of plant fragments in designated receptacle if one is present. If the water body is known or suspected to be infested with zebra mussels, additional decontamination procedures (e.g. hot water decon) are required. Aquatic invasive species may also be present in mud or sediment, and the boat should be cleaned of mud and sediment after use. Follow your state's guidance and/or requirements regarding aquatic invasive species control (e.g. Minnesota's Lake Service Provider permit and training). There are substantial fines for transporting EWM from a water body. There are also fines for transporting other types of noxious weeds and organisms as well. Information concerning these other species is available from the Health and Safety staff.

13.0 Weather

- Summer Storms

  Weather is a major safety concern of boaters, and it can change suddenly. No boater should start out in a storm. There are a number of good sources of weather information. Before setting out, check local television and radio stations, call the Weather Forecast

(612/375-0830), read the forecast in the newspaper, or call the nearest National Weather Service office (612/725-6090).

- Spring and Fall Conditions

  Work in a boat or other watercraft during spring and fall conditions introduces the potential risks associated with hypothermia if a person falls into the water. The Health and Safety staff have information available, developed by the Minnesota Department of Natural Resources, which presents facts relating to "hypothermia" (the loss of enough body heat to lower the body temperature to a dangerous level). The risk varies with water and air temperature, as well as with the time spent in the water and/or cold air. Survival times can range from a fraction of an hour to several hours, depending on water temperature, a person's activities in the water and the clothing or special equipment they are wearing. Employees who find it necessary to work in boats and other watercraft during cold weather (cold water) conditions should obtain copies of the information available concerning hypothermia and incorporate appropriate procedures and equipment into their boating safety plan.

14.0 Work on Rivers and Streams

14.1 Normal Flow Conditions

Barr employees may periodically have to work in boats and other watercraft on rivers and streams. Moving water introduces the potential for a variety of boating hazards that might not exist on still waters. A stream current carries the boat and its occupants toward continuously changing conditions, some of which could be hazardous. Therefore, such work requires continuous attention to surrounding conditions, and a second person or buddy is required. Depending upon the specific river environment and the potential hazards nearby, a third person may also be needed. Helmets may also be required for certain flowing water conditions.

14.2 Flood Conditions

Periodically, Barr's projects may require working on or near a river or stream during flood stage. Such conditions can produce potentially serious hazards. Higher flow velocities occur along with turbulence, the presence of logs, ice and other debris. The combination could potentially capsize and sink smaller watercraft. There is also the potential for the boat to get caught in debris, particularly around bridge piers and other structures, which could make it difficult to escape. A buddy is required for work on or near a river or stream during flood stage. Helmets may also be required during flood stage.

Barr employees should first investigate alternative methods for accomplishing the work before proceeding to work in a boat during flood conditions. If no reasonable alternative is available, including postponing the work, Barr employees are to proceed only after preparing a boat safety checklist that addresses the potential flood safety hazards and after receiving approval of the plan by the principal in charge responsible for the project. The principal in charge may delegate such review and approval to another Barr employee who has the required experience in working on and around flood waters. Even with such pre-approval, employees are expected to evaluate the safety of the stream at the work site and, if safety conditions appear questionable or different from those anticipated in preparation of the safety plan, they should not proceed. They should telephone the project manager, the principal in charge or the person who reviewed and approved the boat safety checklist to discuss the next course of action. No Barr employee is expected to place himself, herself or another person in a dangerous situation, regardless of the perceived importance of the work.

14.3 High Velocity Flows

The forces associated with flowing water are proportional to the stream velocity. Water flowing in rivers and streams at velocities in the range of 5 to 6 feet per second or faster should be regarded as potentially dangerous, even if it occurs without flooding conditions. If the boat's motor fails and the boat becomes turned sideways in the flow, it has the potential to be capsized if it strikes a fixed object. An anchor line might be used in such a situation to try to keep the boat headed into the current. However, working in a boat in such stream velocities should be avoided, and a special safety plan and approval of the principal in charge responsible for the project is required similar to work during flood conditions.

14.4 Tugboats

When encountering a tugboat, remember the following:

- Stay clear of tugboats. They usually have the right-of-way over recreational boats, and they create strong waves.

- Never anchor (without the engine running) in their course, they may require a half-mile or more to stop.
- At night their lights appear far apart compared to small boats.
- They have a "blind area" directly in front of the barges.
- Stay clear of the stern of tugboats. They may suddenly turn on a burst of power that could potentially overturn a small boat.
- Turn your bow into the wake of barges and boats.
- When meeting a tugboat and barge at a bend in the river, move to the inside of the bend where possible.

14.5 Wing Dams

To help improve the navigability of the Mississippi and other rivers by controlling the direction of channel flow, the U.S. Army Corps of Engineers has placed numerous wing dams in navigable rivers.

A wing dam is an elongated pile of rocks, concrete, or other materials extending out from the shore, often perpendicular to the flow, and typically submerged and not marked. They are often placed along a river on the outside of river bends for the purpose of keeping the major portions of the flow in a main navigation channel. They can extend to 100 feet or more into the river. Because wing dams often lie just below the water surface, they typically cannot be visually detected and can pose a danger to the unwary boater. If these boating practices are followed, submerged wing dams may be avoided.

- When moving, stay within the main channel, indicated by buoys and markers. The main channel is regularly dredged and maintained to provide relatively hazard-free boating.
- If approaching shore, proceed slowly from a perpendicular angle.
- Navigation charts showing approximate locations of wing dams may be available for the area from the Corps of Engineers and can sometimes be purchased at map stores.
- Stay clear of ripples in the water surface, these are tell-tale signs of a wing dam or other obstruction lying just below.

14.6 Locks and Dams – Restricted Areas

There are certain restricted areas to protect boaters in the vicinity of locks and dams. Boats may not enter the following areas without preparation of a special safety plan. If it is necessary to be closer, special safety measures may need to be taken.

- The area 600 feet upstream and 150 feet downstream from a dam (including auxiliary locks not in service).
- The area 600 feet upstream from a spillway.

Additional restrictions may be posted at each dam or spillway. Obey all signs.

14.7 Cofferdams

Although Barr does not operate cofferdams, when Barr staff work on or near cofferdams, they will be held responsible for the following OSHA requirements:

1. The cofferdam must be constructed and maintained in accordance with the engineering design.
2. If overtopping of the cofferdam by high waters is possible, then there must be a means to control flooding to the work area.
3. Emergency warning signals for the evacuation of employees must be developed and posted.
4. The cofferdam must have not less than two means of egress.
5. Runways, bridges, or ramps must be provided with guardrails as specified in OSHA construction standards.
6. If cofferdams are located close to navigable shipping channels, then warning devices that are visible to vessels in transit must be provided.

15.0 Working on Barges

It may be necessary at certain times for Barr personnel to work on barges in lakes or rivers. When working on a site where barges are used, Barr personnel shall take several precautions prior to going on the barge. The barge is viewed as a boat and precautions and preparations should be made similar to work on a boat. All personnel shall be certain the barge is safe for pedestrian traffic prior to going onto the barge. Barr personnel should be aware that hazardous conditions may exist on the barge. These hazardous conditions include slippery walking surfaces, uneven and possibly moving surfaces, miscellaneous physical hazards on the barge, and construction machinery on the barge. In addition, other precautions normally taken in construction and field activities should also be considered when working on or near barges.

Barges are usually in place to facilitate access and operations of a third party (not Barr), and are under the control of a third party. This is contrary to Barr staff use of boats, which is generally used expressly for, and under the control of, Barr staff. As such, there is greater need to understand the barge operator's activities, coordinate Barr staff access and operations with the Barge operator, and avoid potential hazards presented by the barge operator's equipment and operations. In situations where Barr does not procure the barge or control barge operation, there is greater need to review and verify safety issues before boarding a barge.

Several safety items must clearly be in place prior to boarding a barge. If any of the safety items are not met, Barr personnel must not go onto the barge until the issues have been resolved. Personnel required to work on the barge must make sure the barge operator has been informed if any of the safety items are not clearly in-place. If these items have not been completed, Barr personnel should inform the project manager so they may address the safety issues with the barge operator, and notify the project owner and client, if necessary. The project manager should make sure the barge operator is complying with these safety requirements before any Barr personnel go onto the barge.

All of the following conditions must be met prior to any Barr personnel going onto a barge(s).

- The barges must be securely anchored to the lake, river, or channel bottom, or to a secure dock or mooring.
- If two or more barges are adjacent, they must be securely connected to one another.
- Any construction machinery on the barge shall be securely anchored on the barge.
- A properly equipped boat with an appropriate method of propulsion for the existing water conditions shall be readily accessible to the barge. Appropriate propulsion for stagnant or low flow water would be oars, while a motor is necessary for higher velocity flows.

- A throwable life-saving ring with 90 foot of rope shall be readily accessible and within 100 feet of the working area of the barge. There should be a ladder from the water to the deck of the barge.

- If the barge does not have appropriate handrail around its perimeter, Barr personnel must wear a personal flotation device as outlined in the water safety and boat safety portions of the Barr Health and Safety Program Manual at all times while on the barge.

- Barr staff should solicit and receive clear acknowledgment from the barge operator and any equipment operators on or in the vicinity of the barge that you are boarding the barge. Operators need to be aware you are in the area, adjust their activities if necessary to assure your safety, and provide permission or approval for your boarding.

- If the access walkway to the barge does not have appropriate handrails, then a PFD is required during barge access. If the barge has appropriate handrails, then the PFD can be removed while on the barge.

Barr staff should use sound judgment in assessing whether anchorage, connection, and equipment is secure, and should consult with the barge and equipment operators to determine their assessment of secure anchorage and connections. If there is question as to the security of any of these items, the project manager or company safety staff should be consulted prior to boarding a barge.

Where construction equipment is located on, over, or near a barge, normal safety precautions associated with such equipment shall be taken. In addition, special precautions shall be taken to assess potential hazard from noise, trip, slip, equipment swing or movement, overhead hazards, limited deck space, and barge movement due to wave, equipment, or other forces.

In addition, all items pertaining to boat and water safety and not specifically mentioned above are applicable to safety of working on barges. These items include the "Buddy System," frozen bodies of water, Personal Flotation Devices, and accidents.

16.0 OSHA Regulations

Attached are several Federal and State OSHA regulations on work around water. Please refer to these prior to any water related field work.

FORM 1
BOAT SAFETY CHECKLIST

Project Name

Project Number

Barr On-Site Employees

Proposed Date of Work

Prepared by

Reviewed Date

Date of Preparation

Barr Health & Safety Team Leader

Objective (describe work activity)

Site Description

Any Boating Restriction on the Water Body?

Name of Buddy

*Buddy system should be implemented when working around or near water. *(see back for definition)*

POTENTIAL SITE HAZARDS (check all that you think may apply* and comment on how these potential site hazards may be avoided)

[ ] Difficult Access (steep bank, severe drop-off, cliffs, unstable slopes, private property)
[ ] Dead Heads (tree stumps, rocks, submerged obstacles)
[ ] Debris in Water (trees, garbage, waste)
[ ] Weedbanks
[ ] Existence of Dams, Spillways, Large Storm Drain Outlets, etc., near work area
[ ] Turbulent Water, Swift Undercurrents, Submerged Stormwater Outlets
[ ] Unfavorable Water Bottom Conditions (bog, mud, sedgeweed, soft bottom, quick conditions)
[ ] Overhead Hazards (tree branches, falling objects from bridges)
[ ] Adverse Weather (thunderstorms, lightning, rain, wind)
[ ] Structural Hazards (piers, bridges, submerged wing dams)
[ ] Vegetation, Brush Growth
[ ] Overhead/Underwater Powerlines or Cables
[ ] Water Traffic (pleasure crafts, barges, boats)
[ ] Heat Stress
[ ] Cold Stress (potential for hypothermia)
[ ] Boat Decontamination Necessary
[ ] Other:

Comments on potential hazards:

*If uncertain, check with someone who has visited the site (PM, PIC, client, etc.)

Please return this form to: JPH (for WR), TDM (for AR), BXJ (for EM), MBH2 (for ED) or Branch Office Health and Safety Coordinator

Boat Safety Checklist (continued)

ANTICIPATED WATER CONDITIONS/BOAT SPECIFICATIONS

Air Temperature ____
Water Temperature ____
Water Velocities * ____
Water Depth ____
Boat Speed Limit ____
Motor Size ____
Boat Type ____
Rated Boat Capacity (no. of people & equipment) ____
Anchor (type) ____
Kill Switch Available ____
Gas Requirements (mixed/unmixed) ____
Water Traffic Control ____
Coast Guard Notification ____
Water Speed Limit ____

- Special care required when stream velocities exceed 4 feet per second.

TELEPHONE NUMBERS	CONTACT	PHONE# (add if not listed)	MPLS PHONE #
County Sheriff	Richard Stanek		612-348-3744
Boat Rental Company			
Corps of Engrs.- Water Control Center (Lock/Dam Info)			612-290-5624
MN Coast Guard			612-290-3991
Project Manager		(W)	(W)
		(H)	(H)
		(Cell)	(Cell)
Weather Forecast (KARE 11)			763-512-1111
National Weather Service (Chanhassen)			952-361-6708
River Stage Information (USCAE)			651-290-5861

FACILITIES NEARBY (if yes, indicate location)			Location
Potable Water Supply	Yes [ ]	No [ ]	
Telephone	Yes [ ]	No [ ]	
Bathrooms	Yes [ ]	No [ ]	
Hospital	Yes [ ]	No [ ]	

In no, indicate action plan: ____

Please return this form to: JPH (for WR), TDM (for AR), BXJ (for EM), MBH2 (for ED) or Branch Office Health and Safety Coordinator

EMERGENCY PROCEDURES (anticipated action plan if any of the following emergency potentials exist)

- Engine Quits ______________________________
- Hole in Boat ______________________________
- Boat Capsizes ______________________________
- Person Overboard ______________________________
- Illness/Injury On Board ______________________________

EQUIPMENT NEEDS

[ ] Floatation Devices (PFDs - one per person on boat and should be worn)
[ ] Communication Equipment (marine radio, mobile phone)
[ ] Throwable Buoyant Cushion or Ring Buoy
[ ] Throw Bags
[ ] First-Aid Kit
[ ] Extra Fuel
[ ] Extra Rope
[ ] Pike Pole or Boat Hook
[ ] Bilge Pump or Bailing Devices
[ ] Tool Kit
[ ] Flashlight
[ ] Heater for cold weather conditions, blankets, etc.
[ ] Potable Water
[ ] Wisconsin requires a battery box or nonconductive cover for battery terminals

Boat rental company should supply the following equipment. Barr watercraft should have the following equipment:

[ ] Oars, Paddles
[ ] Anchor(s) and Line(s)
[ ] Fire Extinguisher
[ ] Lights
[ ] Horn/Whistles
[ ] Auxiliary Outboard Motor
[ ] Ring Buoys (90-foot line for rescue)

PERSONAL EQUIPMENT

[ ] Gloves
[ ] Sunscreen
[ ] Safety Glasses
[ ] Nonslip Boat Shoes
[ ] Rain Gear
[ ] Insect Repellent
[ ] Hard Hat
[ ] Change of Clothing

FLOAT PLAN (provide information to Project Manager prior to boat departure)

1. Description of Boat

Boat Name ______________
Length Overall ______________ (Ft)
Color ______________
Manufacturer ______________
Registration No. ______________

Barr Jon Boat	Barr Jon Boat	Canoe - Grn	Canoe – Slvr	Pontoon
14’	16’	17’	17’	20’
Olive Green	Olive Green	Olive Green	Silver	White
Alumacraft	Alumacraft	Alumacraft	Grumman	Weeres
MN5514KH	MN4489GL	MN5803JJ	MN6704CP	MN2565KA

**See vehicle chart on back for weights.*

2. Trip Plan

Departure Time ______________ (Date/Time) Location ______________ (From) ___ Upriver ___ Downriver

Estimated Return Time ______________ Vehicle Parking Location ______________

Description & License of Vehicle ______________________________

Please return this form to: JPH (for WR), TDM (for AR), BXJ (for EM), MBH2 (for ED) or Branch Office Health and Safety Coordinator

Barr definition of “Buddy System”:

A "Buddy System" for purposes of boat safety means having another person nearby who can see you working, who is capable of and equipped to help you, and who has agreed to do so in an emergency. The second person or "buddy" can either be in the boat or on shore. However, if the second person is to be on shore, he/she must have continuous communication with the person in the boat (e.g., walkie-talkie or close enough to talk and hear), and he/she must also have a clear view of the person, the boat, and the area around the boat (approximately 200 yards). The purpose is to enable the person on shore to keep the person in the boat informed as to what is occurring around him/her and warn them of any hazards. Depending upon the specific river environment and the potential hazards nearby, a third person may also be needed. The person need not necessarily by another Barr employee. The need for a "Buddy" is determined by the specific site conditions and the nature of the work. Knowledge of conditions at the worksite is important in making such decisions.

VEHICLE AND TRAILER WEIGHTS

		00 FRST	05 FELL	93 MIGH	96 REDI	99 WELL	JON BOAT 16'	JON BOAT 14'	PONTOON	ATV
	GVWR	7000	12000	9700	3920	7700	1400	188	2700	1300
1991 CHEV SUBURBAN	6100	13100	18100	15800	10020	13800	7500	6288	8800	7400
1999 FORD Club Wagon (Van)*	9300	16300	21300	19000	13220	17000	10700	9488	12000	10600
1999 FORD F250 CARGO	8600	15600	20600	18300	12520	16300	10000	8788	11300	9900
2001 CHEV SUBURBAN	8600	15600	20600	18300	12520	16300	10000	8788	11300	9900
2002 CHEV ASTRO	5850	12850	17850	15550	9770	13550	7250	6038	8550	7150
2003 FORD E550	17500	24500	29500	27200	21420	25200	18900	17688	20200	18800
2004 CHEV EXPRESS(SUR)	7200	14200	19200	16900	11120	14900	8600	7388	9900	8500
2004 CHEV EXPRESS	7200	14200	19200	16900	11120	14900	8600	7388	9900	8500
2005 CHEV SUBURBAN(A)	8600	15600	20600	18300	12520	16300	10000	8788	11300	9900
2005 CHEV SUBURBAN(B)	8600	15600	20600	18300	12520	16300	10000	8788	11300	9900
2006 CHEV SUBURBAN	8600	15600	20600	18300	12520	16300	10000	8788	11300	9900
2006 CHEV SILVERADO	11400	18400	23400	21100	15320	19100	12800	11588	14100	12700
2006 CHEV EXPRESS	7200	14200	19200	16900	11120	14900	8600	7388	9900	8500
2007 CHEV EXPRESS	7200	14200	19200	16900	11120	14900	8600	7388	9900	8500
2008 CHEV EXPRESS	7200	14200	19200	16900	11120	14900	8600	7388	9900	8500
2008 CHEV SILVERADO	11,400	18400	23400	21100	15320	19100	12800	11588	14100	12700
2008 UPLANDER	5842	12842	17842	15542	9762	13542	7242	6030	8542	7142
2009 CHEV SUBURBAN	8600	15600	20600	18300	12520	16300	10000	8788	11300	9900
2007 CHEV SILVERADO	7000	14000	19000	16700	10920	14700	8400	7188	9700	8300
2004 FORD EXPLORER	5984	12984	17984	15684	9904	13684	7384	6172	8684	7284
2005 CHEV EXPRESS CUBE	10000	17000	22000	19700	13920	17700	11400	10188	12700	11300
1998 CHEV K15 FLEET	6200	13200	18200	15900	10120	13900	7600	6388	8900	7500
2003 CHEV SILVERADO	6400	13400	18400	16100	10320	14100	7800	6588	9100	7700

Driver must be part of the DOT Driver Qualification program to drive vehicle/trailer combinations over 10,000 pounds. Vehicle combinations 10,000 pounds and under are highlighted in gray.

*No trailer hitch installed, this vehicle is not equipped to tow any type of trailer.

Please return this form to: JPH (for WR), TDM (for AR), BXJ (for EM), MBH2 (for ED) or Branch Office Health and Safety Coordinator

Section 14: DOT Hazardous Material Shipping Program

Table of Contents

Section 14: DOT Hazardous Material Shipping Program

1.0 Overview

In CFR 49, the Federal Department of Transportation has spelled out in detail its program and requirements for the shipping of hazardous materials. At Barr, a hazardous material to be shipped may include the following: samples from sites such as contaminated soils or product, sampling bottles with preservatives, Hermit dataloggers, compressed gases, etc.

In addition to very specific requirements for shipping hazardous materials, the regulations have also spelled out specific training and certification requirements for employees involved in hazardous materials shipping. The last section of this program describes the Materials of Trade (MOT) exception. A hazardous material transported in compliance with the MOT exception is not subject to additional hazardous material regulations (e.g., shipping papers, emergency response information, formal training, or recordkeeping). The purpose of the Hazardous Materials Shipping Program is to address the practical shipping requirements, training requirements, and the MOT exception. The program goals also enable project personnel to comply with federal regulations regarding hazardous materials shipping without project delays as a result of shipping.

2.0 Regulation Overview

The following is a brief summary of the DOT Hazardous Material Shipping requirements.

2.1 Training Requirements

In Subpart H—Training, of CFR 49, Part 172, all hazmat employees who, in the course of employment, directly affect hazardous materials shipping, must have training provided at least once every three years. Hazmat employees are defined as anyone who loads, unloads, or handles hazardous materials; prepares paperwork; packages hazardous materials; offers the package for shipment, transports hazardous materials, or is in anyway involved with presenting hazardous materials for shipment. Training is to include the following:

- *General awareness/familiarization training* designed to provide familiarity with the requirements and enable the employee to recognize and identify hazardous materials shipping concerns.

- *Function-specific training* concerning the requirements which specifically apply to the function the employee performs.

- *Safety training* concerning emergency response information, measures to protect the employee from the hazards of hazardous materials, and methods for avoiding accidents involving hazardous materials.

- *Driver training* which is only applicable if driving vehicles containing materials requiring placarding.

Training is to be provided within 90 days after employment or after a job change, and at least once every three (3) years thereafter. A record of current training, inclusive of the preceding three years, must be retained for as long as the employee is a hazmat employee and for 90 days thereafter. Records need to contain the following information:

1. Employee name.
2. Most recent training completion date.
3. A description, copy, or location of training materials used.
4. Name and address of person providing training.
5. Certification that employee has been **trained and tested**.

Training requirements for transporting hazardous materials using the Materials of Trade exception are outlined in Section 4.0 of this Section.

2.2 General Program Requirements

The DOT hazardous materials shipping regulations address several very specific areas regarding shipping in great detail. In general, these areas are as follows:

- *Determine applicability* of DOT hazardous material shipping regulations using available data from project team and literature sources, then comparing data to regulations.

If the material to be shipped falls under DOT Hazmat regulations, then the following steps are taken based on the information provided in CFR 49 or, when relevant, the International Air Transport Association (IATA) Dangerous Goods Regulations.

1. Determine if the *Materials of Trade exception* applies (follow Section 4.0 requirements only)
2. Select the *proper shipping description* for the material being shipped (e.g., *proper shipping name, hazard class or classes, proper UN/NA identification numbers, packing group*)
3. Determine and select the *proper packaging(s)*
4. Mark, label, and/or placard the package(s)
5. Prepare all appropriate shipping papers
6. Conduct *appropriate vehicle pretransport activities* (e.g., loading, blocking, bracing)
7. Offer applicable *placards to transporter* (unless already affixed to transport vehicle)
8. *Hazardous wastes/hazardous substances* rules need to be checked for applicability in addition to DOT regulations

3.0 Barr Program

3.1 Training

Training for *general awareness/familiarization* will be provided in conjunction with the annual eight-hour OSHA refresher course. The general awareness training is presented in a combination live presentation/video tape format and will include, as required by DOT, testing on the information provided. It is anticipated that this aspect of training will take the employees being trained one hour to complete. Training requirements for transporting hazardous materials using the Materials of Trade exception are outlined in Section 4.0 of this Section.

Training for *function-specific* areas will be provided for each individual project hazardous material shipping event. All persons involved in the shipping for the project will be trained. The function-specific training will be conducted by a Barr employee who has been trained by an outside training group in the application of DOT Hazardous Material Shipping regulations. A memo will be prepared for the project based on the material involved, and this memo will be discussed in detail with the employees involved with shipping. A testing and certification step will be included in the memo and kept with training records. It is anticipated that this training aspect will take the employees being trained 10 to 30 minutes to complete, depending on the complexity of the shipping requirements for that project.

Safety training will be provided using both OSHA training and presentation of emergency response information during the one-hour general awareness/familiarization training.

No additional *driver's training* is planned. It is not anticipated that Barr employees will be driving placarded vehicles. In general, a Commercial Driver's License (CDL) with a hazardous materials endorsement would be required.

3.2 General Program

Prior to preparing the memo for function specific training on a specific project, a number of steps are necessary to determine whether the material is hazardous, what special shipping requirements are needed, what exceptions or exemptions apply, and what are the specific project needs. The process for preparing to ship a hazardous material is outlined below.

1. The project team contacts a hazardous materials shipping person.

2. One of the hazardous material shipping persons will gather technical information from both the project team and available resources. Information to be gathered includes, but is not limited to:

    - Nature of the material: what is known from past investigations, are there any laboratory data available, what was the source of the material.

    - Shipping needs: where the material is to be shipped, in what quantities, when does it need to be shipped, is it necessary to keep the material cool, is quick delivery essential, does it need to travel by air.

    - Specific chemical, safety, and toxicological data may also be collected to better evaluate the shipping needs.

- The hazardous materials shipping person will then determine whether the material is considered hazardous by DOT standards and what proper shipping description applies. The hazardous materials shipping person will also determine if the MOT exception may be used for transporting the hazardous materials (refer to Section 4.0 of this Section).

3. Specific shipping requirements regarding packaging, labeling, marking, placarding, and shipping documents will be determined.

4. Packaging materials will be located and ordered. It is necessary to provide whatever lead-time is possible to minimize project delays. In many cases, specific shipping materials need to be ordered for the shipping event

5. A project specific/event specific memo will be prepared detailing all steps to be completed prior to shipping the material.

6. Training, testing and certification of the employees to perform the shipping will take place upon completion of the project specific/event specific memo. The training will be conducted by one of the hazardous material shipping persons. At the time of training any necessary labels, placards, or shipping papers may be provided. Shipping documents will be as complete as possible prior to actual shipping. Additional information may need to be entered on the documents at the time of shipping.

7. Decisions made regarding the shipping determinations for the project will be documented and held in the project file.

8. Any feedback provided by the shippers on problems or difficulties encountered will be reviewed and the shipping process improved as appropriate.

4.0 Materials of Trade Exception

Several materials which fall within DOT Hazardous Materials Shipping regulations are routinely shipped or transported by Barr employees, including the Hermit data loggers, preserved sample bottles sent from environmental laboratories, gasoline, compressed gas cylinders (typically calibration gases), spray paint, insect repellant, and other miscellaneous products containing hazardous materials. 49 CFR 173.6 allows a Material of Trade to be transported under less stringent requirements. Materials of Trade (MOT) are hazardous materials that are carried on a motor vehicle for at least one of the following purposes:

- to protect the health and safety of the motor vehicle operator or passengers (examples include: insect repellant, self-contained breathing apparatus, and fire extinguishers);
- to support the operation or maintenance of motor vehicle or auxiliary equipment (examples include: engine starting fluid, spare battery, and gasoline); and
- to directly support a principal business (other than transportation) when carried by a private motor carrier (an example includes: cylinders of compressed gas carried for the purpose of calibrating instruments in the field).

A MOT that is properly classed, packaged, and transported, does not require shipping papers, emergency response information, package labeling (except cylinders of compressed gasses), or placarding of vehicles.

4.1 Materials and Amounts

Each **vehicle** is limited to a maximum of **440 pounds** (aggregate gross weight) of “Materials of Trade”. A material of trade is limited to the following:

1. Class 3 (flammable liquids), 8 (corrosives), 9 (miscellaneous hazardous materials), Division 4.1 (flammable solids), 5.1 (oxidizers), 5.2 (organic peroxides), 6.1 (poison/toxic liquids or solids), or ORM-D (consumer commodities) materials (e.g., spray paint) contained in a packaging having a gross mass or capacity not over:
    - 1 pound (0.5 kg) or 1 pint (0.5 L) for a Packing Group I Material
    - 66 pounds (30 kg) or 8 gallons (30 L) for a Packing Group II, Packing Group III, or ORM-D Material
    - 400 gallons (1,500 L) for a diluted mixture, not to exceed 2 percent concentration, of a Class 9 Material
2. Division 2.1 (flammable gases) or 2.2 (nonflammable gases) materials in a cylinder with a gross weight not over 220 pounds (100 kg)
3. Division 4.3 (spontaneously combustible) materials in Packing Group II or III contained in a packaging having a gross capacity not exceeding 1 ounce (30 ml)

Packaging Requirements

Hazardous materials transported under the Materials of Trade exception are required to be packaged as follows:

- Liquids and gases must be packaged in leak tight containers.
- Solids must be packaged in sift-proof containers.
- Containers must be securely closed.
- Containers must be secured against movement and protected from damage.
- Each material must be packaged in the original manufacturer's container or a container of equal or greater strength and integrity.
- Outer packaging (for materials originally shipped in combination packaging) is not required as long as each container is secured against movement. That is, they are secured in boxes, cages, carts, bins, or compartments.
- Gasoline must be packaged in metal or plastic containers that meet either the UN packaging standards or OSHA requirements.
- Cylinders must meet the hazardous materials regulations except that outer packagings are not required.

4.2 Hazard Communication

Hazardous materials transported under the MOT exception must meet the following hazard communication requirements.

- The Common Name or Proper Shipping Name must be marked on the outside of the package.
- The letters "RQ" must also be placed on the package with the shipping name if the package contains a reportable quantity of a hazardous substance.
- Cylinders must be marked with the proper shipping name, identification number, and have a hazard class label.

4.3 MOT Training Requirements

Drivers transporting MOT must be aware of the presence of MOT in their vehicle, must be informed of the requirements of the MOT rule, and be able to identify the hazardous material(s) to truck inspectors or emergency response personnel. This information will be presented during the annual eight-hour OSHA hazardous waste refresher course, during other applicable training presentations, or as necessary for specific projects.

Section 15: Motor Vehicle Operation Program

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Forms

Section 15: Motor Vehicle Operation

1.0 Introduction

Barr employees operating motor vehicles on company business are expected to operate these vehicles in a safe manner and in accordance with state and federal requirements.

2.0 Passengers of Motor Vehicles

Barr employees are **not** allowed to ride in the back of pick-up trucks, or vans without back seats, on heavy equipment, or in any other vehicle not designed to carry passengers and not equipped with seat belts for each passenger. Barr employees will carry passengers in appropriate seats with seat belts.

3.0 Driving Requirements

1. Barr employees shall follow the Vehicle Use Policy (Section 1005) of the HR Policy Manual.
2. When driving for Barr Engineering Co., Barr staff are required to wear seat belts at all times.
3. Drivers will obey all traffic rules, drive courteously, practice defensive driving techniques, and practice safe driving behaviors by avoiding activities that may cause distractive driving.
4. Drivers will maintain a valid driver’s license and valid insurance at all times.
5. All vehicle loads shall be secured, and within the manufacturer and legal limits.
6. Barr employees shall only use vehicles that are the correct size and designed for the intended use.
7. Any incident involving the use of a car while working, whether or not it results in any injury to any person or damage to any vehicle or property, and regardless of who is at fault, must be reported immediately to the Barr Health and Safety Program Manager or a Health and Safety Coordinator.

4.0 Vehicle Condition

It is the responsibility of the vehicle operator to make sure that the vehicle is in safe working condition. The driver should verify that the following items are functional:

- Turn indicators
- Head lights and brake lights
- Mirrors
- Horn
- Windshield wipers and washer
- Tires (wear and proper inflation)

5.0 Safety Equipment

First aid and winter survival kits are available in the safety equipment room. First aid kits and fire extinguishers are equipped in the Barr vehicles.

6.0 Parking on or Near Public Roads

It may be necessary at times to park at the side of a public roadway. If it is necessary to park at the side of a roadway, traffic control devices (e.g., traffic cones or reflective triangles) will be placed to warn traffic and to designate traffic control zones. Local traffic control requirements will dictate specific placement of these devices.

The purpose of traffic control is to provide safe and effective work areas and to warn, control, protect, and expedite vehicular and pedestrian traffic. A high visibility vest that complies with state, federal and/or provincial regulations is required for all staff working on the right-of-way and not separated from traffic by a physically protective barrier.

7.0 Vehicle Use on Frozen Bodies of Water

Barr employees are strongly encouraged to restrict their driving of personal or company owned vehicles onto frozen bodies of water. If work requires driving on the ice, all drivers must verify ice thickness prior to taking the vehicle onto ice and will check ice thickness periodically throughout the day. Staff will consult with local authorities on appropriate ice conditions for their work activities. Refer to *Section L: Water and Ice Safety* of the Health and Safety Program Manual.

FORM 1
MOTOR VEHICLE ACCIDENT REPORT

(Complete and Return to Health & Safety Manager)

Date of Accident ____________________ 19____ Day of Week ______________ Hour _________ a.m. p.m.

☐ CITY
☐ SUBURBAN
☐ RURAL

PLACE WHERE ACCIDENT OCCURRED
County ____________ City, town or township ____

If accident was outside the city limits, indicate distance from nearest town. Use two distances and two directions, if necessary.

(__miles______________________)
(north-south)
( )
(__miles______________________)
(east-west)

of

( )
(☐ limits of)
( )
(☐ center of)
( )

____ City or Town

ROAD ON WHICH ACCIDENT OCCURRED ____
Give name of street or highway number (U.S. or State)

☐ AT ITS INTERSECTION WITH ____
Name of intersecting street or highway number

OR

☐ NOT AT INTERSECTION

(Check and complete one)

(__feet________________)
(north-south)
( )
(__feet________________)
(east-west)

of ________________________________
Show nearest intersecting street or highway, house number, curve, bridge, rail crossing, alley, driveway, culvert, milepost, underpass, numbered telephone pole, or other identifying landmark. Show exact distance, using two directions and two distances, if necessary.

OTHER DRIVER'S NAME

ADDRESS

CITY STATE DRIVER'S LICENSE NO.

OTHER VEHICLE OWNER'S NAME

ADDRESS

CITY STATE VEHICLE LICENSE NO.

TYPE VEHICLE MAKE YEAR NO.

DAMAGE TO OTHER VEHICLE AND/OR PROPERTY

INSURED PERSONS	Age	Sex	Injuries
Name			
Address			
Name			
Address			
Name			
Address			

POLICE Name Badge No.

WITNESSES (Name, Address, Phone Number)

INDICATE ON THIS DIAGRAM WHAT HAPPENED

INDICATE NORTH BY ARROW

○

SHOW POSITION OF VEHICLES

DRIVER'S SIGNATURE

Section 16 Ladders and Scaffolds

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Section 16: Ladders and Scaffolds

1.0 Introduction

Barr staff should not climb portable ladders and/or use scaffolds unless there is no other reasonable and safe way to perform the required work. Before a ladder, scaffold, or personal fall protection is used, it must be checked to be sure that it is properly installed, securely placed, capable of supporting the load, of adequate length, and, in the case of scaffolding, approved by a Barr Scaffold Competent Person. Fall Protection is required for work at heights of six (6) feet or greater.

2.0 Ladders — General

Ladders are to be used for access and egress from elevated work stations or for short-term observations and should not to be used for extended work periods (longer than a week). Barr staff shall use ladders only for the purpose for which they were designed. Use the right ladder for the job (step, platform, straight, or extension). When using a straight or extension ladder, select one of sufficient length so that the work can be performed while standing on or below the third rung from the top. Ladders, rungs, cleats, and steps shall be parallel, level, and uniformly spaced when the ladder is in position for use. Ladders shall neither be loaded beyond the maximum intended load for which they were built nor beyond the manufacturer's rated capacity. Only one person is permitted to use a ladder at a time.

2.1 Inspection

All ladders should be kept in good structural condition and visually inspected on a periodic basis. Use of defective ladders is not permitted. Defective ladders should be taken out of service immediately and destroyed if repair is not feasible.

2.2 Portable Ladder Placement

Ladders should be placed only on firm, level footings with the top as close as practical to the work. Do not overreach from the ladder to perform the work.

When using a ladder to gain access to a roof, the ladder should extend at least three feet above the top support to provide a holding point for dismounting and remounting the ladder.

When ladders are placed in aisle ways or near doorways, barricades and/or warning signs should be placed near any access point to the ladder. Doors should be locked or secured to prevent someone from opening a door or walking into the ladder.

2.3 Ladder Access

Employees should face the ladder while ascending or descending. Employees should have a three-point contact (e.g., two feet and one hand) at all times on the ladder. Employees should have their hands free of material while climbing ladders. Hand lines should be used to raise or lower tools or material.

2.4 Fall Protection When Using a Ladder

When it is absolutely necessary to do work requiring the release of both hands from a ladder, a body harness will be used. The body harness should be secured to a shock absorbing lifeline attached to an appropriate anchorage point capable of withstanding loads impacted to it by a falling person (estimate 5,000 to 10,000 pounds). Do not secure it to the ladder. Refer to *Section P: Ladders, Scaffolds and Fall Protection* of this manual.

3.0 Portable Ladder Use

3.1 Extension Ladders

Extension ladders should be placed on the ground or other support so that the distance from the base of the ladder to a line dropped vertically from the top support is approximately one-fourth of the length of the ladder. For example: A 16-foot ladder should be placed so that the bottom is four feet away from the wall.

All extension ladders should be equipped with safety shoes. When climbing an extension ladder, inspect hooks before passing.

Employees working extension ladders should secure the top portion of the ladder before starting the job. Another employee should hold the bottom of the ladder while the top is being tied off and untied.

3.2 Wooden Ladders

Wooden ladders are not recommended except for electrical work. Special ladders may have to be built for work inside vessels or other equipment.

3.3 Step Ladders

Step ladders should be used with the spreader bar fully extended and locked, with all four legs on a secure foundation. When using a step ladder, never stand on a rung higher than the second rung from the top of the ladder. Portable step ladders exceeding 12 feet in height should not be used.

3.4 Portable Metal Ladders

Portable metal ladders should not be used for any electrical work and are not permitted in electrical substations, or any areas where contact may be made with energized circuits of 220 volts or greater.

4.0 Scaffolds

Scaffolds are intended to provide secure platforms for elevated work and are preferred to ladders for work platforms. Only qualified and competent employees are allowed to modify scaffolding systems. Though it is preferable to have the client arrange for all scaffolding erection and dismantling needs, when necessary, qualified Barr employees may erect and dismantle scaffolding under the supervision of a Barr Scaffold Competent Person up to but not exceeding 20 feet in height. When scaffolding in excess of 20 feet in height is required, it is the policy of Barr to have a client or a subcontractor erect and dismantle scaffolding necessary for the completion of elevated tasks.

Prior to scaffold installation, the proposed location should be checked for any unsafe conditions (such as overhead power lines, or doors and windows that can be opened into the work space on the scaffold) that could create a hazard for scaffold workers. Scaffold should not be used closer than 10 feet to energized power lines.

4.1 Barr Scaffold Competent Person

A Barr Scaffold Competent Person is one who is capable of identifying existing and predictable hazards in the surroundings or working conditions which are hazardous or dangerous to employees, and who has the authorization to take prompt corrective measures to eliminate them. A Barr Scaffold Competent Person has received training on scaffolding systems and has the experience and knowledge to recognize safe scaffolding systems.

4.2 Scaffold Condition

Planking or fabricated decking, fabricated end frames, cross-bracing, couplings, and guardrails must all be in good condition. Only scaffolding that is in good condition and free of defective components will be used by Barr employees.

Scaffold components manufactured by different manufacturers must not be intermixed unless the component parts fit together without force and the resulting scaffold’s structural integrity is maintained.

Scaffold structural components made of dissimilar metals (e.g., steel and aluminum) must not be used together.

4.3 Scaffold Footing

Supported scaffold frames and uprights must bear on base plates and adequate mud sills. The footing or anchorage for scaffolds should be level, sound, rigid, and capable of supporting the scaffold in a loaded condition without significant settling or displacement.

4.4 Scaffold Capacity

All scaffolding should be constructed to provide a safety factor of four (4). A safety factor of four (4) means scaffolds and their components should be capable of supporting without failure, at least four times the maximum intended load, including the workers, materials, and equipment.

4.5 Scaffold Guardrails Systems

All scaffolds six feet or higher should be equipped with hand rails, mid rails, and toe boards on all open sides (sides other than those against a wall). Hand rails should be approximately 42 inches, plus or minus three inches, above the scaffold platforms, and mid rails approximately 21inches above the platform. If toe boards are not present, the area below the scaffold must be identified and cordoned off with “Caution” tape or equivalent method.

4.6 Scaffold Walkways

Walkways must be at least 18 inches wide and will be provided with guardrail systems.

4.7 Scaffold Height and Securing

Scaffolds with a height to base width ratio of more than four to one (including outrigger supports, if used) must be restrained from tipping by guying, tying, bracing, or equivalent means. Guys, ties, and braces should be installed according to the scaffold manufacturer's recommendations. Scaffolds should be braced to prevent twisting and flexing.

4.8 Scaffold Work Platform

All platforms, except walkways and those platforms used by employees performing scaffold erection and dismantling operations, must be fully decked or planked.

The work platform of any scaffolding should be constructed from scaffold-grade lumber or manufactured scaffold platforms and unpainted. The working surface of the scaffold should be clean, dry, and free of any obstructions. Tools, materials, and debris should not be allowed to accumulate in quantities that could cause a hazard.

Scaffold planks should extend over their supports not less than six inches or more than 18 inches. Planks should be laid with their edges close together so the platform will be tight, with no space through which tools or materials may fall.

The space between the front edge of a platform and the face of the structure where the scaffold is being used should not be more than 14 inches, unless a guardrail system or personal fall arrest system is employed.

4.9 Scaffold Access/Egress

Access and egress from scaffold platforms over four (4) feet high should be made with a portable ladder or portable stairway from the structure to which it is secured, or ladders built into the scaffold. If ladders or portable stairways are used, they should be secured to the scaffold. Cross bracing should never be used for means of access.

4.10 Scaffold Use

Scaffold and scaffold components should be inspected for visible defects by a Barr Scaffold Competent Person prior to each work shift and after any occurrence which could affect a scaffold's structural integrity. Any unsafe equipment and/or conditions are required to be tagged out by a competent person. Example tagging systems can be obtained from a Barr Equipment Coordinator. All staff are required to comply with these tags. Employees should not work on scaffolds during storms or high winds of more than 40 miles per hour. Scaffold should not be used closer than 10 feet to energized power lines.

4.11 Scaffold Fall Protection

Guardrail systems should be used on all open sides and ends of scaffolds where the work platform is more than 14 inches from the structure.

Personal fall arrest protection should be used where the installation and use of such protection is feasible and does not create a greater hazard. Personal fall protection should be used when there is no guardrail system on all open sides.

4.12 Scaffolding Training

Barr staff designated to be the Barr Scaffold Competent Person for scaffold systems will receive safety training on scaffold systems. This training will enable these employees to recognize safe scaffolding systems and will be conducted by a competent person qualified in providing scaffolding safety training. Training includes hazard awareness/recognition, fall protection, proper use of scaffolds, load capacity, personal protective equipment, and standards and regulations. Specific hazards addressed during scaffold user hazard awareness training include falls, unsafe access, falling objects, electrocution and scaffold collapse. Retraining is required whenever conditions change or when there is reason to believe that an employee lacks the skill or understanding needed for safe work involving scaffolds. Each employee so trained will receive a certificate upon completion of training.

5.0 Protection from Falling Objects

When a Barr employee may be exposed to falling objects, each affected employee is expected to wear a hardhat. In addition, one of the following measures should be incorporated to provide additional protection from falling objects. If one of these measures cannot be implemented, Barr employees are expected to remove themselves from the area.

- Erect toe boards, screens, and/or guardrail systems to prevent objects falling from higher levels.

- Erect a canopy structure and keep potential falling objects far enough from the edge of the higher level so that those objects do not go over the edge if they are accidentally displaced.

- Barricade the area into which objects could fall, prohibit Barr staff from entering the barricaded area, and keep objects that may fall far enough away from the edge of a higher level so that those objects do not go over the edge if they are accidentally displaced.

6.0 Guardrail Systems

Where guardrail systems are required, these systems will comply with the following specifications:

- Top edge height of top rails will be 42 inches, plus or minus three (3) inches above the working/walking level.

- Mid rails will be installed between the top edge of the guardrail system and the walking/working surface.

- Guardrail systems will be capable of withstanding, without failure, a force of at least 200 pounds applied within two (2) inches of the top edge, in any outward or downward direction, at any point along the top edge.

- Guardrail systems will be surfaced so as to prevent injury to an employee from punctures or lacerations, and to prevent snagging of clothing.

- Toe boards will be used when there is potential for employees working below the guardrail system to be exposed to falling objects.

- Additional specifications contained in the OSHA Fall Protection Standard (29 CFR 1926.501).

Section 17 Barr Hazardous Waste Operations Standard Operating Procedures

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Tables

Section 17: Barr Hazardous Waste Operations Standard Operating Procedures

1.0 Introduction

It is Barr's policy that a Project Health and Safety Plan (PHASP) be prepared for all projects involving work on sites containing or suspected to contain hazardous substances. This includes any site where the purpose of our work is to investigate for the presence of hazardous substances. The PHASP will establish safety procedures and the types of equipment that will be used while conducting field activities associated with all such sites.

The Project Health and Safety Plan (PHASP) is aimed specifically at protecting workers from health and safety hazards arising from hazardous substances and/or physical hazards known or suspected to be present at this site. The PHASP includes safety procedures to be followed during anticipated site operations and emergency procedures to be implemented in the event of an injury, fire, accident, or hazardous substance release on site.

The PHASP has been developed based on the guidance contained in the following regulations and guidance documents:

- Occupational Safety and Health Administration (OSHA) Standards, 29 CFR 1910 and 1926.
- U.S. Environmental Protection Agency (USEPA) "Standard Operating Safety Guides," November 1986.
- NIOSH/OSHA/USCG/EPA "Occupational Safety and Health Guidance Manual for Hazardous Waste Site Activities," October 1985.
- American Conference of Governmental Industrial Hygienists (ACGIH); "Threshold Limit Values for Chemical Substances in the Work Environment," 1998 or most current.

2.0 PHASP Overview

Elements addressed in the PHASP will include:

- Project organizational structure

- Physical and chemical hazard evaluation
- Health and safety risk analysis for each site task
- Personal protective equipment required for each site task
- Training requirements for all Barr staff on-site
- Medical surveillance requirements for Barr staff on-site
- Personal and environmental monitoring procedures
- Site control procedures (site work zones, buddy system, communication)
- Site emergencies procedures
- Confined space/excavation entry procedures
- Personal protective equipment program
- Respirator program
- Recordkeeping procedures
- Decontamination procedures. These will be developed, communicated to employees, and implemented before any employees or equipment enter areas onsite where potential for exposure to hazardous substances exists. Decontamination procedures will be monitored by the site health and safety supervisor to determine their effectiveness. When such procedures are found to be ineffective, appropriate steps will be taken to correct any deficiencies. PPE and equipment will be decontaminated, cleaned, laundered, maintained, or replaced as needed to maintain their effectiveness. Employees whose non-impermeable clothing becomes wetted with hazardous substances shall immediately remove the clothing and shower. Unauthorized employees shall not remove protective clothing or equipment from change rooms. If the procedure indicates a need for regular showers and change rooms outside of a contaminated area, they shall be provided and meet the requirements of 29 CFR 1910.141.

The PHASP is based upon information available at the time of preparation and is subject to revision or modification as new data and information become available. The revision dates, if applicable, are listed on the title page, and will be included in the next PHASP update.

Specific questions regarding the PHASP should be addressed to the Project Manager or the Project Health and Safety Contact. Questions that cannot be adequately addressed by either the Project Manager or the Project Health and Safety Contact will be referred to the Barr Health and Safety Manager or the Principal in Charge. On active projects, the PHASP (and its Appendix) will be reviewed on an approximate annual basis and updated, if necessary, at that time. The PHASP may be modified between annual update periods by amendment. A field copy of the PHASP should remain on-site to be made available to all on-site project personnel and subcontractors.

The PHASP applies to all on-site Barr employees and Barr’s subcontractors who participate in investigation, remedial action, construction activity, or other field activities. The PHASP provides guidelines, requirements, and procedures intended to help protect the health and safety of all on-site Barr employees and Barr’s subcontractors in accordance with the provisions of 29 CFR 1910.120, Hazardous Waste Operations and Emergency Response. Subcontractors should write their own PHASP, and it meet the requirements of OSHA standard 29 CFR 1910.120. The subcontractors PHASP should be reviewed by Barr’s health and safety staff. Subcontractors may adopt, in writing, Barr’s PHASP, by using the PHASP Adoption Form (PHASP, Form 3-3).

When another party is responsible for site Health and Safety and has prepared a PHASP, when Barr is a subcontractor to another party, or when the site owner has a PHASP, Barr’s PHASP should incorporate any requirements more stringent than standard Barr procedures. Barr will not incorporate less stringent requirements without the approval of the Barr Health and Safety Manager and the Principal in Charge.

PHASPs address specific safety issues that may be associated with work on sites containing or suspected to contain hazardous substances. A written PHASP will be required when:

- A work area contains or is suspected to contain hazardous substances, or the purpose of our investigation is to determine if the site contains hazardous substances.

  These include:

  a. Cleanup operations at an uncontrolled hazardous waste site.

b. Initial investigations at a government-identified site before the presence or absence of hazardous substances has been ascertained.

c. Corrective actions involving cleanup operations at a site covered by RCRA.

d. Voluntary cleanup operations at a site recognized as an uncontrolled hazardous waste site.

e. Work involving a site activity at a hazardous waste treatment storage, and disposal facility.

f. Work involving intrusive activities on a site known or suspected to contain hazardous substances.

g. Work involving intrusive activities on a site where the purpose of the intrusive activity is to determine if hazardous substances are present.

h. Work involving nonintrusive activities on a site known or suspected to contain hazardous substances where there is a reasonable possibility of exposure.

- A PHASP is required by the government or client.

3.0 PHASP Preparation

The PM will be responsible for assigning the PHASP preparation task to a member of the project team. The project team member will work with the Project Health and Safety Contact to complete the PHASP. The Project Health and Safety Contact will review the PHASP with the PM. A copy of the PHASP will be given to the PIC, the PM, and the Project Health and Safety Contact for signature.

Prior to beginning a new project or a new phase of an existing project, the PHASP will be reviewed by all members of the project team. Following review of the PHASP, all members of the project team shall meet in a safety session led by the Project Health and Safety Contact or designee to discuss the PHASP. Special preparations, equipment, techniques, safety training, or unusual procedures affecting safety will also be reviewed at this time.

A field copy (stamped “Field Copy”) of the PHASP will be on-site at all times while Barr staff are on-site. Sampler and surveyor copies of the PHASP will be distributed appropriately. Copies of any report of injury or accident on the site or relating to a specific PHASP will be maintained in Barr's health and safety files.

The PHASP will be reviewed and signed by the PIC, PM, and Project Health and Safety Contact prior to site operations.

4.0 Noncompliance with Project Health and Safety Plans

All Barr staff are expected to maintain a commitment to their safety and to the safety of others. Normally, this means that PHASPs will be followed for all work activities. However, if an unforeseen situation is encountered and the PHASP is unclear or incomplete, or if an employee's safety is uncertain or in question, the affected employee shall **immediately** remove himself or herself and other employees from the potentially unsafe situation until the uncertainty can be resolved with the aid of the Project Health and Safety Team Leader, PM, and the Project Health and Safety Contact.

In the event that a Barr employee is unable to follow the procedures described in the PHASP, the affected employee shall resolve the situation with the Project Health and Safety Team Leader, PM, and Project Health and Safety Contact. The Barr employee shall document any changes made to the PHASP in the Project Field or Safety Diary or Project Daily Safety Record and field copy of the PHASP.

Willful noncompliance with the procedures set forth in a PHASP will be grounds for disciplinary action or termination of employment.

5.0 Hazard Evaluation

At a given site, Barr staff on the project team may be exposed to any combination of hazardous substances. In addition, there may be the physical hazards inherent to any site from machinery, heavy equipment, sharp objects, uneven terrain, unfriendly neighborhoods, flying objects, noise, temperature extremes (heat and cold), biologic hazards (such as poisonous plants, insects, animals, and indigenous pathogens), and/or falling hazards. Protection from known hazards will be addressed in the PHASP before Barr staff begin work on the project site.

Preliminary Assessment

A PHASP will be prepared for all projects involving field activities at sites containing or suspected to contain hazardous substances. A preliminary assessment will be made by the PIC and the PM after consultation with the Company Health and Safety Manager, to determine if a PHASP is applicable, according to this Barr Health and Safety Program Manual, for that project. This preliminary assessment will consider potential safety risks associated with employee exposure to hazardous substances as a result of activities specified in the project scope of work. The preliminary assessment will be based on existing site information supplied by the client, government agencies, or other sources. Based on the preliminary assessment of the potential health and safety hazards on the site, the PIC and PM may require that a PHASP be prepared.

Hazard Assessment

When hazardous substances are known or suspected on the site or when the purpose of our investigation is to determine if hazardous substances are present on the site, a hazard assessment will be conducted to help define operational procedures, engineering controls (including the use of pressurized cabs or control booths on equipment, and/or the use of remotely-operated material-handling equipment), work practices (including removing all nonessential employees from potential exposure during opening of drums, wetting down dusty operations, and locating employees upwind of possible hazards), and types of equipment needed for physical and respiratory protection and subsequent decontamination procedures (if feasible). The hazard assessment will consider the toxicity and permissible exposure levels for hazardous substances, compared with the observed or expected levels of such materials at the site. When several hazardous substances are present, their total potential hazardous effect will be considered additive, as per ACGIH guidelines. Clothing and respiratory protection will be selected by comparing the known or potential hazard with the appropriate criteria.

The hazard assessment process shall be repeated on regular intervals and reviewed to prevent the development of unsafe working conditions or the creation of new hazards derived from any corrective measures. The hazard assessment process shall be used for routine and non-routine activities as well as new processes, changes in operation, products or services as applicable. The results of the hazard assessment will be incorporated into the PHASP and will be kept current.

Employees and/or sub-contractors shall be actively involved in the hazard assessment process and the hazards shall be reviewed with all employees concerned. Employees shall be trained in the hazard identification process. This training shall include the proper use and care of person protective equipment.

When the hazardous substances that may be encountered at a site are unknown, personal protective equipment and operational procedures will be determined by criteria referenced in Hazardous Waste Operations and Emergency Response Standard (29 CFR 1910.120). When necessary, the hazard assessment may involve an on-site reconnaissance to help identify potential hazards. Appropriate equipment, including air monitoring, personal protection, etc., will be used while conducting any such on-site assessments. When PPE or engineering controls are not adequate, administrative controls may be implemented.

Where employees may be exposed to hazardous substances at hazardous concentrations, air monitoring will be used to identify and qualify airborne levels. Monitoring will address initial entry, periodic monitoring, possible IDLH and whatever exposure may be a possibility.

6.0 Hazard Groups

6.1 Hazard Group Analysis for Project Tasks

A Hazard Group analysis assesses the hazards associated with a particular task on a project site and matches that task to a Hazard Group. There are five hazard groups, and each has been described in TABLE Q-1: HAZARD GROUP DESCRIPTION. Each hazard group represents a different potential for exposure and consequently has been assigned a corresponding level of personal protective equipment (PPE).

The Hazard Groups are differentiated by anticipated concentrations of hazardous substances which may be encountered during work activities. 0Low0, 0medium0 and 0high0 classifications differentiate Hazard Groups 2, 3 and 4. A qualitative description of these concentrations of hazardous substances follows:

"Low" = No pure-phase product containing a hazardous substance expected in either groundwater or soils. Work activity may require some contact, principally walking over soil or contacting soil or groundwater known or suspected to contain hazardous substances with the hands. Previous evaluation of site work has determined that skin contact does not present a significant exposure pathway. The primary purpose of PPE is to prevent hand to mouth contaminant transfer.

"Moderate" = Pure-phase product containing a hazardous substance may be present. Work activity involves handling contaminated soils or groundwater but contact with the torso is expected to be minimal (i.e. prolonged or frequent body contact is not expected and no splash potential exists).

"High" = Pure-phase product containing a hazardous substance is known to be present during work activity and the potential for whole-body contact ranges from possible to unavoidable (i.e. prolonged or frequent body contact is expected and/or splash potential exists).

Table 1 Hazard Group Description

Hazard Group	Description
Group 0	No contact with hazardous substances is expected during this work activity. No construction hazards are immediately adjacent to the work area while this work activity is being performed. No specific level of protection is required except for normal work/street clothes.
Group 1 (Level D1)	No contact with hazardous substances is expected during this work activity. Construction hazards are immediately adjacent to the work area while this work activity is being performed. Level D1 protection would be appropriate.
Group 2 (Level D2)	Contact with 0low0 levels of hazardous substances is expected during this work activity. Construction hazards are immediately adjacent to the work area while this work activity is being performed. Level D2 protection would be appropriate.
Group 3 (Level C3/D3)	Contact with 0moderate0 levels of hazardous substances is expected during this work activity. Construction hazards are immediately adjacent to the work area while this work activity is being performed. Level D3 protection would be appropriate. Possible upgrade to a corresponding Level C protection.
Group 4 (Level C4/D4)	Contact with 0high0 levels of hazardous substances are expected during this work activity or contact with contaminated liquids is possible. Construction hazards are immediately adjacent to the work area while this work activity is being performed. Level D4 protection would be appropriate. Possible upgrade to a corresponding Level C protection.

Typical Barr work activities have been evaluated for their inherent hazards and have been assigned to a particular hazard group. Work activities assigned to the same hazard group have similar exposure potentials, even if the activities are different. In this way, the work activity and its exposure potential prescribes the personal protective level and air monitoring needs in conjunction with the type of site where a work activity is performed.

For example, a nonintrusive activity such as surveying in a field on a former coal tar site which is covered with asphalt may fall into a Hazard Group 1 requiring Level D1 personal protection while an intrusive activity on that same site may fall into a Hazard Group 3 requiring Level D3 personal protection because of the increased potential for exposure from that intrusive work activity. Levels of protection are described in *Section F: Personal Protective Equipment (PPE) Program.*

If, during the course of conducting activities in Group 0 or Group 1, the following are encountered: (1) the detection of odors from exposed soils/fluids; (2) appearance of oiliness in soils; or (3) unnatural soil discoloration, activities should be suspended. The Barr Project Health and Safety Team Leader will reassess field conditions with regard to hazard groups and personal protective levels, choose appropriate modifications, and field personnel will implement the modifications before resuming the Work.

TABLE Q-2: TYPES OF WORK ACTIVITIES IN HAZARD GROUPS lists typical work activities performed by Barr personnel and shows the different types of Hazard Groups in which an activity may be classified. The potentially applicable hazard groups are marked with an 0X0. Actual site specific conditions may require a different level of personal protective equipment than that noted. Site specific levels of personal protective equipment are described in the PHASP.

Table 2 Examples of Common Work Activities Classified in Hazard Groups[1]

Work Activity (Personal Protection Level)	Group 0 (Street Clothes)	Group 1 (Level D1)	Group 2 (Level D2)	Group 3 (Level D3)	Group 4 (Level D4)
Reconnaissance	X	X	X	X	X
Geophysical survey	X	X	X	X	--
Geotechnical soil boring	--	X	--	--	--
Surface water level measurement	X	X	X	--	--
Surface water sampling	X	X	X	--	--
Groundwater level measurement	X	X	X	X	--
Construction observation[2]	--	X	X	--	--
Site remediation construction observation	--	X	X	X	X
Observation of soil boring advancement	--	X	X	X	X
Observation of monitoring well installation	--	X	X	X	X
Observation of piezometer installation	--	X	X	X	X
Soil gas survey	--	X	X	X	--
Groundwater sampling	X	X	X	X	X
Free product sampling	--	--	--	X	X
Monitoring well slug testing	X	X	X	X	X
Monitoring well development	--	X	X	X	X
Monitoring well pump test	X	X	X	X	X
Observation of test trenching	--	--	X	X	X
Collection of surface soil samples	X	X	X	X	--
Collection of soil samples from borehole	--	X	X	X	X
Collection of soil samples from backhoe bucket	--	X	X	X	X
Collection of waste/sludge samples	--	--	--	--	X
Observation of slurry wall construction	--	X	X	X	X
Observation of soil treatment activities	--	--	X	X	X
Performance of jar headspace screening	--	--	X	X	X
Industrial stack sampling	--	X	X	X	--

[1] Site specific conditions may require a higher level of protection.

[2] Construction observation includes observing the following activities: site grading, construction of leachate collection system, installation of drainage system, cap construction, liner construction, etc.

X = Activity may be performed in this Hazard Group.

-- = Activity is not expected to be performed in this Hazard Group.

7.0 On-Site Work Zones

On-site control minimizes potential contamination to other site areas and facilitates safe work activities. Site control methods include the designation of site work zones at the project site, and decontamination of field personnel and equipment.

Five work zones may be established on a site: the hot zone, the exclusion zone, the contamination reduction zone (DECON), the work area, and the support zone. On a complex site all five work zones may be established. On a simple site there may only be three work zones (exclusion zone, DECON zone, and support zone). On a site involving activities which do **not** involve hazardous substances, there may only be one work zone (work area).

These zones may be defined by physical or visual segregation of work activities. Barrier tape, spray painted lines, traffic cones or other physical markers will be used to delineate a work zone area if it is unclear.

These five work zones are defined as follows:

7.1 Hot Zone

A hot zone is contained within the exclusion zone (see 7.2 below) and is an area where hazardous substances are known to be present and a high potential for exposure exists. A hot zone is used to delineate test trenching and contaminated soil excavation activities. Work activities in a hot zone usually are designated as Hazard Group 4.

7.2 Exclusion Zone

An exclusion zone is defined as the area where hazardous substances are expected to be present, or where selected physical hazards may be present because of site activities. All personnel entering the exclusion zone must wear the appropriate protective equipment and comply with appropriate procedures to work in that zone. The purpose of an exclusion zone is to control access into an area where hazardous substances are present and to minimize cross-contamination to the noncontaminated portions of the site.

An exclusion zone designation is required when any of the following conditions exist:

- The site activity is a cleanup operation on a hazardous waste site.
- The site activity is an initial investigation at a government identified site before the presence or absence of hazardous substances has been ascertained and there is a **reasonable** possibility for exposure.
- Hazardous substances are present at the ground surface.

- An intrusive activity will be conducted and there is a possibility for exposure through skin absorption or irritation, or eye irritation.

- An intrusive activity will be conducted and there may be a possibility for exposure which may exceed a work place exposure standard or IDLH concentrations.

- An intrusive activity will be conducted and there may be a possibility for fire or explosion.

7.3 Contamination Reduction (DECON) Zone

A contamination reduction (DECON) zone is the area which all Barr employees and Barr's subcontractors must pass through to enter or exit an exclusion zone to minimize the exposure of uncontaminated employees or equipment to contaminated employees or equipment. A DECON zone is an area suspected to be clean (uncontaminated). It is located adjacent to an exclusion zone as a buffer between: (1) the area where hazardous substances are known or suspected to be present; and (2) the area known or suspected to be clean. Personnel and monitoring equipment decontamination activities occur in this zone.

Supplemental personal protective equipment (such as surgical gloves, chemical apron, face shield, etc.) may be required for the performance of selected tasks in this zone. Sample handling and examination and the packing of sample containers into transporting containers, where the only potential for cross-contamination is from the sample container, may occur in a DECON zone. Decontamination of heavy equipment (e.g. drill rigs and drain hole equipment, backhoes, etc.) should be conducted in this zone.

All employees leaving a contaminated area are to be appropriately decontaminated in this zone and all contaminated clothing and equipment leaving a contaminated area are to be appropriately disposed of or decontaminated.

7.4 Work Area

The work area is that portion of a site where work activities are being performed, and where no hazardous substances are expected to be encountered. The work area is generally not included in another designated zone (i.e., hot zones, exclusion zones, DECON zones, or support zones). The purpose of a work area is to control access due to physical hazards. Basic safety equipment such as hard hat, steel-toed work boots/insulated steel-toed boots, and safety glasses (Level D1) are required in the work area unless otherwise specified in the PHASP. Portions of the work area may be subject to the provisions and requirements of safety plans or health and safety plans of other employers performing activities in the work area.

7.5 Support Zone

A support zone is located in an area that is not known or expected to contain hazardous substances. The physical hazards that are common to the site are generally not present. Support materials (clean protective equipment, supplies, etc.) will generally be located in this zone. Personal use articles, such as vehicles, telephones, office trailers, and sanitation facilities can be located in this zone. Basic personal safety equipment (hard hat, steel-toed work boots/insulated steel-toed boots, and safety glasses) are generally not required in this zone.

A support zone may be established at a site based on the following considerations:

- The support zone area is not suspected to be contaminated.
- The location of a contamination reduction (DECON) zone is adjacent to support zone.
- The availability of services or ability to provide services, such as electric power, telephone, water, roads, etc. are convenient to the support zone.
- The support zone is upwind of site activities.

Eating, drinking, and smoking may be permitted in selected portions of a support zone or a work area.

8.0 Buddy System

The buddy system is a system whereby each member of a project field team has a specific agreement with at least one other member of the field team to mutually maintain line-of-site communication and provide rapid assistance in the event of an emergency.

Entry into the exclusion zone or hot zone requires implementation of the buddy system. The only work zones that do not require the use of the buddy system are the DECON zone, the work area, and the support zone.

To properly utilize the buddy system, all applicable Barr employees and Barr’s subcontractors are assigned at least one buddy while working in the exclusion zone or hot zone. When it is not feasible for two Barr employees to act as each other's buddy, the buddy may be a client (owner’s representative), an assigned employee of Barr’s subcontractor, an assigned employee of the owner’s contractor, as long as both buddies agree to act as each other’s buddy prior to entry to the exclusion or hot zones. Buddies must remain in each other’s line-of-sight at all times unless both buddies are in possession of operating radios. Barr’s subcontractor will be required to provide a buddy whenever necessary when a Barr employee is working in the exclusion or hot zones.

During low hazard activities in an exclusion zone, a buddy is not required within the same exclusion or hot zone, as long as (1) communication equipment (such as radios) or line-of-sight are used and (2) the buddy can render emergency care if needed. This requires that the buddy be prepared (wearing proper personal protective attire) to promptly enter the exclusion/hot zone to render emergency care if necessary.

9.0 Site Security and Control

The purpose of site security and site control is to protect the public from a site's chemical and physical hazards and to limit access to the site by the general public and unauthorized persons when necessary. The site perimeter may be delineated by an existing fenceline, boundary markings, or through the use of a security patrol. Individual site work zones may be delineated within this boundary. If necessary, signs may be posted to prevent unauthorized entry onto the site. Specific site control measures are described in the PHASP.

10.0 Site Communications

Successful communications between personnel is essential. There are two types of communications systems: normal operating communications and emergency communications. The following normal operating communications systems may be available for on-site activities:

- Normal, direct verbal communication
- Walkie-talkies
- Whistle
- Hand signals (TABLE Q-3: NONVERBAL COMMUNICATION SYSTEM)

- Portable phone
- Land-line phone

Project specific emergency communications are described in the PHASP.

TABLE Q-3: NONVERBAL COMMUNICATION SYSTEM describes the hand signals that may be used to communicate while on site.

Table 3 Nonverbal Communication System

Hand Signal	Definition
Thumbs up	OK/I am alright/I understand
Thumbs down	No/negative
Finger across the neck	Shut down equipment/Stop activity
Hands on top of head	Need assistance
Hands clutching throat	Out of air/cannot breath
Arms waving upright	Send backup support
Grip partner№s wrist	Exit area immediately

11.0 Safe Work Practices

The following safe work practices should be followed by all Barr employees and Barr№s subcontractors during regular (nonemergency) site work.

11.1 Personal Precautions

Personal precautions for work on-site are described below:

- Use appropriate personal protective equipment (hard hat, steel-toed boots, safety glasses, etc.).
- Limit on-site work to daylight hours unless area lighting is provided.
- Hands and face must be thoroughly washed before eating/drinking or using tobacco products.
- Facial hair shall not interfere with proper respirator fit.

- Be aware that some prescribed drugs may potentiate the effects from exposure to moderately hazardous substances, may interfere with the safe performance of a work activity, or may interfere with tolerance to temperature extremes.

- Refrain from wearing rings, necklaces, bracelets, or earrings when conducting a work activity.

- Be aware that off-hour use of alcohol or caffeine may cause dehydration and affect endurance during temperature extremes.

- Be aware that lack of adequate rest during off-hours may interfere with alertness to potential hazards.

11.2 Standard Operating Practices for Work On Site

Standard operating practices for work on site, within the hot zone, exclusion zone, or DECON zone are described below:

- No smoking, eating, drinking, or chewing tobacco or gum.

- No matches, lighters, or torches, unless specifically addressed in specifications as a necessary component of site activities.

- Buddy system implemented when working in the exclusion zone or hot zone with line-of-sight with buddy maintained unless both buddies are in possession of operating walkie/talkies, which are effective for the range used.

- Normal communications system implemented.

- Refrain from wearing rings, necklaces, bracelets, or earrings around any machinery.

- Appropriate level of personal protection worn.

- Perform air monitoring as specified in PHASP.

- Safety information documentation as specified in PHASP.

12.0 Identification of Key Personnel On Site and Responsibilities

Barr has designated safety responsibilities to various project team members. These responsibilities are given to the Company Safety Officer, Principal in Charge, Company Health & Safety Manager, Project Manager, Project Health and Safety Contact, Barr Project Health and Safety Team Leader, and Barr's on-site representative. Barr's subcontractors have designated safety responsibilities for this project to various members of the subcontractor's staff. These responsibilities are described below:

- ***Company Safety Officer*:** The Company Safety Officer is the person designated by Barr to have corporate responsibility for the safety of Barr employees.

- ***Principal in Charge*:** The Principal in Charge is the person designated by Barr to have corporate responsibility for the project and responsibility for employee safety on the project. Responsibilities include contracting/negotiating work scope, scheduling, budgeting, and billing. The Project Manager will report to the Principal in Charge as necessary.

- ***Company Health and Safety Manager*:** The Company Health and Safety Manager is the person designated by Barr to administer the Health and Safety Program.

- ***Project Manager*:** The Project Manager is the person designated by the Principal in Charge to have day-to-day safety and management responsibility for a given project.

- ***Project Health and Safety Contact*:** The Project Health and Safety Contact is responsible for providing guidance for implementing the PHASP.

- ***Barr Project Health and Safety Team Leader*:** The Barr Project Health and Safety Team Leader is designated by the project manager and is responsible for implementing safety procedures on the project site. This person will be identified in the PHASP. If not designated, the safety trained Barr employee on the project site with the most experience working at Barr will assume the role on the project site. The Project Health and Safety Team Leader reports to the Project Manager.

- ***Barr Resident Project Representative*:** The Barr On-site representative is the person responsible for on-site observation of the project along with implementation of the plans and specifications. This person may also act as the Barr Health and Safety Team Leader.

- ***Subcontractor*:** The subcontractor is the person designated by the subcontracting firm to have corporate responsibility for the project. Responsibilities include subcontracting with Barr, scheduling, budgeting, and billing/collecting. The subcontractor's representatives will report to the subcontractor as necessary.

- ***Subcontractor's Site Safety Officer*:** The Subcontractor's Site Safety Officer is the person responsible for implementing safety procedures on the project verifying that procedures are followed by subcontractor's employees, and is designated by the subcontractor. The Subcontractor's Site Safety Officer will be on-site while the subcontractor's work is in progress.

- ***Subcontractor's Representative*:** The Subcontractor's Representative is the person designated by the subcontractor to have responsibility for on-site implementation of the subcontractor's work. This person is designated by the subcontractor, and may also act as the Subcontractor's Health and Safety Team Leader.

13.0 Project Safety Documentation

Project safety documentation (a Project Field or Safety Diary or Project Daily Safety Record Form, PHASP, Form 3-1) is required on all projects that have a PHASP. Project safety documentation provides that the safety procedures required by the PHASP have been implemented during field operations. As such, the project safety documentation may contain a summary of:

- Personal protective equipment used

- Results of real-time air monitoring

- Actions taken if action levels were exceeded

- Personal air monitoring equipment used

- Decontamination procedures

- Any accidents, over-exposures, illnesses, injuries or “near misses” that occurred on-site

This information will be entered on a daily basis.

Project safety documentation should be kept at the project site during site operations and should be maintained in the Project Safety File when site activities are not occurring. Upon completion of a work phase, the completed project safety documentation will be filed in the library with the project files.

14.0 Project Health and Safety Plan Updates and Reviews

Updates and amendments to the PHASP will be made as required by changes in Barr policy, requirements of law and regulations, changes in site activities, site conditions, or when additional information becomes available. The effectiveness of the PHASP may be evaluated by the Project Health and Safety Contact or other qualified individual (e.g., industrial hygienist) at Barr during the course of the project or upon completion of field work. This evaluation is usually conducted by interviewing members of the project team to evaluate the effectiveness of the PHASP. In addition, all Barr PHASPs at active project sites will be reviewed on an approximate annual basis and, if necessary, updated to reflect the appropriate changes.

An onsite review/audit may be completed using the Project Worksite Safety Audit Form (PHASP, Form 3-5) and/or the EPA Health and Safety Audit Guidelines. The results of this audit will be communicated verbally or in a written memorandum to the project team members, including the Project Manager and the Principal in Charge. The audit results will also be noted in the project safety file.

15.0 Visitors to the Site

The following guidelines were developed to assist field staff when dealing with visitors to Barr sites. A visitor is typically defined as a person with legitimate reasons for access to the site where it can be demonstrated that access does not involve exposure or the reasonable possibility for exposure to health and safety hazards. However, a visitor may also need to access portions of the site which may involve exposure or the reasonable possibility for exposure to health and safety hazards.

15.1   Sites Controlled by Barr

Determine who the visitor is, and their affiliation (agency, client, PRP, media, general public, etc.). Find out what they need to see, and whether they can accomplish their task from outside the work zones (decontamination and exclusion zone). Record this information in the Project Field or Safety Diary, or Daily Safety Record (PHASP, Form 3-1).

15.1.1 Visitors to the site may include:

- ***General Public, Media:*** If the site, including the support zone is fenced, the Barr Health & Safety Team Leader should keep members of the press or general public outside the fence, unless the project manager or principal in charge gives permission for them to access the site. If the site is unfenced, members of the general public may be allowed in our support zone only; however, those parties should be asked to stand well back from any heavy equipment or other operations. The more clearly work zones are marked, the easier it is to keep the general public out of those areas. The project manager should be informed promptly of any visits by members of the general public or press.

- ***Regulatory Agencies:*** Unless their visits have been previously arranged, regulatory agency personnel should be asked to wait in the support zone, while the Barr Health and Safety Team Leader contacts the project manager, principal in charge, or, if they are not available, any available Company principal. The project manager or principal in charge will advise the field project personnel how to proceed. While waiting for a response from project management, make the person from the regulatory agency comfortable. If available, invite the visitor into the Barr trailer or other office on-site.

- ***Other Parties Needing to Access the Site:*** If other parties request access to the site, this request should first be discussed with the project manager. They should not be allowed in to work zones other than the support zone without first presenting training documentation.

15.1.2 Visitors that need to access portions of the site other than the support zone will be required to provide the following documentation.

- ***Training Documentation:*** Persons wishing to access work zones other than the support zone should present evidence that they have completed the following training:

  40-hour Hazardous Waste Training

  8-hour Annual Refresher Training (current)

  In some circumstances a lesser amount of training, such as 24-hour training, may be acceptable. This should be decided by the project manager with advice from the health and safety staff.

- ***Medical Documentation:*** Generally, persons wishing to access work zones other than the support zone must present documentation that they have been examined by a physician, and that the physician has cleared them for work on a hazardous waste site. If the person may be required to wear a respirator, the documentation should also include a physician's clearance to wear a respirator.

  Exceptions to the medical documentation requirement may be made by the project manager, with advice from the health and safety staff. Exceptions may be made in the case of short duration (1-2 days) visits, where exposure would be minimal, and the visitor would not be required to wear respiratory protection.

15.1.3 Barr’s Responsibility for Visitors

By admitting visitors to the work area, Barr accepts a measure of responsibility for the visitors' safety. While Barr does not generally supply visitors with protective clothing unless prior arrangements have been made, the project health and safety team leader should make sure that the visitor is wearing clothing appropriate to the site conditions, in accordance with the project health and safety plan.

All visitors should be briefed on the potential hazards, site safety requirements, and emergency procedures. The visitor should be asked to sign a site log-in sheet.

Under no circumstances should visitors be allowed to wander around a site unescorted. Ideally, a Barr escort should be provided for the visitor. If there are not sufficient Barr staff to do this, then, at a minimum, the visitor should be kept in verbal and visual communication range.

15.1.4 Unauthorized/Uncooperative Visitors

The primary concern of Barr personnel on any site must be their health and safety. Personnel should exercise their best judgment when dealing with uncooperative or unauthorized visitors. While Barr personnel may politely ask or instruct someone not to enter the site, they should never attempt to physically restrain a visitor, nor should they be drawn into an argument. If unauthorized personnel disregard Barr's request not to enter the site, project personnel should immediately shut down site operations and contact the project manager or principal in charge. Similarly, if visitors allowed on site refuse to follow the site rules, they should be politely asked to leave the site. If they do not leave the site, operations should be immediately shut down and the project manager or principal in charge notified as soon as possible.

If, at any time, Barr employees or Barr's subcontractors feel their safety is jeopardized by a visitor, leave the area, if possible, and contact the police. After Barr employees have assured themselves of their safety, then they should contact the project manager or principal in charge.

15.2 Sites Not Controlled by Barr

When Barr is on a site as a technical observer of site work, with no direct responsibility for management of the site, Barr's responsibility regarding visitors is limited. Barr employees should record the visit in the Project Field or Safety Diary, or on the Daily Safety Record (PHASP, Form 3-1), and attempt to find out the purpose of the visit. In the case of visits from regulatory agencies, the media, or other parties, which could impact our client, the project manager or principal in charge should be promptly notified.

Barr staff are advised not to attempt to screen the visitor, deny or permit them access, or take responsibility for their safety on the site. In addition, Barr staff are advised to note whether the party controlling the site has taken the appropriate precautions.

Section 18: Decontamination Procedures

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Section 18: Decontamination Procedures

1.0 Scope

Personal protective equipment (PPE) and monitoring equipment must either be decontaminated or properly discarded upon exiting from the exclusion zone. This practice prevents cross-contamination to clean areas. All Barr employees and Barr's subcontractors must enter and exit the exclusion zone through the decontamination (DECON) zone.

2.0 Decontamination Methods

Decontamination methods should involve: physically removing contaminants, neutralizing contaminants, or removing contaminants through a combination of both physical and chemical means. The types, physical states, and concentrations of contamination present will determine the feasibility of DECON and appropriate method of decontamination.

3.0 Procedures

A step-by-step representation of decontamination procedures and recommended locations for decontamination stations for Levels D, C, and B is provided in FIGURE R-1: DECONTAMINATION PROCEDURES. The Project Health and Safety Team Leader will monitor decontamination procedures and may modify, if appropriate, to suit site conditions and specific protective levels in use. General standard operating procedures to be followed are:

- Minimize contact with contaminants in order to minimize the need for extensive decontamination.

- Sampling/monitoring equipment, when feasible, should be enclosed in plastic bags to prevent contamination and the need for DECON.

- Decontamination solution of soap on other detergent, such as trisodium phosphate (TSP) and water should be used.

- Gloves, boot covers, and disposable outer clothing should be rolled down with the insides out and discarded in appropriate containers.

4.0 Equipment Decontamination

Air monitoring equipment will be decontaminated before leaving the site. While the decontamination procedures should be appropriate for the type and concentration of site contaminants expected, the selected procedure should not be damaging to the monitoring equipment. Generally, wiping the equipment with a damp cloth or cloth soaked in a mild soap solution is sufficient to remove most contaminants. If solvent cleaning or more rigorous cleaning techniques are required, the Equipment Coordinator should be consulted.

Other site equipment such as vehicles, soil, or other sampling equipment should be decontaminated prior to leaving the site. Vehicle decontamination at minimum should consist of steam or pressure washing tires. Depending upon site conditions, the use of solvents or more extensive pressure washing may be necessary. Site-specific equipment decontamination procedures, if required, are discussed in the Health and Safety Plan.

5.0 Waste Disposal

Barr personnel on site will determine whether protective clothing is contaminated, in which case it will remain on site for future disposal by the owner. Personal protective clothing may be considered contaminated when the level of contamination present meets hazardous waste criteria. Clothing which does not carry levels of contamination sufficient to warrant this categorization may be disposed of as garbage. ATTACHMENT R-1 should be consulted for further guidance.

It is unlikely that any nonvisible residue adhering to disposable protective clothing would be present at the levels required to meet hazardous waste criteria. Protective clothing that is not visibly dirty will therefore be placed in garbage bags to be disposed of as garbage. All visibly dirty protective clothing will be placed in drums or secured plastic bags to remain on site or otherwise disposed of as determined in the work scope of the project.

6.0 Management and Disposal of Decontamination Solutions and Other Investigation-derived Wastes

Decontamination solutions and other investigation-derived wastes must be decontaminated or be properly disposed. In determining if a particular management disposal option is appropriate, the following should be considered:

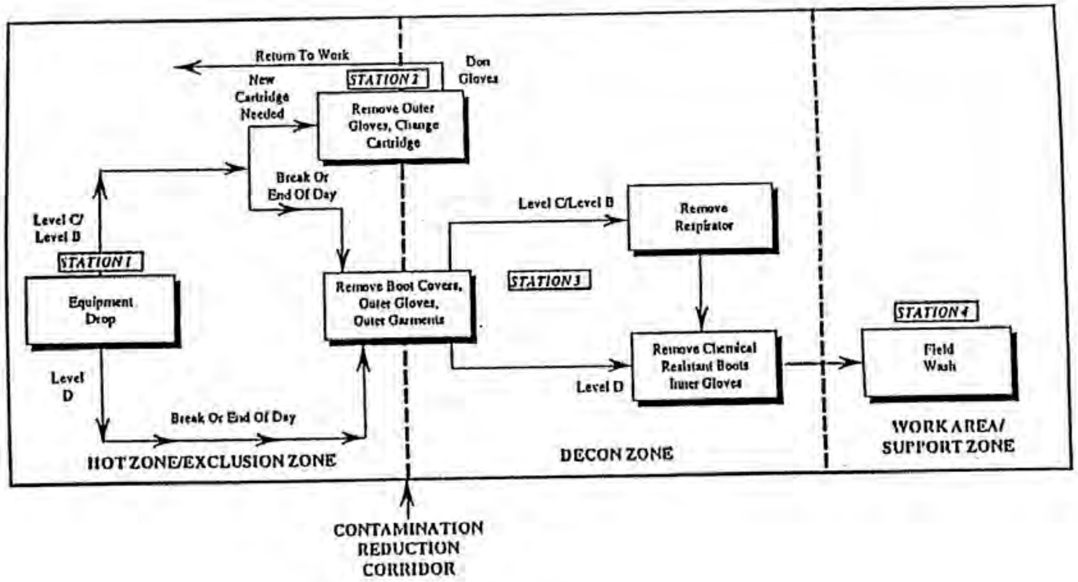
- The contaminants, their concentrations, and the total volume of decontamination solution
- Media potentially affected (e.g., groundwater, soil) under management options
- Location of the nearest population(s) and the likelihood and/or degree of site access
- Potential exposure to workers

- Potential for environmental impacts

The U.S. EPA has released a fact sheet (January 1992) summarizing appropriate methods for managing decontamination solutions and other investigation-derived waste. ATTACHMENT R-1: GUIDE TO MANAGEMENT OF INVESTIGATION-DERIVED WASTES contains the information in the U.S. EPA fact sheet, which has been retyped to improve its legibility.

7.0 Showers and Change Rooms

Showers and/or change rooms may be provided for Barr employees when the duration of the project activities extends beyond a six-month continuous period or will be provided when site conditions warrant the need for a separate change area.



1. Decontaminate Equipment
2. Remove boot covers
3. Remove outer gloves and tyvek
4. Remove respirator
5. Place all disposed PPE in garbage bags or drum
6. Remove inner gloves and place in garbage bags or drum
7. Wash hands and face with water, alcohol wipes, other cleaning wipes
8. Shower as soon as possible off-site

Figure R-1

DECONTAMINATION PROCEDURES

ATTACHMENT 1
Guide to Management of Investigation-derived Wastes
(U.S. EPA Fact Sheet, January 1992)

ATTACHMENT R-1

United States
Environmental Protection
Agency

Office of
Solid Waste and
Emergency Response

Publication: 9345.3-03FS
January 1992

EPA

Guide to Management of Investigation–Derived Wastes

Office of Emergency and Remedial Response
Hazardous Site Control Division OS-220W

Quick Reference Fact Sheet

CERCLA field investigation activities (e.g., remedial investigation/feasibility studies and remedial designs) may result in the generation of waste materials that may pose a risk to human health and the environment. These investigation-derived wastes (IDW) may include drilling muds, cuttings, and purge water from test pit and well installation; purge water, soil, and other materials from collection of samples; residues (e.g., ash, spent carbon, well development purge water) from testing of treatment technologies and pump and treat systems; contaminated personal protective equipment (PPE); and solutions (aqueous or otherwise) used to decontaminate non-disposable protective clothing and equipment. The management of IDW must ensure protection of human health and the environment and comply with (or waive) regulatory requirements that are applicable or relevant and appropriate requirements (ARAR). This fact sheet presents an overview of possible IDW management options, discusses the protectiveness requirements and ARARs associated with these options, and outlines general objectives established for IDW management under Superfund.[1]

The general options for managing IDW (see **Highlight 1**) are collection and either (1) immediate disposal or (2) some type of interim management. Interim management may include storage or other temporary. As dismissed below, the specific option selected will depend on the type of waste produced, its relative threat to human health and the environment, and other site-specific conditions.

IDW MANAGEMENT REQUIREMENTS

When managing IDW, site managers are required to choose an option that: (1) is protective of human health and the environment and (2) complies with (or waives) ARARs, as described below.

Protectiveness

In determining if a particular management/disposal option is protective, site managers should consider the following:

- The contaminants, their concentrations, and total Volume of IDW;
- Media potentially affected (e.g., ground water, soil) under management options;
- Location of the nearest population(s) and the likelihood and/or degree of site access;
- Potential exposures to workers; and
- Potential for environmental impacts.

As a general rule, it will be necessary to use best professional judgment, in light of the site-specific conditions, to determine whether an option is protective of human health and the environment. For example, a site manager may determine that storing IDW temporary until the final action or returning IDW to its source is protective, based on knowledge that the material poses low risk and/or that the final action will address any risks posed by the wastes and there will be no unacceptable risks in the interim.

Alternatively, if the site includes or is near residential areas, the site is unsecured, and/or contaminants appear to be present at unacceptable levels, it may not be protective to return excavated soil to the source. Storing IDW in containers in an on-site, secure location, or sending it off site immediately may be more appropriate.

Site managers also need to consider the potential effects of IDW management-related activities on environmental media. For example, pouring contaminated purge water on the ground around a well may not be prudent, because such an action could mobilize any hazardous constituents present in the soil or introduce contaminants into clean soil.

Compliance with ARARs

Remedial Investigation/Feasibility Study (RI/FS) and Remedial Design (RD) actions must comply with ARARs "to the extent practicable, considering the exigencies of the situation" (NCP, 55 FR 8756, emphasis added); therefore, it generally will not be necessary to obtain a waiver if an ARAR cannot be attained during these actions. If a site manager determines that, based on site-specific factors, compliance with an ARAR is practicable but an ARAR waiver is warranted for an RI/FS or RD action, an interim action waiver may be available if the final remedy will attain the ARAR. An action memorandum should be prepared for the waiver, the state given an opportunity to comment, and the decision document placed in the administrative record.

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[1] Management of treatability study and treatment pilot wastes is discussed in Guide for Conducting Treatability Studies Under CERCLA. Interim Final, December 1989, EPA/540/2-89/058. Information on management of IDW generated during Preliminary Assessments and Site Investigations is provided in Management of Investigation-Derived Waste During Site Investigations. May 1990, EPA/540/G-91/009.

ATTACHMENT R-1 (CONT.)

Highlight 1: IDW MANAGEMENT OPTIONS

Type of IDW	Generation Processes[*]	Management Options
Soil	• Well/test pit installation • Borehole drilling • Soil sampling	• Return to boring, pit, or source immediately after generation • Spread around boring, pit, or source within the AOC[+] • Consolidate in a pit (within the AOC) • Send to on-site TDU[+] • Send to TDU off site immediately • Store for future treatment and/or disposal
Sludges/sediment	• Sludge pit/sediment sampling	• Return to boring, pit, or source immediately after generation • Send to on-site TDU • Send to TDU off site immediately • Store for future treatment and/or disposal
Aqueous liquids (ground water, surface water, drilling fluids, other wastewaters)	• Well installation/development • Well purging during sampling • Ground water discharge during pump tests • Surface water sampling	• Discharge to surface water • Pour onto ground close to well (non-hazardous waste) • Send to on-site TDU • Send to off-site commercial treatment unit • Send to POTW[+] • Store for future treatment and/or disposal
Decontamination fluids	• Decontamination of PPE[+] and equipment	• Send to on-site TDU • Evaporate (for small amounts of low contamination organic fluids) • Send to TDU off site immediately • Store for future treatment and/or disposal
Disposable PPE	• Sampling procedures or other on-site activities	• Send to on-site TDU • Place in on-site industrial dumpster • Send to TDU off site immediately • Store for future treatment and/or disposal

[*] The generation processes listed here are provided as examples. IDW may also be produced as a result of activities not listed here.

[+] AOC: Area of Contamination (AOCs at a site may not yet have been identified at the time of the RI/FS); TDU: Treatment/disposal Unit; POTW: Publicly Owned Treatment Works; PPE: Personal Protective Equipment

Potential ARARs for IDW at CERCLA sites include regulations under the Resource Conservation and Recovery Act (RCRA) (including both Federal and State underground injection control (UIC) regulations), the Clean Water Act (CWA), the Clean Air Act (CAA), the Toxic Substances Control Act (TSCA), and other State environmental laws. How these various requirements may direct or influence IDW management decisions is described below.

Resource Conservation and Recovery Act (RCRA). Certain sections of the RCRA Subtitle C hazardous waste regulations (e.g., land disposal restrictions and storage restrictions) may be ARARs for IDW should RCRA hazardous waste be identified at a site. (Note that RCRA may be relevant and appropriate even if the IDW is not a RCRA hazardous waste.) A waste is hazardous under RCRA if it is listed as such in 40 CFR 261.31 - 261.33 or if it exhibits one of four characteristics: ignitability, corrosivity, reactivity, or toxicity.

Site managers should not assume that a waste considered to pose a potential risk at a CERCLA site is a listed or characteristic RCRA hazardous waste. Until there is positive evidence (records, test results, other knowledge of waste properties) that the IDW is a RCRA hazardous waste, site managers should manage it in a protective manner (but not necessarily in accordance with Subtitle C requirements). Business records or facility processes should be examined to determine whether RCRA listed wastes were generated and are present in the IDW. For characteristic wastes, site managers should rely on testing results or on knowledge of the material's properties. If best professional judgment and available information indicate that, for protectiveness reasons (or because managed as a "hazardous waste" management in accordance with Subtitle C requirements is prudent, regardless of whether it is known to be a RCRA waste.

If aqueous liquid IDW is considered a RCRA hazardous waste, the site manager should determine whether the Domestic Sewage Exclusion (DSE) applies to the discharge of that IDW to a POTW. The RCRA DSE exempts domestic sewage and any mixture of domestic sewage and other wastes that passes through a sewer system to a POTW for treatment from classification as a solid waste and, therefore, as a RCRA hazardous waste (40 CFR 261.4).

- Land Disposal Restrictions

If IDW is determined to be a RCRA hazardous waste and subject to the land disposal restrictions (LDRs), "land disposal" of the IDW will be prohibited unless specified treatment standards are met (see Superfund LDR Guides #5 and #7, Determining When LDRs Are Applicable to CERCLA Response Actions and Determining When LDRs Are Relevant and Appropriate to CERCLA Response Actions, OSWER Directive 9347.3-05FS and 9347.3-08FS, June 1989 and December 1989 and the NCP, 55 FR 8759, March 8, 1990). "Land disposal" occurs when wastes from different AOCs are consolidated into one AOC; when wastes are moved outside an AOC (for treatment or storage) and returned to the same or a different AOC; or when wastes are excavated, placed in a separate hazardous waste management unit such as an incinerator or tank within the AOC, and then redeposited into the AOC.

Storing IDW in a container ("a portable device in which a material is stored, transported, treated, disposed of, or otherwise handled" (40 CFR 260.10)) within the AOC and then returning it to its source, however, is allowable without meeting the specified LDR treatment standards. Under the definition of "hazardous waste management until" (40 CFR 260.10), EPA states that "a container alone does not constitute a unit; the unit includes the containers and the land or pad upon which they are placed." Therefore, returning IDW that has been stored in containers (not tanks or other RCRA-regulated units) within the AOC to its source does not constitute land disposal, as long as containers are not managed in such a manner as to constitute a RCRA storage unit as defined in 40 CFR 260.10. In addition, sampling and direct replacement of wastes within an AOC do not constitute land disposal.

- Storage

Subtitle C outlines the storage requirements for RCRA hazardous wastes. Under RCRA, "storage" is defined as "the holding of hazardous waste for a temporary period, at the end of which the hazardous waste is treated, disposed of, or stored elsewhere" (40 CFR 260.10).

On-site Superfund actions are only required to comply with the substantive standards of other laws (see 40 CFR 300.5, definitions of applicable or relevant and appropriate requirements). Superfund sites are also exempt from permit requirements under CERCLA §121(e). Therefore, site managers are not required to comply with administrative requirements triggered by RCRA storage deadlines (e.g., contingency planning, inspections, recordkeeping). Generally equivalent administrative activities are undertaken at Superfund sites, however, under existing Superfund management practices.

Site managers storing known RCRA hazardous waste must comply with the substantive, technical requirements of 40 CFR Parts 264 and 265 Subparts I (containers), J (tanks), and L (waste piles), to the extent practicable. (See **Highlight 2** for a summary of these technical requirements for each type of unit). In addition, the ground-water monitoring requirements of 40 CFR Parts 264 and 265 Subpart F are potential ARARs, and to the extent they are determined to be ARARs at a site, they should be attained to the extent practicable (or waived). (In many cases, ground-water monitoring conducted during the RI/FS will provide protection equivalent to the Subpart F requirements.)

[NOTE: Under the LDRs, restricted RCRA hazardous waste may not be stored at a site unless the storage is solely for the purpose of accumulating sufficient quantities of the waste to facilitate proper disposal, treatment, or recovery (see 40 CFR 268.50). Generally, storing IDW until a final disposal option is selected in a Record of Decision (ROD) and implemented during the remedial action is allowable storage under the RCRA LDR storage prohibition.]

- Recordkeeping and Manifesting

If hazardous wastes are sent off site, the site manager must comply with both administrative and substantive elements of the RCRA generator requirements of 40 CFR Part 262 and LDR notification and certification requirements of Part 268. (For example, a site manager must prepare an LDR notification and certification when restricted wastes are sent off site to a land disposal facility.) These standards include requirements such as manifests for shipping waste that list all hazardous waste listings and characteristics applicable to the waste (see 40 CFR 262.11), packaging and transport requirements, and recordkeeping requirements.

If the LDRs are applicable, the following information should be collected and available before the removal of wastes to an off-site disposal facility: EPA hazardous waste number, LDR treatment

Highlight 2:
EXAMPLES OF RCRA TECHNICAL STORAGE REQUIREMENTS*

RCRA storage requirements, applicable to both less-than-90-days generators and permitted or interim status storage facilities, may include the following substantive requirements:

Containers 40 CFR 264 Subpart I and 265 Subpart I

- Containers must be in good condition
- Wastes must be compatible with container
- Container must be closed during storage
- Container storage areas must have a containment system that can contain 10 percent of the volume of containers or of the largest container
- Spilled or leaked waste must be removed from the collection area as necessary to prevent overflow

Tanks 40 CFR 264 Subpart J and 265 Subpart J

- Tanks must have a secondary containment system that includes a liner, a vault, a double-walled tank, or an equivalent device (applies only to certain tanks)

Waste Piles 40 CFR 264 Subpart L and 265 Subpart L

- Waste piles must have a liner and a leachate collection and removal system
- Owners/operators must have a run-on control system to prevent flow onto the active portion of the pile during peak discharge from at least a 25-year storm
- Owners/operators must have a run-off management system to collect and control at least the water volume resulting from a 24-hour, 25-year storm

- This is a partial list of substantive requirements. For more detail, see 40 CFR Part 264 and 265.

standards, manifest number for the waste shipment, and waste analysis data.

- Underground Injection Control (UIC) Program

Under the UIC regulations, RCRA hazardous wastes may be injected into Class I permitted wells. In some cases, hazardous liquids, such as extracted ground water from pump and treat operations, may be injected into a Class IV UIC well. For example, ground water contaminated with RCRA hazardous wastes may be injected into Class IV permitted wells if it is part of a CERCLA response action or a RCRA corrective action and if it has been treated to "substantially reduce hazardous constituents prior to such injection..." (RCRA § 3020(b)). (See Applicability of Land Disposal Restrictions to RCRA and CERCLA Ground Water Treatment Reinjection, OSWER Directive #9234,1-06, December 1989.)

- Non-RCRA Hazardous Wastes

Some non-RCRA hazardous waste may be subject to management requirements under Subtitle D of RCRA as solid wastes. Subtitle D regulates disposal of solid waste in facilities such as municipal landfills. Therefore, non-RCRA hazardous IDW, such as decontaminated PPE or equipment, may need to be disposed of in a Subtitle D facility (depending on State requirements).

Clean Water Act (CWA). Discharges of aqueous IDW to surface water and publicly owned treatment works (POTWs) may be required to comply with CWA Federal, State, and local requirements. Requirements to be met may include water quality criteria, pretreatment standards, State water quality standards, and NPDES permit conditions. Direct discharges to on-site waters are subject only to substantive requirements, while discharges to POTWs and other off-site discharges must comply with both substantive and administrative CWA requirements (including permitting requirements). (See Guide to Discharging CERCLA Aqueous Wastes to POTWs, June 1991 and CERCLA Compliance with the CWA and SDWA, #9234.2-06FS, January 1991.)

Toxic Substances Control Act (TSCA). If IDW contains PCBs, TSCA treatment and/or disposal requirements may apply during its management. TSCA requirements regulate the disposal of material contaminated with PCBs at concentrations of 50 ppm or greater as found on site (i.e., based on sample analysis and not the PCB concentration of the source material {e.g., transformer fluid}). (See PCB Guidance Manual, EPA/540/G-90/007, August 1990.) In addition, TSCA storage requirements may apply that limit the time that PCBs may be stored to one year. Furthermore, if PCB materials are mixed with a RCRA hazardous waste, they may be regulated by the LDR California list prohibitions. (See RCRA sections 3004(d)(2)(D) and (E).)

Department of Transportation (DOT) requirements. Where IDW will be disposed of off site or transported on public roads to a site, DOT requirements for containerizing, labeling, and transporting hazardous materials and substances may apply.

State requirements. Promulgated State regulations that are legally enforceable, timely identified, and more stringent than Federal regulations may be potential ARARs for IDW managed on site. Substantive requirements of State law that may be ARARs for IDW management include State water quality standards, direct discharge limits, and RCRA requirements (including underground injection control regulations) promulgated in a State with an authorized RCRA hazardous waste management program (as well as programs authorized by State laws). Off-site, substantive and administrative requirements of State law may apply.

Off-Site Policy. In addition to complying with requirements of Federal and State laws, all off-site disposal of wastes must comply with CERCLA section 121(d)(3) and the CERCLA Off-Site Policy (OSWER Directive No. 9834.11 (November 13, 1987)). The Off-Site Policy establishes criteria for selecting an appropriate treatment, storage, or disposal facility (TSDF), including release criteria for all facilities that receive wastes from CERCLA-authorized or funded response actions. In addition, receiving facilities must be in compliance with all "applicable laws."

Before shipping wastes off site, approval should be obtained for the proposed disposal facility from EPA's Regional Off-Site Policy Coordinator. In addition, EPA has adopted a policy for Superfund wastes shipped out of State that written notification should be provided to receiving States (OSWER Directive 9330.2-07, September 14, 1989).

GENERAL OBJECTIVES FOR IDW MANAGEMENT

In addition to the two requirements of protectiveness and compliance with ARARs to the extent practicable (on site) or compliance with applicable law (off site), EPA has identified two general objectives that Superfund site managers should consider when managing IDW: (1) minimization of IDW generation; and (2) management of IDW consistent with the final remedy for the site. The extent to which these objectives can be achieved is highly dependent on site-specific circumstances.

IDW Minimization

Site managers should strive to minimize the generation of IDW to reduce the need for special storage or disposal requirements that may result in substantial additional costs yet provide little or no reduction in site risks relative to the final remedial action. Generation of IDW can be minimized through proper planning of all remedial activities that may generate IDW, as well as through use of screening information from the site inspection. The potential problems of managing IDW should be a factor in choosing an investigative method. Site managers may wish to consider techniques such as replacing solvent-based cleaners with aqueous-based cleaners for decontamination of equipment, reuse of equipment (where it can be decontaminated), limitation of traffic between clean and hot zones, and drilling methods and sampling techniques that generate little waste. Examples of such techniques include using gridding techniques to minimize the number of test pits or using soil borings instead of test pits. Alternative drilling and subsurface sampling methods may include the use of small diameter boreholes, as well as borehole testing methods such as a core penetrometer instead of coring. Site managers should also be careful to keep hazardous wastes separate from nonhazardous wastes.

Management Consistent with Final Remedy

Most IDW (with the exception of non-indigenous IDW) generated during the course of an investigation are intrinsic elements of the site. If possible, IDW should be considered part of the site and should be managed with other wastes from the site, consistent with the final remedy. This will avoid the need for separate treatment and/or disposal arrangements.

Because early planning or IDW management can prevent unnecessary costs and the use of treatment or disposal capacity, IDW management should be considered as early as possible during the remedial process. A key decision to be made is whether the waste will best be treated/disposed of immediately or addressed with the final remedy. If addressed with the final remedy, IDW volumes should be considered in the FS. In addition, when IDW is stored on site, it should be managed as part of the first remedial action/operable unit that addresses the affected media.

SELECTION OF IDW DISPOSAL OPTIONS

The following sections present the Agency's presumptions for IDW management that have been established based on the above considerations. The actual option selected should be based upon best professional judgment and should take into account the following factors:

- The type and quantity of IDW generated (sludge/soil, aqueous liquid, non-indigenous IDW);
- Risk posed by managing the IDW on site (e.g., based on site access controls, contaminant concentrations);
- Compliance with ARARs, to the extent practicable (on site);
- IDW minimization; and
- Whether the final remedy is anticipated to be an off-site or on-site remedy (or this information is unknown) and whether IDW can be managed consistent with the final remedy.

Off-site Final Remedies

If a site manager believes that the final remedy will involve off-site disposal of wastes, EPA's presumption is to manage the IDW as part of the remedial action addressing the waste/medium. Thus, until the final action, the IDW may be stored (e.g., drummed, covered waste pile) or returned to its source. However, the management option selected should also take into account any protectiveness concerns, ARARs, and other relevant site-specific factors (e.g., weather, storage space, and public concern/perceptions).

There are several potential reasons why it may be advisable to store IDW until the final action. First, because wastes at the site will be shipped off site eventually, returning IDW (especially sludges and soil) to its source would require that it be excavated again. Thus, site managers may consider it practical to containerize IDW as soon as it is generated. Second, storing IDW in containers may be more protective than returning it to its source. Third, because off-site actions may trigger such requirements as the LDRs, temporary storage will eliminate the need to meet these additional requirements until the final remedy.

In some cases, circumstances may lead site managers to choose to return the IDW to its source. This may be appropriate if it is determined that returning IDW to the source is protective and that storage at the site is not possible or practicable (i.e., given State or community concerns). In other cases, long-term storage may not be protective, and immediate off-site disposal may be a better option.

Examples: A site involves volatile organic RCRA hazardous wastes that will likely be sent off site for final treatment and disposal. Site conditions are such that temporary storage of IDW is considered protective until the remedial action begins. Because off-site disposal will trigger RCRA disposal requirements such as the LDRs and immediate containerization would be more protective than redepositing into the source area at the time of sampling, the site manager decides to containerize the IDW (and comply with RCRA substantive technical tank and container standards) until the final action is initiated.

On-site Final Remedies (or Final Management is as Unknown Location)

When final management of wastes is likely to occur on site, the management presumptions vary depending on the type of IDW produced.

Sludge/soil

Generally, the Agency expects sludge or soil IDW will be returned to its source if short-term protectiveness is not an issue. The reason behind this presumption is that IDW that may pose a risk to human health and the environment in the long term will be addressed by the final action. Storage of RCRA hazardous IDW in containers with the AOC prior to returning it to the source will not trigger the LDRs, as long as the containers are not managed in such a way as to constitute a RCRA storage unit as defined in 40 CFR 260.10. Therefore, it may be possible to store IDW temporarily before redisposing of it. However, EPA believes that, in many cases, returning sludges and soils to their source immediately will be protective and will avoid potentially increased costs and requirements associated with storage. Site-specific decisions on how to manage sludge and soil IDW may ultimately vary from the presumption based on protectiveness, ARARs, and/or community concerns.

Example 1: The soil at a site contains wastes that are expected to be stabilized on site during the final remedial action. The site manager determines that sending soil IDW off site is not cost-effective, because off-site disposal would involve testing and transport costs for a relatively small amount of waste. Instead, knowing that the site is secured and that redisposing the waste at the source will not increase site risk or violate ARARs, the site manager decides to return soil IDW to the source area from which it originated.

Example 2: A site manager determines that returning highly contaminated PCB wastes to the ground at a site is not protective because of the potential risks associated with the material; instead, the site manager chooses to drum the waste and send it off site (in compliance with TSCA). (Off-site disposal may occur immediately or at a later date.)

Example 3: Soil IDW contaminated with a RCRA hazardous waste is generated from a soil boring. The site manager decides to put the IDW back into the borehole immediately after generation, but ensures that site risks will not be increased (e.g., the contaminated soil will not be replaced at a greater depth than where it was originally so that it will not contaminate "clean" areas) and that the contamination will be addressed in the final remedy.

Aqueous liquids

EPA has not established a presumption for the management of aqueous liquid IDW (e.g., ground water). Site managers should determine the most appropriate disposal option for aqueous liquids on a site-specific basis. Parameters to consider, especially in making the protectiveness decision, include the volume of IDW, the contaminants present in the ground water, the presence of contaminants in the soil at the site, whether the ground or surface water is a drinking water supply, and whether the ground-water plume is contained or moving. Special disposal/handling may be needed for drilling fluids because they may contain significant solid components. Examples of aqueous liquid management decisions considering these factors are presented in the following box.

Example 1: A site manager has large volumes of ground water IDW and does not know if it is contaminated. Pouring this IDW on the ground would not be protective, because it may contaminate previously uncontaminated soil or may mobilize contaminants that are present in the soil. Therefore, the site manager stores the water in a mobile tank until a determination is made as to whether the water and soil are contaminated or until the final action.

Example 2: IDW is generated from the sampling of background, upgradient wells. Because there are no community concerns or evidence of any soil contamination from other sources, the site manager decides to pour this presumably uncontaminated IDW on the ground around the well.

Example 3: Purge water from a deep aquifer is known to be contaminated with a RCRA hazardous waste. At this site, if this water were poured on the ground, it could contaminate a previously uncontaminated shallow aquifer that is a potential drinking water source and would have to comply with the LDRs. The site manager decides to containerize the water within the AOC and store it until the final remedy.

Non-indigenous IDW

Non-indigenous IDW (e.g., sampling materials, disposable PPE, decontamination fluids) should be stored until the final remedy or disposed of immediately. If contaminated, such waste may not be disposed of onto the ground because such an action would add contamination that was not present when activities began at the site (e.g., solvents used for decontamination). If non-indigenous IDW is contaminated with RCRA hazardous waste, it must be managed in accordance with RCRA Subtitle C requirements. Otherwise, site managers may generally dispose of it in an on-site dumpster (for PPE).

Example 1: Disposable PPE (e.g., gloves, shoe covers) becomes contaminated with RCRA hazardous waste during the field investigation. The site manager containerizes and disposes of this IDW in compliance with RCRA Subtitle C requirements.

Example 2: Disposable equipment becomes contaminated during a field investigation. The site manager decontaminates them and sends them to a Subtitle D facility.

COMMUNITY CONCERNS

Residents of communities near a CERCLA site, local governments, or States may have concerns about certain disposal methods or long-term storage of IDW at the site. As with all CERCLA activities, site managers should evaluate community concerns regarding disposal of IDW in deciding what action to take. For example, if a community is concerned about the direct discharge of IDW water to surface water on site, site managers may want to consider sending the water to a POTW, if one is located nearby. In some instances, it may be appropriate to prepare fact sheets, include options in other community relations documents, or explain IDW management decisions at public meetings prior to actions.

NOTICE: The policies set out in this memorandum are not final agency action, but are intended solely as guidance. They are not intended, nor can they be relied upon, to create any rights enforceable by any party in litigation with the United States. EPA officials may decide to follow the guidance provided in this memorandum, or to act at variance with the guidance, based on an analysis of specific site circumstances. The Agency also reserves the right to change this guidance any time without public notice.

Section 19: Air Monitoring Program

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Section 19: Air Monitoring Program

1.0 Overview

Air monitoring is conducted to help verify that the level of protection selected is appropriate for different phases of the field operations for sites containing or suspected to contain hazardous substances. Real-time air monitoring using direct reading instruments is conducted based on the nature of site activities. Consideration for real-time air monitoring should be conducted when:

- Hazardous waste site remediation begins
- Hazardous waste operations change
- Work begins on a different portion of the site
- Any intrusive site activity begins on sites containing or suspected to contain hazardous substances
- Contaminants other than those previously identified are being handled
- When obviously contaminated materials, leaking drums or containers are handled

Air monitoring efforts are focused on those Barr employees conducting tasks representative of potential maximum exposure and on all employees likely to be exposed to any substance above the OSHA-Permissible Exposure Limit (PEL) or other published exposure level.

2.0 Monitoring Procedures

Two types of air monitoring are conducted, real-time and personal exposure monitoring. Real-time monitoring provides instant readout and is conducted for on-site screening for exposures to airborne levels of hazardous substances to determine the appropriate level of employee protection. Personal exposure monitoring involves collecting a sample for subsequent analysis and is conducted to quantify specific airborne concentrations of hazardous substances.

Monitoring is primarily conducted in the breathing zone. Monitoring also may be conducted at the source of potential contamination or at the point of intrusive activity. The breathing zone is an area within a 2-foot radius around the head. Information obtained from air monitoring is used to assure proper selection of engineering controls, personal protective levels, work zones, work practices, and to assure compliance with OSHA PELs and other published exposure levels.

The results of all real-time air monitoring will be recorded as specified in the PHASP. Real-time air monitoring results will be recorded and maintained in the Barr Project Field or Safety Diary or on the Daily Safety Record Form (PHASP, Form 3-1). These records will be stored with the Project Files.

3.0 Initial Entry

Prior to initial entry, a site history is obtained to determine potential contaminants that may be encountered and to assist in personal protective equipment and air monitoring equipment selection. During initial entry, real-time instruments may be used to monitor for those IDLH conditions that could potentially be encountered such as toxic, explosive, combustible and oxygen deficient atmospheres. When the site history indicates that ionizing radiation is suspected to be present, real-time instrumentation for determining levels of radiation are used, along with TLD badges to confirm personnel exposure. Additionally, visual observations are made continuously during the initial entry so that actual or potential IDLH conditions or other dangerous conditions can be noted for present and future use.

4.0 Site Characterization

During site characterization, real-time monitoring is conducted where there is a reasonable possibility for exposure. Real-time monitoring is continued if the possibility of an IDLH or flammable atmosphere condition exists, or if there is an indication, based on initial entry monitoring, that exposures may approach action levels determined in the PHASP. Additionally, personal exposure monitoring is conducted when there is no suitable real-time instrument to monitor airborne levels of any of the hazardous substances anticipated.

During site characterization, periodic monitoring is conducted when:

- Intrusive activities are conducted
- Work begins on a different portion of the site
- When hazardous substances other than those identified during initial entry are being handled

- A different type of operation is initiated
- When work is conducted in areas where hazardous substances are obviously present.

5.0 Site Remediation

Periodic real-time and/or personal exposure monitoring is conducted throughout the remedial investigation phase and during the actual site remediation phase of a hazardous waste operation, when soil, water, waste, or containers which contain or are suspected to contain hazardous substances are moved or disturbed. Personal exposure monitoring is conducted for Barr employees who are likely to have the highest exposures to hazardous substances. Personal exposure monitoring is also conducted when there is no suitable real-time instrument to monitor airborne levels of any of the hazardous substances anticipated.

The frequency of personal exposure monitoring will be sufficient to characterize employee exposure and to confirm selection of personal protective levels.

If the air monitoring results indicate airborne hazardous substances above the action levels established in the PHASP, the personal protective level will be upgraded to the indicated level and air monitoring continued. If the air monitoring results indicate that levels are below the action levels established in the PHASP, it may be determined that subsequent personal exposure monitoring is not required, and that the current personal employee protective level is sufficient to provide protection from potential exposure. Air monitoring results may be used to determine that personal employee protective level may be downgraded.

6.0 Monitoring Equipment

Equipment operation and information (in accordance with manufacturer’s recommended operating procedures) is provided later in this section. Real-time monitoring equipment available at Barr’s office are listed in TABLE S-1: TYPES OF REAL-TIME MONITORING EQUIPMENT.

Table 1 Types of Real-Time Monitoring Equipment

Combustible Gas Monitor:	MSA 260/360; MSA Microgard, Industrial Scientific MX 251, MX271
Oxygen Detection Monitor:	MSA 260/360; MSA Microgard, , Industrial Scientific MX 251, MX271
Carbon Monoxide Monitor:	MSA 360
Organic Vapor Analyzer: Photoionization Detectors: Flame-ionization Detectors:	Thermo Environmental OVM 580B; HNU PI-101 and DL-101 Foxboro OVA 128 and 108
Detector Tube Pump	Drager/Sensidyne Pump With Chemical Specific Detector Tubes
Hydrogen Sulfide Monitor:	Industrial Scientific; HS267
Sulfur Dioxide Monitor:	Industrial Scientific; SO261
Real-Time Dust Monitor:	MIE Miniram; PDM-3, PDR-1000
Noise Monitor	Quest 2700 SLM
Radiation Monitor	S.E. International Monitor 4
Heat Stress Monitor	RSS-214 WiBGeT

Personal exposure monitoring equipment consists of a calibrated portable Gillian/SKC air sample pump and compound specific filters/adsorbent tubes that are available from the Industrial Hygiene staff. Personal exposure monitoring for organic vapor may be performed through the use of a 3M 3500 or 3520 (with backup) organic vapor passive dosimeter monitor When necessary, Barr field employees are issued a thermoluminescent dosimeter (TLD) badge that measures ionizing radiation exposure.

7.0 Exposure Monitoring Equipment

SKC-Gillian high and low flow pumps are used to collect personal/area exposure samples. TABLE S-2: SAMPLE PROTOCOLS lists the types of exposure samples, which may be collected on site, and a brief overview of sample/analysis procedures. Sampling procedures for the specific contaminants of concern will be provided by the Project Health and Safety Contact or other representative of the health and safety staff.

Table 2 Sample Protocols

Compound Sampled	Sample/ Analytical Procedure	Sample Media	Flow Rate (L/Min.)	Max. Vol. (L)	Sample Duration (Hrs.)
BETX1	NIOSH 1501	Charcoal tube (series)*	0.05	24	7 to 8
CTPVs2	OSHA 58	GF4 Filter	2.0	960	7 to 8
Total Dust (Nuisance)	NIOSH 0500	PVC5 Filter	2	133	7 to 8
Metals: Pb, As, Cd & Cr	NIOSH 7300	MCEF6 Filter	2	2,000	7 to 8
Phenol	OSHA 32	XAD-7 Tube	0.05	24	4
Naphthalene	NIOSH 1501	Charcoal Tube	0.5	200	7 to 8
Pentachlorophenol	OSHA 39	XAD-7 Tube (treated)	0.1	48	4
PCBs3	NIOSH 5503	Florisil Tube	0.1	50	7 to 8
BETX1 & Naphthalene	NIOSH 1501	3M 3500 Badge	Diffusion	NA	8 to 10

[1] Benzene, ethyl benzene, toluene & xylene
[2] Coal tar pitch volatiles
[3] Polychlorobiphenyls
[4] Glass Fiber
[5] Polyvinyl chloride
[6] Mixed cellulose ester filter

* Note: Sample 2 tubes in series. Analyze first tube (both sections) together and front section of second tube. If detected, analyze back section of second tube.

8.0 Air Monitoring Instrument Guidelines

8.1 Volatile Organic Compound (VOC) Monitoring

Volatile organic compound monitoring may be required when:

- Volatile organic compounds are known or suspected to be present and previous monitoring has not been performed or has indicated VOC concentrations above background.

- An intrusive activity will be conducted where there is a reasonable possibility for inhalation exposure which may exceed a workplace exposure standard or IDLH concentrations.

- Periodic Monitoring Frequency:
    - Unusual or unidentified new odors are encountered.
    - Discolored soils are encountered.

VOC detection is accomplished through either photoionization or flame ionization.

Principle of Photoionization

The Photoionization Detector (PID) consists of an ultraviolet lamp and an ion chamber. The PID measures the concentration of gases present in a sample using photoionization. Photoionization occurs when a molecule absorbs a photon (light energy) of sufficient energy to cause an electron to leave its orbital and create a positive ion:

$$\mathrm{RH} + \mathrm{hv} \rightarrow \mathrm{RH}^{+} + \mathrm{c}^{-}$$

in which

RH = molecule of the species to be ionized
hv = photon with an energy level equal to or greater than the ionization potential of RH
RH^{+} = positive ion of the species ionized
c^{-} = free electron

The ionization potential of a molecule is that energy in electron volts (eV) required to free an electron from the molecule. The amount of ionization occurring, and thus the input signal to the amplifier, is proportional to the amount of gas in the ion chamber and to the ionization sensitivity of that gas.

Attributes:

High Sensitivity to aromatics, unsaturated hydrocarbons and chlorinated hydrocarbons.

Ability to measure some inorganic gases.

Works well in colder weather (14°F and above).

Fast response – 90% full scale in three seconds.

Variety of lamps available make pinpointing compounds easier.

Simple to operate.

Limitations:

Does not respond to methane.

High humidity and condensation can drastically impair readings.

Decreased sensitivity to toluene and gasoline in the presence of methane.

Does not respond to compounds that have a higher ionization potential than the energy of lamp.

Electrical power lines or power transformers may cause interference.

Instruments Available:

- Hnu PI-101 w/10.2eV lamp (analog)
- Hnu DL-101 w/10.2 or 11.7 eV lamp (digital)
- TEC 580B w/10.6 eV lamp (digital)

Principle of Flame Ionization

A Flame Ionization Detector (FID) measures organic compounds by utilizing flame produced by the combustion of hydrogen and air. When hydrocarbons in the sample are introduced to the detection zone, ions are produced by the following reaction:

$$\mathrm{RH} + \mathrm{O} \rightarrow \mathrm{RHO}^{+} + \mathrm{e}^{-} \rightarrow \mathrm{H_2O} + \mathrm{CO_2}$$

where

R = carbon compound

A collector electrode with a polarizing voltage is also located within the detector chamber, and the ions produced by this reaction are attracted to it. As the ions migrate towards the collector, a current is produced which is directly proportional to the concentration of hydrocarbons introduced to the flame. this current is then amplified and sent to a microprocessor and/or analog readout device.

Attributes:	**Limitations:**
Responds to all volatile organic including methane.	May indicate higher concentrations than what actually exist.
Responses to all non-halogenated hydrocarbons.	Does not function reliably in cold weather (below 50°F).
Will operate reliably in high humidity.	Requires a minimum of 10 to 13% of oxygen to support combustion of flame.
Fast response – two seconds for 90% of final reading.	A supply of hydrogen is required for extended operation.
Charcoal probe tip screens all but methane.	Operation procedure is complex.

Instruments available:

- Foxboro OVA108 (0 – 10,000 ppm)
- Foxboro OVA128 (0 – 1,000 ppm)

8.2 Combustible Gas Monitoring

Combustible gas monitoring may be required when:

- Confined space entry.
- Excavation/trench entry.
- Intrusive activity at a landfill, intrusive activity when nature of hazardous substances present at site is unknown, and any intrusive activity when combustible gas may potentially have accumulated.
- Periodic Monitoring Frequency:
    - The organic vapor monitor registers sustained readings above action level.
    - Intrusive activity when combustible gases may potentially have accumulated.
    - The potential exists for a combustible atmosphere to develop.

8.3 Particulate (aerosol) Monitoring

Particulate (aerosol) monitoring may be required when:

- Hazardous substances are present at the ground surface and may become airborne as dust containing or suspected to contain hazardous substances.
- An intrusive activity will be conducted where there is a reasonable possibility for skin absorption, skin irritation, or eye irritation from airborne dust containing or suspected to contain hazardous substances.
- An intrusive activity will be conducted where there is a reasonable possibility for exposure to particulates which may exceed a workplace exposure standard or IDLH concentrations.
- Periodic Monitoring Frequency:
    - Large area(s) of material (soil) known or suspected to contain hazardous substances may become airborne from excavating trenching activities.
    - The potential exists for CTPVs to become airborne.

8.4 Detector Tubes

Detector tubes may be required when:

- Total organic vapor readout is equal to or exceeds the action limit for a 10-minute duration.
- An upgrade to Level C should be made until the VOCs of concern can be characterized with detector tubes, which may be used if outside temperature is 50°F or greater.
- If temperature is less than 50°F, the detector tubes become unreliable and should not be used to characterize VOCs.

9.0 Action Level Determination

A standard action level has been determined to protect against over exposure to organic vapors and airborne dust containing hazardous substances.

9.1 Organic Vapors

An action level of 2.5 ppm total organic vapors for 10 minutes is generally considered adequate to maintain exposure levels lower than 50 percent of most TLVs, PELs or STELs (including benzene) of hazardous substances, whether monitoring with the HNU, OVA, or OVM. The specific action level for site operations is described in the PHASP.

9.2 Combustible Gases

An action level of 10 percent of the Lower Explosive Limit (LEL) is generally considered to be protective for exposure to a flammable atmosphere.

9.3 Total Dust

An action level of 5 mg/m^3 total dust (50 percent of nuisance dust TLV) will generally be more conservative than an action level determined for specific particulate compounds.

To determine if 5 mg/m^3 total dust is protective enough for the hazardous substance of concern, follow the procedure provided below:

1. Multiply the known fraction of the hazardous substance in the soil by the action level for total dust to determine what the airborne concentration of the hazardous substance would be at the

dust action level assuming that all dust generated contains hazardous substances at that concentration. Compare with 50 percent of the TLV, PEL, or STEL (whichever is lowest). If the airborne concentration is lower, the action limit should remain 5 mg/m^3.

Example:

The PEL for lead is 0.05 mg/m^3. Fifty percent of the PEL is 0.025 mg/m^3. If the concentration of the lead in the soil is 1,000 mg/kg (or ppm):

$$\frac{1000\text{ mg Pb}}{10^6\text{ mg soil}} \text{ x } \frac{5\text{ mg soil}}{\text{m}^3\text{ air}} = \frac{0.005\text{ mg Pb}}{\text{m}^3\text{ air}}$$

A comparison of 0.005 mg/m^3 airborne lead at the dust action level with the action level for lead (0.025 mg/m^3) shows that the dust action level is protective to prevent lead exposure for soil containing 1,000 mg/kg of lead.

2. Alternatively, to determine a soil concentration of concern (i.e., the concentration corresponding with the hazardous substance’s action level), divide the hazardous substance action level by the dust action level to determine the concentration of hazardous substance required in the soil to reach the action level.

Example:

$$0.025\,\frac{\text{mg Pb}}{\text{m}^3\text{ air}} \text{ x } \frac{\text{m}^3\text{ air}}{5\text{ mg soil}} = \frac{0.025\text{ mg Pb}}{5\text{ mg soil}} = 5000\,\frac{\text{mg Pb}}{\text{kg soil}}$$

9.4 Coal Tar Pitch Volatiles

Polycyclic aromatic hydrocarbons (PAHs) are not highly volatile and, therefore, cannot be readily measured using an organic vapor indicator. During excavation activities, Barr monitors airborne PAHs as particulates using a Miniram aerosol monitor and uses this data to determine potential for exposure to coal tar pitch volatiles.

PAHs do not have a TLV or PEL. The TLV for coal tar pitch volatiles (CTPV) is 0.2 mg/m^3. Barr used this TLV to calculate the action level for airborne dust which may contain PAHs as a representative measure for airborne coal tar pitch volatiles.

According to the Gas Engineers Handbook (1966, p. 3/17), coal tar consists of approximately 33 percent PAHs, 62 percent coal tar pitch, and five percent volatile organic compounds. Ignoring the five percent volatile fraction, the remaining 95 percent coal tar constituents were used for the following calculations.

1. Total maximum PAH concentration measured at the site: Assume 1,000 mg PAH/106 mg soil.

2. Presenting PAHs in terms of coal tar concentrations:

$$\frac{1000\text{ mg PAH}}{\text{kg}} \text{ x } \frac{0.95\text{ Coal Tar}}{0.33\text{ PAH}} = \frac{2879\text{ mg}}{\text{kg}}\text{ Coal Tar}$$

3. Normalizing for coal tar pitch constituents:

$$\frac{2879\text{ mg coal tar}}{\text{kg}} \text{ x } \frac{62\%\text{ coal tar pitch}}{\text{coal tar}} = \frac{1785\text{ mg}}{\text{kg}}\text{ coal tar pitch}$$

4. Using Barr’s typical dust action level of 5 mg/ m3:

$$\frac{1785\text{ mg Coal Tar Pitch}}{10^6\text{ mg soil}} \text{ x } \frac{5\text{ mg soil}}{\text{m}^3\text{ air}} = \frac{0.009\text{ mg Coal Tar Pitch}}{\text{m}^3\text{ air}}$$

5. Since total dust can be measured using the Miniram Aerosol Monitor and an action level of 5 mg/m3 total dust is protective for coal tar pitch volatiles which are attached to dust particles, this monitor can be used to screen for real-time exposure to coal tar pitch volatiles with an action level for 5 mg/m3 total dust.

10.0 General Maintenance and Calibration Information

The Equipment Coordinator is responsible for calibrating air monitoring instruments on a weekly and as-needed basis and for training Barr employees on the operation and use of all monitoring equipment. It is the responsibility of the Project Health and Safety Team Leader or other user to check each piece of air monitoring equipment necessary for the project before removing it from the safety equipment room. On-site, daily calibration is the responsibility of the Project Health and Safety Team Leader and documentation of this calibration on-site (Project Field or Safety Diary or Daily Safety Record Form, PHASP, Form 3-1). It is each user’s responsibility to notify an

Equipment Maintenance Technician if an instrument fails to operate in the field, or if it needs repair or replacement parts.

Equipment maintenance and calibration records for air monitoring equipment are kept at Barr's office and are maintained by an Equipment Coordinator. Any equipment that does not function appropriately is taken out of service and is made unavailable to Barr employees until the repair is made. Air monitoring equipment used on site is calibrated daily, or before each use if used less than daily. Calibration logs are to be kept in the Project Field or Safety Diary or on the Daily Safety Report form. Instruction on calibration may be obtained from the Equipment Coordinator.

It is each user’s responsibility to be sure that all air monitoring equipment used in the field is appropriately decontaminated in the field prior to leaving the project site. Equipment decontamination procedures are described in the PHASP.

11.0 Equipment Operation

The following discussion will describe manufacturer's information on the operation and limitations of instruments listed in TABLE S-1: TYPES OF REAL-TIME MONITORING EQUIPMENT. It should be noted that some of the monitoring equipment is affected by low oxygen levels and may not operate or readout accurately. Temperature use limitations also vary for the equipment. These particular limitations are listed in the specific discussions on each instrument.

11.1 HNU PI-101 Photoionization Detector (PID)

The PI-101 is a portable instrument used to detect, measure, and provide a direct reading of the concentration of a variety of trace gases. PI-101 DOES NOT detect methane. The instrument measures the concentration of trace gases present in the atmosphere by photoionization.

PI-101 Specifications

Range Settings	0 to 20, 200, 2,000 ppm
Lamp Rating	10.2 eV standard, 9.5 or 11.7 eV optional
Detection Range*	0.1 to 2,000 ppm
Minimum Detection Level*	0.1 ppm
Calibration	Isobutylene as a benzene reference
Maximum Sensitivity*	0 to 20 ppm full-scale deflection at SPAN = 9.8 (full scale deflection) 0 to 2 ppm full-scale deflection at SPAN = 0.0
Repeatability*	±1% of full-scale deflection
Linear Range*	0.1 to 400 ppm

Useful Range*	0.1 to 2,000 ppm
Response Time	Less than 5 seconds to 90% of full-scale deflection
Ambient Humidity	Up to 90% RH, noncondensing
Ambient Operating Temperature	14° to 104°F
Operating Time on Battery, continuous use	Approximately 10 hours; at lower temperatures time is reduced due to effect of cold temperature on battery
Recharge Time from Full Discharge	Full recharge - 12 to 14 hours
Dimensions	8.25 x 5.25 x 6.5 inches (readout assembly)
Weight	7 pounds (readout assembly)

NOTE: * When equipped with 10.2 eV Probe with SPAN set at 9.8 and measuring benzene. Values will vary for other compounds and conditions.

Operating guidelines:

- Check calibration on a daily basis, or before each use.
- Allow the instrument to stabilize at the temperature of use.
- Check operation of lamp with span gas or a magic marker. Avoid looking directly at lamp.
- Avoid damp or wet operating conditions.
- Do not allow water droplets or liquid on or into sample probe tip.
- To attach the probe to the readout unit, match the alignment key, then twist the connector clockwise until a distinct locking is felt.
- Make sure span control is set to 9.8 for 10.2 eV probe, benzene calibration.

*See PI-101 manual for specific operating instructions.

11.2 DL-101 Photoionization Detector (PID)

The microprocessor-based DL-101 is a portable photoionization analyzer which detects and provides a direct reading of a variety of ionizable gases. DL-101 DOES NOT detect methane. Data may be automatically stored in the field and later downloaded to a printer/PC or recalled to the LCD display. The DL-101 features a patented ion chamber that provides electronic zero eliminating the need for zero gas, and offers low-end sensitivity. Datalogging provides data storage for up to 255 sites. The control module is equipped with rechargeable batteries providing 8 hours of operation.

DL-101 Specifications

Certification	For use in Class I, Division II, Groups A, B, C, D Hazardous Locations
Lamp Rating	10.2 eV standard, 9.5 or 11.7 eV optional
Range*	0.1 to 2000 ppm
Linear Range*	0.1 to 400 ppm
Detection Limit	0.1 ppm

Calibration	Isobutylene as a benzene reference
Repeatability*	± 1%
Response Time	< 3 seconds to 90% response
Inlet Flow	225 cc/min
Ambient Operating Temperature	To 104°F (temperature compensated so that a 68°F change in temperature corresponds in reading of <±2% full scale at maximum sensitivity)
Ambient Humidity	To 95% RH, noncondensing
Calibration	Benzene referred default plus 11 user defined calibrations
Operating Time on Battery, continuous use	> 8 hours continuous use at 74°F approximately 6.4 hours at 32°F
Recharge Time from Full Discharge	12 to 14 hours
Recorder Output	2 V ± 3% at 2000 ppm
Dimensions	Probe (8 in. x 3 in.) Readout module (8 x 3 x 6 in.) Cable (36 in.)
Weight	Probe (3 lbs.) Readout module (4 lbs.) Total weight (7 lbs.)

NOTE: * When equipped with 10.2 eV lamp and measuring benzene. Values vary for other compounds, conditions, and lamp used. Use of multipoint calibration can increase the linear range.

Operating guidelines:

- Check calibration on a daily basis or before each use.
- Avoid wet operating conditions.
- Allow instrument to stabilize at the temperature of use.
- Do not allow a vacuum or flow restriction to be created, as this may reduce response.
- Do not allow water droplets or liquid on or into sample probe tip.

* See DL-101 manual for specific operating instructions.

11.3 Thermo Environmental Instruments 580B (PID)

The Model 580B organic vapor meter is a quantitative instrument that makes use of the photoionization detection system using a lamp with an ionization energy of 10.6 eV which is standard in the Model 580B. Microprocessor based, the 580B provides maximum signal hold, signal linearization, and over-range lockout. The 580B has the capability of logging 700 data points plus recording location, date, and time of each point with an operating range of 0 to 2,000 ppm with a minimum detectable level of 0.1 ppm. 580B DOES NOT detect methane.

580B Specifications

Certification	**For use in Class I, Division I and II, Groups A, B, C, D, hazardous locations**
Lamp Rating	**10.6 eV standard, 11.8 eV optional**
Ranges	**0 to 200 ppm, resolution to 0.1 ppm; 200 to 2,000 ppm, resolution to 1 ppm**
Linear Range	**0.1 to 2,000 ppm**
Detection Limit	**0.1 ppm**
Response Time	**2 seconds**
Inlet Flow	**500 cc/min**
Ambient Operating Temperature	**32º to 104ºF**
Ambient Humidity	**0 to 95% RH, noncondensing**
Calibration	**Isobutylene as a benzene reference**
Operating Time	**8 to 10 hours (73°F)**
Charging Time	**12 to 14 hours (completely discharged)**
Power Source	**Rechargeable lead acid battery (gel cell)**
Dimensions	**6.75 x 5.75 x 10.00 inches**
Weight	**6 pounds**

Operating guidelines:

- Check calibration on a daily basis, or before each use.
- Avoid wet operating conditions, instrument may appear water resistant, but is not.
- Allow instrument to stabilize at the temperature of use.
- Do not allow water droplets or liquid on or into sample probe tip.

*See 580B manual for specific operating instructions.

11.4 Foxboro OVA108 (FID)

The OVA 108 Analyzer is designed to detect and measure hazardous organic vapors and gases. It has broad application since it has a chemically resistant sampling system, and can be calibrated to almost all organic vapors. It can provide accurate indication of gas concentration from 1 to 10,000 ppm or 1 percent.

The instrument utilizes the principle of hydrogen flame ionization for detection and measurement of organic vapors. The instrument measures organic vapor concentration by producing a response to an unknown sample, which can be related to a gas of known composition to which the instrument has previously been calibrated. During normal survey mode operation, a continuous sample is drawn into the probe and transmitted to the detector chamber by an internal pump.

OVA108 Specifications

Certification	**For use in Class I, Groups A, B, C, D, Division I hazardous locations**
Range	**0 to 10,000 ppm (logarithmic)**
Detection Limit (Methane)	**0.2 ppm**
Response Time	**Approximately 2 seconds for 90% of final reading**
Alarm	**Flameout and adjustable detection alarm**
Inlet Flow	**Approximately 1 LPM**
Relative Humidity	**5 to 95%**
Operating Temperature Range	**50 to 104°F**
Minimum Ambient Temperature	**59°F for flame ignition (cold start)**
Calibration	**Methane**

Calibration Temperature	**Operating Temperature**	**Accuracy in % of Full Scale**
68 to 77°F	**50 to 104°F**	**" 20% 1 to 10,000 ppm**

Dimensions	**9 x 12 x 5 inches (side pack assembly)**
Weight	**12 pounds**
Service Life	**8 hours minimum, with fully charged battery 1,800 PSI of hydrogen**
Battery recharge	**14 hours minimum**

Operating guidelines:

- Check calibration daily or before use.
- Avoid use at temperatures below 50°F.
- Allow instrument to "warm up" 15 to 20 minutes after ignition before checking calibration or monitoring.
- Before monitoring, make sure calibration switch is off and alarm volume knob is turned up to indicate a flameout condition.
- At shutdown procedure, make sure instrument switch is off and both H2 tank and supply valves are turned off.
- Understand difference between regular and charcoal probe tips

* See OVA108 manual for specific operating instructions.

11.5 Foxboro OVA128 (FID)

The OVA 128 Analyzer is designed to detect and measure hazardous organic vapors and gases. It has broad application since it has a chemically resistant sampling system, and can be calibrated to almost all organic vapors. It can provide accurate indication of gas concentration from 1 to 1,000 ppm.

The instrument utilizes the principle of hydrogen flame ionization for detection and measurement of organic vapors. The instrument measures organic vapor concentration by producing a response to an unknown sample, which can be related to a gas of known composition to which the instrument has previously been calibrated. During normal survey mode operation, a continuous sample is drawn into the probe and transmitted to the detector chamber by an internal pump.

OVA128 Specifications

Certification	**For use in Class I, Groups A, B, C, D, Division I hazardous locations**	
Range	**0 - 10, 0 - 100, 0 - 1,000 ppm**	
Detection Limit (Methane)	**0.2 ppm (0 -10 range)**	
Response Time	**Approximately 2 seconds for 90% of final reading**	
Alarm	**Flameout and adjustable detection alarm**	
Inlet Flow	**Approximately 1 LPM**	
Relative Humidity	**5 to 95%**	
Operating Temperature Range	**50 to 104°F**	
Minimum Ambient Temperature	**59°F for flame ignition (cold start)**	
Calibration	**Methane**	
Calibration Temperature	**Operating Temperature**	**Accuracy in % of Full Scale**
68 to 77°F	**50 to 104°F**	**± 20% 1 to 10,000 ppm**
Dimensions	**9 x 12 x 5 inches (side pack assembly)**	
Weight	**12 pounds**	
Service Life	**8 hours minimum, with fully charged battery 1,800 PSI of hydrogen**	
Battery Recharge	**14 hours minimum**	

Operating guidelines:

- Check calibration daily or before use.
- Avoid use at temperatures below 50°F.
- Allow instrument to "warm up" 15 to 20 minutes after ignition before checking calibration or monitoring.
- Before monitoring, make sure calibration switch is off and alarm volume knob is turned up to indicate a flameout condition.
- At shutdown procedure, make sure instrument switch is off and both H2 tank and supply valves are turned off.
- Recognize difference between charcoal and regular probe tips.

* See OVA128 manual for specific operating instructions.

11.6 MSA260 Combustible Gas/Oxygen Indicator

The MSA 260 portable alarm is a continuously monitoring instrument for the detection of oxygen deficient or enriched and combustible atmospheres. Built-in, positive displacement pump enables user to monitor confined spaces before entry by use of 5-foot sample draw hose.

MSA 260 Specifications

Certification	**For use in Class I, Division I, Groups C and D hazardous locations**
Sensors	**Oxygen: electrochemical** **Combustible gas: catalytic**
Range	**Oxygen: 0 to 25%** **Combustible gas: 0 to 100%**
Accuracy	**Oxygen: + 0.3% at constant temperature and pressure** **Combustible gas: + 3% LEL**
Response Time	**Oxygen: 90% of final in 20 seconds at 32° to 104°F, 3 minutes at 0° to 32°F** **Combustible gas: 15 seconds at 32° to 104°F**
Ambient Operating Temperature	**Oxygen: 32° to 104°F normal, 0° to 104°F if calibrated at temperature of use** **Combustible gas: 0° to 104°F**
Humidity	**10 to 90% RH, noncondensing**
Power Source	**4.0 volt sealed lead acid rechargeable battery**
Battery Life	**8 to 10 hours, fully charged**
Dimensions	**10 x 7 x 3.75 inches**
Weight	**7.5 pounds**

Operating guidelines:

- Check calibration daily or before each use.
- Allow instrument to stabilize in fresh air at the temperature of use before "zeroing" or calibrating.
- Calibrate at temperature of use (if below 32ºF).
- Keep away from compounds containing silicon or leaded gasoline, as this will poison and seriously impair the response of this instrument. If unavoidable, use an inhibitor filter.
- Changes in atmospheric pressure will affect the oxygen sensor. Calibrate at elevation of use.

* See MSA260 manual for specific operating instructions.

11.7 MSA360 Combustible Gas/Oxygen/Carbon Monoxide Indicator

The Model 360 is a hand-carried, battery-operated instrument designed to sample atmospheres for oxygen, combustible gases, and carbon monoxide concentrations. Built-in, positive displacement pump enables user to monitor confined spaces before entry by use of 5-foot sample draw hose.

MSA 360 Specifications

Certification	**For use in Class I, Groups A, B, C, D, Division I hazardous locations**
Sensors	**Oxygen: electrochemical** **Combustible gas: catalytic** **Carbon monoxide: electrochemical**
Range	**Oxygen: 0 to 25%** **Combustible gas: 0 to 100% LEL** **Carbon monoxide: 0 to 500 ppm**
Accuracy	**Oxygen: + 0.3% at constant temperature and pressure** **Combustible gas: + 3% LEL** **Carbon monoxide: + 5% of reading at constant temperature and pressure**
Response Time	**(to 90% of full scale)** **Oxygen: 20 seconds at 32° to 104°F, 3 minutes at 0° to 32°F** **Combustible gas: 15 seconds at 32° to 104°F** **Carbon monoxide: 30 seconds at 32° to 104°F**
Ambient Operating Temperature	**Oxygen: 32° to 104°F (0° to 104°F if calibrated at temperature of use)** **Combustible gas: 0° to 104°F** **Carbon monoxide: 32° to 104°F**
Humidity	**10 to 90% RH, noncondensing**
Power Source	**4.0 volt sealed lead acid rechargeable battery**
Battery Life	**A minimum of 8 hours on a fully charged battery**
Dimensions	**10 x 7 x 3.75 inches**
Weight	**7.5 pounds**

Operating guidelines:

- Check calibration daily or before each use.
- Allow instrument to stabilize in fresh air at the temperature of use before "zeroing" or calibrating.
- Calibrate at temperature of use (if below 32ºF).
- Keep away from compounds containing silicon or leaded gasoline, as this will poison and seriously impair the response of this instrument. If unavoidable, use an inhibitor filter.
- Changes in atmospheric pressure will affect the oxygen and toxic gas sensors. Calibrate at elevation of use.

* See MSA360 manual for specific operating instructions.

11.8 MSA Microgard Combustible Gas/Oxygen Indicator

The Microgard portable alarm is a pocket-sized, diffusion-type instrument for simultaneously monitoring combustible gas and oxygen concentrations in atmospheres and confined spaces.

Microgard Specifications

Certification	**For use in Class I, Groups A, B, C, D Hazardous Locations**
Sensors	**Oxygen: electrochemical** **Combustible gas: catalytic**
Range	**Oxygen: 0 to 25%** **LEL: 0 to 100%**
Accuracy	**Oxygen: + 0.3% at constant temperature and atmospheric pressure, + 0.5% with temperature changes from calibration temperature over the range 32° to 104°F** **Combustible gas: + 3% LEL for 0 to 50% LEL and + 5% LEL for 50 to 100% LEL**
Response Time	**Oxygen: 90% of final reading in 10 seconds at 32° to 104°F, 90% of final reading in 3 minutes at 0°F** **Combustible gas: 90% of final reading in 8 seconds**
Ambient Operating Temperature	**Oxygen: 32° to 104°F normal, low limit is 0°F when calibrated at temperature of use** **Combustible gas: 32°F to 122°, low limit is 0°F when calibrated at temperature of use**
Humidity	**10 to 90% RH, noncondensing**
Power Source	**2.4 volt rechargeable nickel cadmium battery**
Battery Life	**8 to 10 hours continuous at ambient temperature, less than 8 hours at 32°F**
Dimensions	**5.75 x 2.75 x 1.30 inches**
Weight	**14.3 ounces**

Operating guidelines:

- Check calibration daily or before each use.
- Allow instrument to stabilize in fresh air at the temperature of use before "zeroing" or calibrating.
- Calibrate at temperature of use (if below 32ºF).
- Allow battery to completely discharge before recharging to eliminate "memory effect". Do not charge for more than 24 hours.
- Keep away from compounds containing silicon or leaded gasoline, as this will poison and seriously impair the response of this instrument.
- Do not allow sensor screens to become obstructed or dirty.
- Changes in atmospheric pressure will affect the oxygen sensor. Calibrate at elevation of use.

*See Microgard manual for specific operating instructions.

11.9 Industrial Scientific MX251 Combustible Gas/Oxygen Indicator

The MX251 portable alarm is a pocket-sized, diffusion-type instrument for simultaneously monitoring combustible gas and oxygen concentrations in atmospheres and confined spaces.

MX251 Specifications

Certification	**For use in Class I, Groups A, B, C, D, Division 1, Hazardous Locations**
Sensors	**Oxygen: electrochemical** **Combustible gas: catalytic**
Range	**Oxygen: 0 to 30% of volume** **LEL: 0 to 99%**
Accuracy	**Oxygen: + 0.5% at 10 - 30% oxygen, + 0.75% at 0-10% oxygen** **Combustible gas: + 2% LEL full range**
Ambient Operating Temperature	**5º to 113ºF**
Humidity	**0 to 95% RH, noncondensing**
Power Source	**4.8 volt rechargeable nickel cadmium battery**
Battery Life	**10 hours continuous at ambient temperature**
Dimensions	**4.75 x 2.75 x 1.5 inches**
Weight	**20 ounces**

Operating guidelines:

- Check calibration daily or before each use.
- Allow instrument to stabilize in fresh air at the temperature of use before "zeroing" or calibrating.
- Calibrate at temperature of use (if below 32ºF).
- Allow battery to completely discharge before recharging to eliminate "memory effect". Do not charge for more than 24 hours.
- Keep away from compounds containing silicon or leaded gasoline, as this will poison and seriously impair the response of this instrument.
- Do not allow sensor screens to become obstructed or dirty.
- Changes in atmospheric pressure will affect the oxygen sensor. Calibrate at elevation of use.

*See MX251 manual for specific operating instructions.

11.10 Industrial Scientific MX271 Hydrogen Sulfide, Combustible Gas/Oxygen Indicator

The MX271 portable alarm is a pocket-sized, diffusion-type instrument for simultaneously monitoring hydrogen sulfide, combustible gas and oxygen concentrations in atmospheres and confined spaces.

MX271 Specifications

Certification	**For use in Class I, Groups A, B, C, D, Division 1, Hazardous Locations**
Sensors	**Hydrogen sulfide: electrochemical** **Oxygen: electrochemical** **Combustible gas: catalytic**
Range	**Hydrogen sulfide: 0 to 1999 ppm** **Oxygen: 0 to 30% of volume** **LEL: 0 to 99%**
Accuracy	**Hydrogen sulfide: + 5% at 0 - 100 ppm, + 10% at 100 - 1999 ppm** **Oxygen: + 0.5% at 10 - 30% oxygen, + 0.75% at 0-10% oxygen** **Combustible gas: + 2% LEL full range**
Ambient Operating Temperature	**5º to 113ºF**
Humidity	**0 to 95% RH, noncondensing**
Power Source	**Four “AAA” alkaline batteries**
Battery Life	**8 hours continuous at ambient temperature**
Dimensions	**4.75 x 2.75 x 1.5 inches**
Weight	**22 ounces**

Operating guidelines:

- Check calibration daily or before each use.
- Allow instrument to stabilize in fresh air at the temperature of use before "zeroing" or calibrating.
- Calibrate at temperature of use (if below 32ºF).
- Keep away from compounds containing silicon or leaded gasoline, as this will poison and seriously impair the response of this instrument.
- Do not allow sensor screens to become obstructed or dirty.
- Changes in atmospheric pressure will affect the oxygen sensor. Calibrate at elevation of use.

CAUTION: Do not use calibration gas indoors or in a poorly ventilated area.

*See MX271 manual for specific operating instructions.

11.11 Industrial Scientific Model HS267 Hydrogen Sulfide Monitor

The HS267 is a hand-held, diffusion-type instrument that monitors hydrogen sulfide content of the air and displays the level in parts per million (ppm) on a digital readout.

HS267 Specifications

Certification	**For use in Class I, Groups A, B, C, D, Division I hazardous locations**
Sensor	**Electrochemical**
Range	**1 to 1,999 ppm H_2S**
Detection Limit	**1 ppm**
Accuracy	**At temperature of calibration: 1-100 ppm + 5% of reading or 1 ppm (whichever is greater)**
Alarm Response	**Less than 20 seconds when exposed to 25 ppm H_2S with alarm set at 10 ppm H_2S**
Ambient Operating Temperature	**-13° to 104°F**
Humidity	**5% to 90% RH, noncondensing**
Power Source	**Four (4) "AA" alkaline batteries**
Battery Life	**2,000 hours continuous (nonalarm)**
Dimensions	**4.75 x 2.75 x 1.5 inches**
Weight	**15.5 ounces**

Operating guidelines:

- Check calibration daily, or before each use.
- Allow instrument to stabilize in fresh air at temperature of use before "zeroing" or calibrating.
- Do not allow sensor screen to become obstructed or dirty.

CAUTION: Do not use calibration gas indoors or in a poorly ventilated area.

*See HS267 manual for specific operating instructions.

11.12 Industrial Scientific Model S0261 Sulfur Dioxide Monitor

The S0261 is a hand-held, diffusion-type instrument that monitors the sulfur dioxide content of the air and displays the level in tenths of a part per million (ppm) on a digital readout.

S0261 Specifications

Certification	**For use in Class I, Groups A, B, C, D, Division I hazardous locations**
Sensor	**Electrochemical**
Range	**0 to 200 ppm of SO2**
Detection Limit	**0.1 ppm**
Accuracy	**At temperature of calibration: 1-100 ppm ± 5% of reading or 0.1 ppm (whichever is greater)**
Alarm Response	**Less than 20 seconds when exposed to 10 ppm SO2 with alarm set at 2 ppm**
Ambient Operating Temperature	**-4° to 104°F**
Humidity	**5% to 90% RH, noncondensing**
Power Source	**Four (4) "AA" alkaline batteries**
Battery Life	**2,000 hours continuous (nonalarm)**
Dimensions	**4.75 x 2.75 x 1.5 inches**
Weight	**15.5 ounces**

Operating guidelines:

- Check calibration daily, or before each use.
- Allow instrument to stabilize in fresh air to temperature of use before "zeroing" or calibrating.
- Do not allow sensor screen to become obstructed or dirty.

CAUTION: Do not use calibration gas indoors or in poorly ventilated areas.

* See SO261 manual for specific operating instructions.

11.13 M.I.E. Model PDM-3 Dust/Aerosol Monitor

The MINIRAM (Miniature Real-time Aerosol Monitor) Model PDM-3 is an ultra-compact personal-size airborne particulate monitor whose operating principle is based on the detection of scattered electromagnetic radiation in the near infrared.

The MINIRAM measures the concentration of any airborne particles, both solid and liquid, and the display indicates this level in the units of milligrams per cubic meter, based on its factory calibration, against a filter-gravimetric reference, using a standard test dust (Arizona road dust). The MINIRAM can be used to measure the concentration of all forms of aerosol: dusts, fumes, smokes, fogs, etc.

PDM-3 Specifications

Certification	**MSHA 2G-3532-0 approval intrinsically safe for operation in methane-air mixtures**
Measurement Ranges	**0.01 to 10 mg/m3 and 0.1 to 100 mg/m3**
Precision and Stability (For 10 sec. Readings)*	**± 0.03 mg/m3 (2-sigma)**
Precision and Stability of Time-Averaged Measurements*	**± 0.02 mg/m3 (for 1 minute averaging)** **± 0.006 mg/m3 (for 10 minute averaging)** **± 0.003 mg/m3 (for 1 hour averaging)** **± 0.001 mg/m3 (for 8 hour averaging)**
Particle Size Range of Maximum Response	**0.1 to 10 µm in diameter**
Data Storage	**Seven concentration averages, sampling periods in minutes, off time, identification number, zero value, programmable code, and check sum. LCD memory playback.**
Power Source	**7.5 V nickel cadmium battery**
Battery Life	**10 hours (on a full charge)**
Operating Temperature	**32° to 120°F**
Dimensions	**Main body: 4 x 4 x 2 inches** **Sensing chamber cover: 3 x 1.5 x 0.6 inches**
Weight	**16 ounces**

* At constant temperature (typically 77°F).

Operating guidelines:

- Zero instrument daily, or before each use.
- When using for personal monitoring, the instrument should be positioned vertically, with display/control panel facing upwards or clipped to a belt or shoulder strap.
- Allow battery to completely discharge before recharging to eliminate memory effect.
- Place instrument in carrying case when not in use.

*See PDM-3 manual for specific operating instructions.

11.14 M.I.E. Model PDR-1000 Dust/Aerosol Monitor

The *personal*DATARAM (Personal Data-logging Real-time Aerosol Monitor) Model PDR-1000 is an ultra-compact personal-size airborne particulate monitor whose operating principle is based on the detection of scattered electromagnetic radiation in the near infrared.

The MINIRAM measures the concentration of any airborne particles, both solid and liquid, and the display indicates this level in the units of milligrams per cubic meter, based on its factory calibration, against a filter-gravimetric reference, using a standard test dust (Arizona road dust). The DATARAM can be used to measure the concentration of all forms of aerosol: dusts, fumes, smokes, fogs, etc.

PDR-1000 Specifications

Certification	**Not** intrinsically safe
Concentration Measurement Range (auto-ranging)	0.001 to 400 mg/m^3
Precision and Stability of Time-Averaged Measurements*	± 10.0 μg/m^3 (for 1 second averaging) ± 1.5 μg/m^3 (for 60 second averaging) ± 0.003 mg/m^3 (for 1 hour averaging) ± 0.001 mg/m^3 (for 8 hour averaging)
Accuracy	± 5% of reading
Resolution	0.1% of reading or 0.001 mg/m^3, whichever is larger
Particle Size Range of Maximum Response	0.1 to 10 μm in diameter
Alarm	Selectable over entire measurement range
Data Storage	Seven concentration averages, sampling periods in minutes, off time, identification number, zero value, programmable code, and check sum. LCD memory playback.
Power Source	9 V alkaline battery (may be operated with universal AC adapter)
Battery Life	15 hours
Operating Temperature	14° to 122°F
Dimensions	Main body: 6 x 3.6 x 2.5 inches
Weight	18 ounces

* At constant temperature

Operating guidelines:

- Zero instrument daily, or before each use.
- When using for personal monitoring, the instrument should be positioned vertically, with display/control panel facing upwards or clipped to a belt or shoulder strap.
- Place instrument in carrying case when not in use.

*See PDR-1000 manual for specific operating instructions

11.15 Quest Model 2700 Sound Level Meter

The Quest Model 2700 functions as a Sound Level Meter and Impulse Sound Level Meter. In all modes, the instrument delivers Type 2 accuracy for noise measurements and statistical analysis. The Quest Model 2700 utilizes low noise, low power analog and digital integrated circuitry to ensure long battery life, maximum stability, and superior reliability over a wide range of environmental conditions. Applications include laboratory, industrial, community, and audiometric measurement and analysis.

2700 Specifications

Certification	Meets or exceeds ANSI S1.4-1983, Type 2, and relevant sections of IEC 651-1979, Type 2(I).
Detector	True RMS.
Frequency Range	4 Hz (-3dB) to 50 kHz (-3dB) on linear weighing, meter only. (Subject to microphone limitations.)
Reference Range	60 to 120 dB range setting.
Primary Indicator Range/Linearity Range	60 db (The range as indicated by both the dB range switch and the painted 60 dB scale.) Tested with a sinusoidal signal input.
Level Linearity	Inside the Primary Indicator Range. It is tested on the Reference Range (60 to 120 dB) with a sinusoidal input signal. Tolerance is ± 1.0 dB referenced to 94 dB.
Display	3 1/2 Digit Liquid Crystal Display with an additional Quasi-Analogue 60 dB indicator in 2 dB increments. Level display indicates to 0.1 dB resolution. Annunciators are included for Battery Check, Hold, and Overload Indication.
Modes of Operation	Measures Sound Pressure Level (SPL) and Maximum Level (MAX). Peak Level (PEAK) and Impulse Level (IMP) can also be measured.
Accuracy	Within 0.7 dB at 77ºF; within 1.0 dB over the temperature range of 14° to 124°F.
Temperature Range	Operation Temperature Range: 14° to 124°F. Accuracy over the Operation Temperature is within ± 0.5 dB. Storage Temperature Range (less batteries): -4° to 140°F. Do not exceed the Storage Temperature Range because possible damage to the unit may result.
Operating Humidity	Over a range of 30 to 90% relative humidity, the accuracy is within ± 0.5 dB. Do not exceed 95% relative humidity because possible damage to the unit may result.
Batteries	Two 9-volt alkaline batteries (NEDA 1604A) will provide approximately 20 hours of continuous operation. (10 hours with optional filter set.)
Dimensions	3.3 x 8.2 x 1.8 inches (84 x 208 x 47mm) without preamp.
Weight	24 oz. (680g) including the preamp and batteries.

Operating guidelines:

- Calibration should be checked and adjusted, if necessary, before each use.
- For best results, mount instrument on a tripod in a relatively open area. Avoid corners or walls.
- Use windscreen to reduce erroneous measurements.

*See 2700 manual for specific operating instructions.

11.16 S.E. International Monitor 4 Radiation Monitor

The Monitor 4 senses ionizing radiation by means of a GM (Geiger Mueller) tube with a thin mica window. When a ray or particle of ionizing radiation enters or passes through the tube, it is sensed electronically.

Monitor 4 Specifications

Certification	**Not intrinsically safe**
Sensor	**Halogen-quenched uncompensated GM tube. Thin mica window is 1.5 - 2.0 mg/cm3**
Sensitivity	**Detects alpha down to 2.5 MeV. Typical detection efficiency at 3.6 MeV is greater than 80%** **Detect beta at 50 keV with typical 35% detection efficiency** **Detects beta at 150 keV with typical 75% detection efficiency** **Detects gamma and x-rays down to 10 keV** **Normal background is 5-20 CPM**
Operating Range	**0-50 mR/hr and 0-50,000 CPM, or 0-500 µSv/hr and 0-50 mR/hr**
Accuracy	**+ 15% of full scale (referenced to Cs-137)**
Temperature Range	**-4° to 131°**
Power Source	**9 V alkaline battery**
Battery Life	**2,000 hours at normal background radiation levels**
Dimensions	**5.7 x 2.8 x 1.5 inches**
Weight	**6.3 ounces**

Operating guidelines:

- Avoid exposing the instrument to liquids, moisture, and corrosive gases
- Avoid extreme temperatures or direct sunlight for extended periods.
- Instrument may be sensitive to and may not operate in radio frequency, microwave, electrostatic, and magnetic fields.
- May be rendered inoperable by an atomic detonation.

* See Monitor 4 manual for specific operating instructions.

11.17 RSS-214 “WiBGeT”

The RSS-214 WiBGeT is a hand held micro-processor based Wet Bulb Globe Thermometer which accurately measures environmental factors that contribute to heat stress. The Wet Bulb Globe Temperature (WBGT) method and index are tools for the safe management of human heat stress exposure. WBGT is a weighted sum of DRY BULB, WET BULB and VERNON GLOBE temperatures.

Dry Bulb Temperature (DB) provides a measure of simple “ambient temperature”.

Wet Bulb Temperature (WB) provides a measure of evaporative cooling including effects of air speed and humidity. WB is always lower than DB.

VERNON GLOBE Temperature (GT) provides a measure of radiant heat load including air speed effects.

RSS-214 Specifications

Accuracy @ Air Speed	180 fpm minimum	
Ranges	°C	°F
Display	0 to 100+	32 to 199.9
Monitor	0 to 65	32 to 150
Sensors	0 to 100	32 to 210
Storage	-25 to 65	-10 to 150
Response	Electronic < 3 seconds Sensors (90%) < 2.2 minutes Sensors (95%) <4.5 minutes	
Battery	8.4V nickel cadmium Operating Time - 17 hours nominal Recharge Time – 14 hours nominal	
Additional Features	Analog/Recorder Output – 10mV/°C ± 1mV	
Data Logger/RS232C Port Option	Memory type – Non volatile Communications standard – RS232C Maximum # of data sets – 511 Auto log interval – 0.5 – 30 minutes Auto log period – 255 to 15,300 minutes	

Operating guidelines:

- Do not twist sensors once engaged
- Keep wet bulb reservoir filled with distilled or de-ionized water, replace wick if discolored or stiffened
- Keep sensor connections dry
- See RSS-214 manual for specific operating instructions.

Section 20: Medical Surveillance Program

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Section 20: Medical Surveillance Program

1.0 Overview

All Barr Engineering employees with 40-hour HAZWOPER training participate in a medical surveillance program that meets the requirements of 29 CFR 1910.120 (f). All Barr Engineering employees involved in field activities have been trained in the recognition of symptoms and signs that might indicate over-exposure to physical or chemical hazards during their initial 24/40-hour training and during annual 8-hour refresher training.

The purposes of the medical surveillance program are to:

- Establish an employee baseline health condition for employees who will conduct work covered by this medical surveillance program.
- Determine whether there are any detectable medical conditions that would place an employee at increased risk of material impairment to health from work covered by this medical surveillance program.
- Evaluate the employee's physical capabilities to perform the work, and ability to wear personal protective equipment under conditions that may be expected.
- Monitor the employee's health condition in response to the work environment.
- Document the employee's health status at the termination of employment.

Medical examinations, when required, will be at Barr's expense. Costs for any physical examination not scheduled or authorized by the Company Health and Safety Manager or other authorized Barr management person, will be the financial responsibility of the Barr employee and not the financial responsibility of Barr. In the event of an emergency while conducting work for Barr, the Barr employee is authorized to seek emergency care and the cost of that emergency care will be covered by Barr.

2.0 Baseline Medical Surveillance

Baseline medical evaluations are provided without cost to employees with 40-hour training, prior to working on or near sites known or expected to contain hazardous substances. The baseline evaluation includes a medical and work history with special emphasis on symptoms related to the handling of hazardous substances and health hazards. Special emphasis is placed on fitness for duty, including the ability to wear any required personal protective equipment under conditions that may be expected at a work site. The Baseline Medical Surveillance exam is classified as NProtocol AN.

3.0 Periodic Medical Surveillance

Periodic medical surveillance is conducted either annually or biannually for employees with 40-hour training, who have worked on or near hazardous waste operations on a frequent basis. The attending occupational physician is responsible for determining the appropriate medical surveillance monitoring period. The periodic medical evaluation is classified as ‘Protocol B.’

4.0 Site-Specific Medical Surveillance

In the event that Barr employees will be working on or near hazardous waste operations, and the medical examination protocols established are not specific for hazardous substances that may be encountered on that site, additional medical evaluations will be performed on an individual basis to be determined by the attending physician. Additionally, in the event that the attending physician determines that the medical evaluation frequency should be increased, medical examinations will be performed as recommended.

5.0 Function-Specific Medical Surveillance

1. Respirator Examination. This exam is designed for respirator users who are not covered under Protocol B.

2. Diver’s Examination. This exam is designed for Barr staff who perform commercial diving operations.

3. Episodic Exam. Upon notification by an employee that the Barr employee has developed signs or symptoms of exposure to a potential hazardous substance, or has been exposed above the permissible limits or published exposure limits.

6.0 Exposure/Injury/Medical Support

In the event that notification reveals that an employee has possibly been overexposed to hazardous substances or health hazards above the PEL or other published exposure level, has been injured, or has developed signs or symptoms indicating possible overexposure to hazardous substances or health hazards, an additional medical evaluation will be performed as soon as possible. The content of this examination will be determined by the attending physician who has been advised of the possible overexposure. The Barr Project Health and Safety Team Leader should facilitate emergency care as described in the PHASP and the Project Manager should be notified after the emergency is abated.

7.0 Termination Medical Evaluation

Upon termination of employment with Barr or upon reassignment to work within the company that does not involve working on or near hazardous waste operations on a frequent basis, a medical evaluation is conducted and is classified as ℕProtocol Dℕ. This examination may include an annual medical history, vital signs, vision screening, blood profile including complete blood count and blood chemistry, heavy metal blood screen for lead, mercury and arsenic, urinalysis, pulmonary function consisting of FVC, FEV, FEV1, and audiometry. The content of this examination will be determined by the attending physician.

8.0 Information Provided to Physician

Barr has provided its occupational medicine consultant with a copy of the Hazardous Waste Operations and Emergency Response Standard (29 CFR 1910.120) and its appendices. Job descriptions for Barr employees, measured and anticipated employee exposure levels, personal protective equipment used, and information from previous medical examinations are also provided to Barr’s medical consultant.

9.0 Recordkeeping

Barr receives a written physician’s opinion for all medical evaluations from the examining physician, documenting that the employee is qualified to work on or near hazardous waste operations and to wear respiratory protection equipment. The employee receives a copy of this written physician’s opinion, copies of laboratory results, and any confidential medical information.

All medical records are confidentially maintained at the office of the attending physician and are made available to employees or their designee upon written request. The written physician’s opinion indicating an employee's suitability to work in hazardous waste operations and their physical ability to wear respiratory protective equipment is maintained at Barr’s office.

10.0 Return to Work

It is the goal at Barr Engineering to return employees to meaningful, productive temporary employment following a work related injury or illness until their healthcare provider releases them to full duty. Barr will provide modified work opportunities to injured employees, whenever practicable. The physical demands will be assessed for the modified duty jobs to determine that they can be safely performed by the injured employee.

Section 21: Bloodborne Pathogens Exposure Control Plan (ECP)

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Section 21: Bloodborne Pathogens Exposure Control Plan (ECP)

1.0 Purpose

In accordance with the OSHA Bloodborne Pathogens Standard, 29 CFR 1910.1030, the following Exposure Control Plan (ECP) has been developed. The purpose of this ECP is to:

- Eliminate or minimize employee occupational exposure to blood or other potentially infectious materials.

- Comply with the OSHA Bloodborne Pathogens Standard, 29 CFR 1910.1030 for work for Lakehead Pipeline.

2.0 Definitions

Blood: human blood, human blood components, and products made from human blood.

Bloodborne Pathogens: pathogenic microorganisms that are present in human blood and can cause disease in humans. These pathogens include, but are not limited to, hepatitis B virus (HBV) and human immunodeficiency virus (HIV).

Contaminated: the presence or the reasonably anticipated presence of blood or other potentially infectious materials on an item or surface.

Contaminated Sharps: any contaminated object that can penetrate the skin including, but not limited to, needles, scalpels, broken glass, and broken capillary tubes.

Decontamination: The use of physical or chemical means to remove, inactivate, or destroy bloodborne pathogens on a surface or item to the point where they are no longer capable of transmitting infectious particles and the surface or item is rendered safe for handling, use, or disposal.

Engineering Controls: controls that isolate or remove the bloodborne pathogens hazard from the workplace.

HBV: hepatitis B virus

HIV: human immunodeficiency virus

Occupational Exposure: reasonably anticipated skin, eye, mucous membrane, or parenteral contact with blood or other potentially infectious materials that may result from the performance of an employee's duties.

Other Potentially Infectious Materials (OPIM): (1) includes the following human body fluids – semen, vaginal secretions, cerebrospinal fluid, synovial fluid, pleural fluid, pericardial fluid, peritoneal fluid, amniotic fluid, saliva in dental procedures, any body fluid that is visibly contaminated with blood, and all body fluids in situations where it is difficult or impossible to differentiate between body fluids; (2) any unfixed tissue or organ (other than intact skin) from a human (living or dead); and (3) HIV-containing cell or tissue cultures, organ cultures, and HIV- or HBV-containing culture medium or other solutions; and blood, organs, or other tissues from experimental animals infected with HIV or HBV.

Parenteral: piercing mucous membranes or the skin barrier through such events as needlesticks, human bites, and abrasions.

Regulated Waste: liquid or semi-liquid blood or other potentially infectious materials; contaminated items that would release blood or other potentially infectious materials in a liquid or semi-liquid state if compressed; items that are caked with dried blood or other potentially infectious materials and are capable of releasing the materials during handling; contaminated sharps; and pathological and microbiological wastes containing blood or other potentially infectious materials.

Universal Precautions: an approach to infection control where all human blood and certain human body fluids are treated as if known to be infectious for HIV, HBV, and other bloodborne pathogens.

Work Practice Controls: controls that reduce the likelihood of exposure by altering the manner in which a task is performed.

3.0 Exposure Determination

OSHA requires employers to perform an exposure determination concerning which employees may incur occupational exposure to blood or other potentially infectious materials. The exposure determination is made without regard to the use of personal protective equipment (i.e., employees are considered to be exposed even if they wear personal protective equipment). This exposure determination is required to list all job classifications in which all employees may be expected to incur such occupational exposure, regardless of frequency. The following job classifications are in this category:

Job Classification
Barr Emergency Medical Response Team

In addition, OSHA requires a listing of job classifications in which some employees may have occupational exposure. Since not all the employees in these categories would be expected to incur exposure to blood or other potentially infectious materials, tasks or procedures that would cause these employees to have occupational exposure are also required to be listed in order to clearly understand which employees in these categories are considered to have occupational exposure. The job classifications and associated tasks for these categories are as follows:

Job Classification	Task/Procedure
Project Manager	Providing emergency first aid
Geologist	Providing emergency first aid
Hydrogeologist	Providing emergency first aid

4.0 Implementation Schedule and Methodology

OSHA also requires that this plan include a schedule and method of implementation for the various requirements of the standard. The following complies with this requirement:

4.1 Compliance Methods

Universal precautions will be observed in order to prevent contact with blood or other potentially infectious materials. All blood or other potentially infectious material will be considered infectious regardless of the perceived status of the source individual.

Engineering and work practice controls will be utilized to eliminate or minimize exposure to employees. Where occupational exposure remains after institution of these controls, personal protective equipment shall also be utilized. The following engineering controls will be utilized:

- Biosafety Disposal Bags

The above controls will be examined and maintained on a regular schedule. The schedule for reviewing the effectiveness of the controls is as follows:

- Biosafety Disposal Bags — Prior to initiating project site work for field first aid kits and on a quarterly basis for company first aid kits

Handwashing facilities are also available to the employees who incur exposure to blood or other potentially infectious materials. OSHA requires that these facilities be readily accessible after incurring exposure. Hand washing facilities are located in the company restrooms and lunchrooms. Antiseptic towelettes will be provided for Barr employees working in the field since the precise location of hand washing facilities will be project site-specific. If this alternative is used, then the hands are to be washed with soap and running water as soon as feasible.

- Field first aid kits will contain antiseptic towelettes and will be inspected prior to initiating project site work.

Towelettes may be disposed of in the same manner as other trash unless they are contaminated to the extent that they would be considered regulated waste.

After the removal of personal protective gloves, employees shall wash hands and any other potentially contaminated skin area immediately or as soon as feasible with soap and water.

If employees incur exposure to their skin or mucous membranes, then those areas shall be washed or flushed with water as soon as feasible following contact.

The Project Manager or onsite Project Health and Safety Team Leader is responsible for ensuring the above occur during field-related activities.

4.2 Needles

Contaminated needles and other contaminated sharps will not be bent, recapped, removed, sheared or purposely broken.

- Barr staff are not qualified and are not expected to work with needles.

4.3 Containers for Reusable Sharps

Contaminated sharps that are reusable are to be placed immediately, or as soon as possible, after use into appropriate sharps containers. Sharps containers will be puncture resistant, labeled with a biohazard label and are leak proof.

- Since Barr staff are not qualified and are not expected to work with needles, they will not be using sharps containers.

4.4 Work Area Restrictions

In work areas where there is a reasonable likelihood of exposure to blood or other potentially infectious materials, employees are not to eat, drink, apply cosmetics or lip balm, smoke, or handle contact lenses. Food and beverages are not to be kept in refrigerators, freezers, shelves, cabinets, or on counter tops or bench tops where blood or other potentially infectious materials are present.

Mouth pipetting/suctioning of blood or other potentially infectious materials is prohibited.

All procedures will be conducted in a manner, which will minimize splashing, spraying, splattering, and generation of droplets of blood or other potentially infectious materials.

4.5 Specimens

Specimens of blood or other potentially infectious materials will be placed in a container, which prevents leakage during the collection, handling, processing, storage, and transport of the specimens.

The container used for this purpose will be labeled or color-coded in accordance with the requirements of the OSHA standard.

Any specimens which could puncture a primary container will be placed within a secondary container which is puncture resistant.

If outside contamination of the primary container occurs, the primary container shall be placed within a secondary container, which prevents leakage during the handling, processing, storage, transport, or shipping of the specimen.

- Barr staff are not qualified nor expected to work with specimens of blood or other potentially infectious materials.

4.6 Contaminated Equipment

For field-related projects, the Project Manager or onsite Project Health and Safety Team Leader is responsible for ensuring that equipment which has become contaminated with blood or other potentially infectious materials shall be examined prior to servicing or shipping and shall be decontaminated as necessary unless the decontamination of the equipment is not feasible. The Barr Emergency Medical Response Team is responsible for decontamination of any equipment used for rendering first aid or for the clean-up of equipment contaminated with blood or other potentially infectious materials.

4.7 Personal Protective Equipment (PPE)

PPE Provision

Barr is responsible for ensuring that Barr employees use appropriate personal protective equipment. For field-related projects, the Project Manager or onsite Project Health and Safety Team Leader is responsible for ensuring that the following provisions are met.

All personal protective equipment used will be provided without cost to employees. Personal protective equipment will be chosen based on the anticipated exposure to blood or other potentially infectious materials. The protective equipment will be considered appropriate only if it does not permit blood or other potentially infectious materials to pass through or reach the employees' clothing, skin, eyes, mouth, or other mucous membranes under normal conditions of use and for the duration of time which the protective equipment will be used.

- Personal protective equipment will be included in each first-aid kit. This equipment may consist of disposable gloves, disposable mask and gown, CPR mask, and eye protection.

PPE Use

For field-related projects, the Project Manager or onsite Project Health and Safety Team Leader shall make sure that appropriate PPE in the appropriate sizes is readily accessible at the work site or is issued without cost to employees. Members of the Barr Emergency Medical Response Team will be provided with the appropriate PPE upon assignment to the team. Hypoallergenic gloves, glove liners, powerless gloves, or other similar alternatives shall be readily accessible to those employees who are allergic to the gloves normally provided. PPE shall be used unless it can be shown that Barr employees temporarily declined to wear PPE under rare circumstances.

PPE Cleaning, Laundering and Disposal

All personal protective equipment will be cleaned, laundered, and disposed of by Barr at no cost to the Barr employees. Barr will also make all repairs and replacements at no cost to Barr employees.

All garments, which are penetrated by blood shall be removed immediately or as soon as feasible. All PPE will be removed prior to leaving the work area.

When PPE is removed, it shall be placed in an appropriately designated area or container for storage, washing, decontamination or disposal.

Gloves

Gloves shall be worn where it is reasonably anticipated that employees will have hand contact with blood, other potentially infectious materials, nonintact skin, and mucous membranes; and when handling or touching contaminated items or surfaces.

Disposable gloves used are not to be washed or decontaminated for re-use and are to be replaced as soon as practical when they become contaminated or as soon as feasible if they are torn, punctured, or when their ability to function as a barrier is compromised. Utility gloves may be decontaminated for re-use provided that the integrity of the glove is not compromised. Utility gloves will be discarded if they are cracked, peeling, torn, punctured, or exhibit other signs of deterioration or when their ability to function as a barrier is compromised.

Eye and Face Protection

Masks in combination with eye protection devices, such as goggles or glasses with solid side shield, or chin length face shields, are required to be worn whenever splashes, spray, spatter, or droplets of blood or other potentially infectious materials may be generated and eye, nose or mouth contamination can reasonably be anticipated. Situations which may require such protection are when Barr employees provide emergency first aid.

Additional Protection

Additional protective clothing (such as lab coats, gowns, aprons, clinic jackets, or similar outer garments) shall be worn in instances when gross contamination can reasonably be anticipated.

4.8 Housekeeping

The work area will be cleaned and decontaminated each time a Barr employee provides emergency first aid.

Decontamination will be accomplished by utilizing a bleach solution or an EPA-registered disinfectant that is effective against both HIV and HBV.

All contaminated work surfaces will be decontaminated after completion of procedures and immediately or as soon as feasible after any spill of blood or other potentially infectious materials, as well as the end of the work shift if the surface may have become contaminated since the last cleaning.

All bins, pails, cans, and similar receptacles shall be inspected and decontaminated each time a Barr employee provides emergency first aid.

Any broken glassware which may be contaminated will not be picked up directly with the hands. Broken glassware will be cleaned up using mechanical means, such as a brush and dust pan, tongs, or forceps.

Reusable sharps that are contaminated with blood or other potentially infectious materials shall not be stored or processed in a manner that requires employees to reach by hand into the containers where these sharps have been placed.

- Barr staff are not qualified and are not expected to work with reusable sharps.

4.9 Regulated Waste Disposal

Disposable Sharps

Contaminated sharps shall be discarded immediately or as soon as feasible in containers that are closable, puncture resistant, leak proof on sides and bottom and labeled or color-coded.

During use, containers for contaminated sharps shall be easily accessible to personnel and located as close as is feasible to the immediate area where sharps are used or can be reasonably anticipated to be found (e.g., laundries).

The containers shall be maintained upright throughout use and replaced routinely and not be allowed to overfill.

When moving containers of contaminated sharps from the area of use, the containers shall be closed immediately prior to removal or replacement to prevent spillage or protrusion of contents during handling, storage, transport, or shipping.

The container shall be placed in a secondary container if leakage of the primary container is possible. The second container shall be closeable, constructed to contain all contents and prevent leakage during handling, storage and transport, or shipping. The second container shall be labeled or color-coded to identify its contents.

Reusable containers shall not be opened, emptied, or cleaned manually or in any other manner which would expose employees to the risk of percutaneous injury.

- Barr staff are not qualified or expected to work with contaminated sharps, such as, needles, scalpels, or broken capillary tubes. However, it is possible that Barr staff performing emergency first aid may encounter broken glass.

Other Regulated Waste

Other regulated waste shall be placed in containers which are closeable, constructed to contain all contents and prevent leakage of fluids during handling, storage, transportation or shipping.

The waste must be labeled or color-coded and closed prior to removal to prevent spillage or protrusion of contents during handling, storage, transport, or shipping.

Note: Disposal of all regulated waste shall be in accordance with applicable United States, state and local regulations.

Non-regulated Waste

Non-regulated waste may be disposed of in the same manner as other trash. As a rule of thumb, items such as Band-Aids® or tissues that would typically be thrown in the wastebasket are not regulated medical waste.

4.10 Contaminated Clothing Procedures

Clothing contaminated with blood or other potentially infectious materials will be handled as little as possible. Such clothing will be placed in appropriately marked (biohazard labeled, or color-coded red) bags at the location where it was used. Such clothing will not be sorted or rinsed in the area of use. This clothing will be disposed of according to local waste management company's specifications.

4.11 Hepatitis B Vaccine and Post Exposure Evaluation and Follow-up

General

Barr Engineering Company shall make available the Hepatitis B vaccine and vaccination series to all employees who have occupational exposure, and post exposure follow-up to employees who have had an exposure incident.

The Barr Health and Safety Manager shall make sure that all medical evaluations and procedures including the Hepatitis B vaccine and vaccination series and post exposure follow-up, including prophylaxis are:

1. Made available at no cost to the employee.
2. Made available to the employee at a reasonable time and place.
3. Performed by or under the supervision of a licensed physician or by or under the supervision of another licensed healthcare professional.
4. Provided according to the recommendations of the U.S. Public Health Service.

All laboratory tests shall be conducted by an accredited laboratory at no cost to the employee.

Hepatitis B Vaccination

The Barr Health and Safety Manager is in charge of the Hepatitis B vaccination program. We contract with the Park Nicollet Airport Clinic, Minneapolis, Minnesota, and the Duluth Clinic, Duluth, Minnesota, to provide this service.

Hepatitis B vaccination shall be made available after the employee has received the training in occupational exposure (see Information and Training) and within 10 working days of initial assignment to all employees who have occupational exposure unless the employee has previously received the complete Hepatitis B vaccination series, antibody testing has revealed that the employee is immune, or the vaccine is contraindicate for medical reasons.

Participation in a pre-screening program shall not be a prerequisite for receiving Hepatitis B vaccination.

If the employee initially declines Hepatitis B vaccination but at a later date while still covered under the standard decides to accept the vaccination, the vaccination shall then be made available.

All employees who decline the Hepatitis B vaccination offered shall sign the OSHA required waiver indicating their refusal. A copy of this waiver form (Form U-1) is included at the back of this program.

If a routine booster dose of Hepatitis B vaccine is recommended by the U.S. Public Health Service at a future date, such booster doses shall be made available.

Post Exposure Evaluation and Follow-Up/Procedure for the Evaluation of Exposure Incidents

All exposure incidents shall be reported, investigated, and documented. When the employee incurs an exposure incident, it shall be reported to the Barr Health and Safety Manager.

Following a report of an exposure incident, the exposed employee shall immediately receive a confidential medical evaluation and follow-up, including at least the following elements:

1. Documentation of the route of exposure, and the circumstances under which the exposure incident occurred. This information may include, engineering controls used at the time of the incident, work practices followed, PPE used at the time of the exposure incident, location where the incident occurred, procedures being performed when the incident occurred, the employee’s training, and the injured employee’s opinion about whether any other engineering, administrative, or work practice control could have prevented the injury and the basis for that opinion.

2. Identification and documentation of the source individual, unless it can be established that identification is infeasible or prohibited by state or local law.

3. The source individual's blood shall be tested as soon as feasible and after consent is obtained in order to determine HBV and HIV infectivity. If consent is not obtained, the Barr Health and Safety Manager shall establish that legally required consent cannot be obtained. When

the source individual's consent is not required by law, the source individual's blood, if available, shall be tested and the results documented.

4. When the source individual is already known to be infected with HBV or HIV, testing for the source individual's known HBV or HIV status need not be repeated.

5. Results of the source individual's testing shall be made available to the exposed employee, and the employee shall be informed of applicable laws and regulations concerning disclosure of the identity and infectious status of the source individual.

Collection and testing of blood for HBV and HIV serological status will comply with the following:

1. The exposed employee's blood shall be collected as soon as feasible and tested after consent is obtained.

2. The employee will be offered the option of having their blood collected for testing of the employees HIV/HBV serological status. The blood sample will be preserved for up to 90 days to allow the employee to decide if the blood should be tested for HIV serological status.

All employees who incur an exposure incident will be offered post-exposure evaluation and follow-up in accordance with the OSHA standard. All post exposure follow-up will be performed by the Park Nicollet Airport Clinic in Minneapolis, Minnesota, or the Duluth Clinic in Duluth, Minnesota.

Information Provided to the Healthcare Professional

The Barr Health and Safety Manager shall make sure that the healthcare professional responsible for evaluating an employee after an exposure incident is provided with the following:

1. A copy of 29 CFR 1910.1030.

2. A written description of the exposed employee's duties as they relate to the exposure incident.

3. Written documentation of the route of exposure and circumstances under which exposure occurred.

4. Results of the source individuals blood testing, if available.

5. All medical records relevant to the appropriate treatment of the employee including vaccination status.

Healthcare Professionals Written Opinion

The Barr Health and Safety Manager shall obtain and provide the employee with a copy of the evaluating healthcare professional's written opinion within 15 days of the completion of the evaluation.

The healthcare professionals written opinion for HBV vaccination shall be limited to whether HBV vaccination is indicated for an employee, and if the employee has received such vaccination. The healthcare professional's written opinion for post exposure follow-up shall be limited to the following information:

1. A statement that the employee has been informed of the results of the evaluation.

2. A statement that the employee has been told about any medical conditions resulting from exposure to blood or other potentially infectious materials which require further evaluation or treatment.

Note: All other findings or diagnosis shall remain confidential and shall not be included in the written report.

4.12 Labels and Signs

Biohazard labels shall be affixed to containers of regulated waste, refrigerators and freezers containing blood or other potentially infectious materials, and other containers used to store, transport or ship blood or other potentially infectious materials. The universal biohazard symbol shall be used. The label shall be fluorescent orange or orange-red with lettering and symbols in a contrasting color. Red bags or containers may be substituted for labels. However, regulated wastes must be handled in accordance with the rules and regulations of the organization having jurisdiction.

4.13 Information and Training

Training will be provided at the time of initial assignment to tasks where occupational exposure to blood or other potentially infectious materials may take place and at least annually thereafter. Additional training shall be provided to employees when there are any changes of tasks or procedures affecting the employee’s occupational exposure. Training shall be tailored to the education and language level of the employee, and offered during the normal work shift. The training will be interactive and cover the following:

1. A copy of the standard and an explanation of its contents.
2. A discussion of the epidemiology and symptoms of bloodborne diseases.
3. An explanation of the modes of transmission of bloodborne pathogens.
4. An explanation of the Barr Engineering Company Bloodborne Pathogen ECP, and a method for obtaining a copy.
5. The recognition of tasks that may involve exposure.
6. An explanation of the use and limitations of methods to reduce exposure, for example engineering control, work practices and personal protective equipment (PPE).
7. Information on the types, use, location, removal, handling, decontamination, and disposal of PPE.
8. An explanation of the basis of selection of PPE.
9. Information on the Hepatitis B vaccination, including efficacy, safety, method of administration, benefits, and that it will be offered free of charge.
10. Information on the appropriate actions to take and persons to contact in an emergency involving blood or other potentially infectious materials.
11. An explanation of the procedures to follow if an exposure incident occurs, including the method of reporting and medical follow-up.
12. Information on the evaluation and follow-up required after an employee exposure incident.
13. An explanation of the signs, labels, and color coding systems.
14. An opportunity to ask questions and receive answers from the person conducting the training session.

The person conducting the training shall be knowledgeable in the subject matter.

4.14 Recordkeeping

Medical Records

The Barr Health and Safety Manager is responsible for maintaining medical records as indicated below. These records will be kept at the Minneapolis office.

Medical records shall be maintained in accordance with OSHA Standard 29 CFR 1910.20. These records shall be kept confidential, and must be maintained for at least the duration of employment plus 30 years. Medical records must have employee written consent before being released. The medical records shall include the following:

1. The name and social security number of the employee.
2. A copy of the employee's HBV vaccination status, including the dates of vaccination.
3. A copy of all results of examinations, medical testing, and follow-up procedures.
4. A copy of the information provided to the healthcare professional, including a description of the employee's duties as they relate to the exposure incident, and documentation of the routes of exposure and circumstances of the exposure.

Training Records

The Barr Health and Safety Manager is responsible for maintaining the following training records. These records will be kept at the Minneapolis office.

Training records shall be maintained for three years from the date of training. The following information shall be documented:

1. The dates of the training sessions.
2. An outline describing the material presented.
3. The names and qualifications of persons conducting the training.
4. The names and job titles of all persons attending the training sessions.

Availability

All employee records shall be made available to the employees upon request, in accordance with 29 CFR 1910.20. All employees covered by this plan shall receive a copy of this ECP.

All employee records shall be made available to the Assistant Secretary of Labor for the Occupational Safety and Health Administration and the Director of the National Institute for Occupational Safety and Health upon request.

Transfer of Records

If Barr Engineering Company curtails business operations or there is no successor employer to receive and retain the records for the prescribed period, the Director of the NIOSH shall be contacted for final disposition.

4.15 Evaluation and Review

The Barr Health and Safety Manager is responsible for annually reviewing this program, and its effectiveness, and for updating this program as needed.

4.16 Dates

All provisions required by this standard will be implemented by March 1, 1999. The ECP was reviewed and revised on the following dates:

- March 27, 2000
- September 8, 2000
- March 18, 2002
- October 2, 2002

Form 1
Hepatitis B Vaccine Declination Form

The following form is one you may choose to sign only if of your own accord you decide you do not want the hepatitis B vaccine.

Hepatitis B Vaccine Declination Form

I understand that due to my occupational exposure to blood or other potentially infectious materials I may be at risk of acquiring hepatitis B virus (HBV) infection. I have been given the opportunity to be vaccinated with hepatitis B vaccine, at no charge to myself. However, I decline hepatitis B vaccination at this time. I understand that by declining this vaccine, I continue to be at risk of acquiring hepatitis B, a serious disease. If in the future I continue to have occupational exposure to blood or other potentially infectious materials and I want to be vaccinated with hepatitis B vaccine, I can receive the vaccination series at no charge to me.

Signature of employee ____

Print name of employee ____

Witness signature and position ____

Section 22: Process Safety Management Plan

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Section 22: Process Safety Management Plan

1.0 Purpose

The purpose of the process safety management program is to make all Barr employees performing designated work assignments for a contracting authority (hereafter referred to as a client) aware of possible hazards of such assignments so that the consequences of a catastrophic release of toxic, reactive, flammable or explosive chemicals related to such work assignments can be prevented or at least minimized. The program is also intended to assure that all Barr employees working on such assignments have received training to respond properly in the event of such emergencies.

2.0 Employer Responsibilities

Barr Engineering Company will require that each employee receive safety training for such work assignments. This training will be provided by clients who are familiar with the hazards associated with their processes. Employees performing such work assignments are required to attend these training sessions. Barr's Principal in Charge of such projects will be responsible for assuring that Barr staff have received the required safety training.

3.0 Training Related to Potential Fire, Explosion or Toxic Release Hazards and the Emergency Action Plan

Barr Engineering Company will assure that employees performing designated work assignments are properly instructed in the known potential fire, explosion or toxic release hazards related to his/her job on a client's premises. Barr's safety training program also includes instruction regarding potential hazards employees may encounter during work activities at client sites. Employees are also trained to recognize and avoid potentially dangerous situations that may occur during work activities at such sites.

Training includes initial hazardous waste-related operations training for all Barr staff assigned to work at sites containing or suspected to contain hazardous substances. Initial training is provided prior to assignment to work at such sites. Training for employees with onsite managerial and/or supervisory responsibilities for work at such sites is also provided. Refresher training is provided annually for all employees working on such sites.

Barr employees working at client sites are provided with instruction on applicable provisions of Barr’s emergency action plan for that particular site. *A copy of a sample emergency action plan is included as an attachment to this document.* Additional training related to process safety is provided as needed throughout the tenure of employment using hazard communications, material safety data sheets (MSDSs), client site orientations, and hands-on training by qualified supervisory personnel. Because Barr employees work with a number of clients whose processes involve proprietary information, Barr and its employees must respect the confidentiality of client materials, including trade secret information.

4.0 Documentation and Record Keeping

Barr Engineering Company’s Health and Safety Manager is responsible for maintenance of safety training records. These records show who has received training, the date(s) training took place, and the categories of training given and required. All records related to safety training are kept in the Barr health and safety administrative files. Records also include tests and evaluation forms for selected training sessions.

5.0 Safe Work Practices

All Barr employees will abide by the proven safe work practices of client contracting authorities when performing designated activities at client sites. In addition, Barr’s health and safety staff will provide a project health and safety plan (PHASP) for Barr staff and subcontractors, which translates Barr’s health and safety program into site- and activity-specific procedures. In the event that a client’s program differs from Barr’s, the more stringent program and procedures will apply.

Whenever Barr employees perform work at any refinery or gas plant, pre-job safety meetings will be held to make employees aware of possible hazards, chemicals they may come in contact with, confined spaces, lockout-tagout procedures, and other information relevant to the work being performed at the client’s facility. Other sections in this Manual includes specific programs, policies and procedures related to:

- Portable ladders and scaffolds
- Excavation entry
- Confined space entry

- Construction safety (heavy equipment, electrical equipment, power tools, welding and cutting, compressed gas cylinders)
- Water and ice safety
- Boat safety
- Diving safety
- Motor vehicle operation

In preparation for work at a client site and as part of our ongoing communication with clients during work at their sites, clients are requested to advise Barr of any unique hazards associated with Barr employees' designated activities at the site. In return, Barr and its employees will also inform clients of any hazards found during Barr employees' work at the site.

6.0 Hot Work Permits

Employees of Barr Engineering Company will be informed that no work involving hazards related to ignition, flames, electricity, or other spark-causing activities or sources will be performed without obtaining a hot work permit from the client. Hot work permits will remain on site until hot work operations are complete. Either Barr supervisory personnel and/or client staff will ensure that all provisions of the permit are explained to and understood by the employee.

7.0 Incident Investigation Procedures

Barr employees working at a client site will be instructed to immediately report to the Barr project manager and/or appropriate client staff, all accidents, injuries, and near misses, including incidents which resulted in or could reasonable have resulted in a catastrophic release of highly hazardous chemicals in the workplace. The employee involved and/or the Barr project manager will report the incident to Barr's Company Health and Safety Manager. An incident investigation will be initiated within 48 hours by an incident investigation team. This incident investigation team will consist of at least one person knowledgeable in the process involved, including a Barr employee if the incident involved work of Barr, and other persons with appropriate knowledge and experience to thoroughly investigate and analyze the incident. Resolution of the incident and any corrective action(s) taken will be documented and records maintained in Barr's health and safety administrative files for five years.

8.0 Program Updates

Barr Engineering Company will review and update this program as needed to reflect changes which may occur. Whenever changes are made, all employees performing designated activities at client facilities will be provided with additional training. This will be documented and records maintained in Barr’s health and safety administrative files.

Section 23: Laboratory Safety

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Section 23: Laboratory Safety

1.0 Introduction

Barr personnel will conduct work in laboratory areas in a safe and healthful work manner. Barr will comply with all relevant health and safety standards, in particular the OSHA standard for Occupational Exposures to Hazardous Chemicals in Laboratories (29 CFR 910.1450).

2.0 Chemical Hygiene Plan

Barr has developed a *Chemical Hygiene Plan* that sets forth procedures, equipment, personal protective equipment, and work practices to protect Barr staff from potential hazards from hazardous substances used in laboratory areas, and which incorporates standard operating procedures relevant to health and safety in the laboratory.

Copies of the *Chemical Hygiene Plan* are kept in the Barr library and the laboratory area or may be obtained from a representative of the Barr Health and Safety staff. The plan will be reviewed annually and, if necessary, updated by the Barr Chemical Hygiene Administrator.

3.0 Chemical Hygiene Administrator

Barr has designated a Chemical Hygiene Administrator who is qualified by training and experience to provide technical guidance in the development, administration, and implementation of the *Chemical Hygiene Plan*. The administrator is named in the *Chemical Hygiene Plan*.

Section 24: Material Safety Data Sheets

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Section 24: Material Safety Data Sheets

1.0 Scope

Materials Safety Data Sheets (MSDS) are included in this section for all hazardous substances that may be brought on site by Barr employees. Barr's Hazard Communication (Employee Right-to-Know) program is described in the Barr Health and Safety Program Manual and has not been duplicated in the PHASP.

MSDS in this Section include:

a) Alcohol Free Towelettes (personal safety equipment cleaning pad)

b) Alconox (powdered detergent)

c) Buffer Solution pH 4.0 (Color-Coded Red) (2 MSDSs)

d) Buffer Solution pH 7.0 (Color-Coded Yellow)

e) Buffer Solution pH 10.0 (Color-Coded Blue)

f) Compressed breathing air (Grade D or better)

g) Diesel Fuel Oil

h) Gasoline (lead-free)

i) Hexane

j) Hydrochloric Acid

k) Hydrogen (Foxboro OVA)

l) Hydrogen Sulfide Calibration Gas (Industrial Scientific HS267 H_2S Monitor)

m) Isobutylene in Air Calibration gas (HNu; Thermo OVM)

n) Isopropyl (Rubbing) Alcohol

o) Liqui-nox (anionic liquid detergent)

p) Methane Calibration gas (Foxboro OVA)

q) Methane, Carbon Dioxide, Balance Air Calibration Gas (Land Tec GA-90 landfill gas monitor)

r) Methyl Alcohol (methanol)

s) MSA Cleaner Sanitizer II (Respirator cleaning powder)

t) MSA P/N 478191 Calibration gas (MSA 260/360; MSA Microgard)

u) Nitric Acid

v) Personal Safety Equipment Cleaning Pad (Respirator Wipe Pad)

w) Propane

x) Sodium Hydroxide Solution

y) Sulfur Dioxide Calibration Gas (Industrial Scientific SO261 SO_2 Monitor)

z) Sulfuric Acid

aa) YSI 3682 Zobell Solution (Redox Calibration Solution)

ab) YSI 5775 O_2 Probe Solution

Section 25: OSHA Posters

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Section 25: OSHA Posters

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Section 26 Benzene and Hydrogen Sulfide Awareness Program

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Tables

Section 26: Benzene and Hydrogen Sulfide Awareness Program

1.0 Introduction

Barr Engineering has developed this program to help provide benzene, hydrogen sulfide and lead awareness when working on job assignments where there is a potential for exposure. Potential locations where employees could be exposed to benzene and hydrogen sulfide are petroleum refining sites and petroleum pipelines. In addition, employees should be aware and follow the provisions of site specific contingency plans.

2.0 Benzene

Table 1 provides benzene awareness information.

Table 1 Benzene Awareness Information

Parameter	Benzene
Appearance & Color	Clear, colorless liquid with a distinctive sweet odor
Auto Ignition Temperature	1076F
Boiling Point (760 mm Hg)	176 F
Conditions Attributing to Instability	Heat
Evaporation Rate (ether = 1)	2.8
Flammable Limits in Air (% by volume)	Lower = 1.3% Upper = 7.5%
Flash Point (closed cup)	12F
Hazardous Decomposition Byproducts	Toxic gases and vapors (such as carbon monoxide)
Incompatibility	Heat and oxidizing materials
Melting Point	42F
Molecular Formula	C6 H6
Solubility in Water	.06%
Specific Gravity	.879
STEL (airborne)	5 ppm
Toxicity	Known carcinogen
TWA (airborne)	1 ppm
Vapor Density (air = 1)	2.7
Vapor Pressure at 68F	75 mm Hg

Parameter	**Benzene**
Health Effects	Short-term (Acute) Overexposure: If you are overexposed to high concentrations of benzene, well above the levels where its odor is first recognizable, you may feel breathless, irritable, euphoric, or giddy; you may experience irritation in eyes, nose, and respiratory tract. You may develop a headache, feel dizzy, nauseated, or intoxicated. Severe exposures may lead to convulsions and loss of consciousness. Long-term (Chronic) Exposure: Repeated or prolonged exposure to benzene, even at relatively low concentrations, may result in various blood disorders, ranging from anemia to leukemia, an irreversible, fatal disease. Many blood disorders associated with benzene exposure may occur without symptoms.
Necessary PPE	Respirators - Respirators are required for those operations in which engineering controls or work practice controls are not feasible to reduce exposure to the permissible level. However, where employers can document that benzene is present in the workplace less than 30 days a year, respirators may be used in lieu of engineering controls. If respirators are worn, they must have joint Mine Safety and Health Administration and the National Institute for Occupational Safety and Health (NIOSH) seal of approval, and cartridge or canisters must be replaced before the end of their service life, or the end of the shift, whichever occurs first Protective Clothing – You must wear appropriate protective clothing (such as boots, gloves, sleeves, aprons, etc.) over any parts of your body that could be exposed to liquid benzene. Eye and Face Protection - You must wear splash-proof safety goggles if it is possible that benzene may get into your eyes. In addition, you must wear a face shield if your face could be splashed with benzene liquid.
Safety Precautions	Benzene liquid is highly flammable. It should be stored in tightly closed containers in a cool, well ventilated area. Benzene vapor may form explosive mixtures in air. All sources of ignition must be controlled. Use non-sparking tools when opening or closing benzene containers. Fire extinguishers, where provided, must be readily available. Know where they are located and how to operate them. Smoking is prohibited in areas where benzene is used or stored.
Potential Locations Where Employees May Be Exposed	Refinery process streams; Tank gauging (tanks at producing, pipeline & refining operations); Field maintenance

3.0 Hydrogen Sulfide

Table 2 provides hydrogen sulfide awareness information.

Table 2 Hydrogen Sulfide Awareness Information

Parameter	Hydrogen Sulfide
Appearance & Color	Colorless gas or liquefied gas with a repulsive (rotten egg) odor
Auto Ignition Temperature	500F
Boiling Point (760 mm Hg)	-77F
Conditions Attributing to Instability	Heat, flame or other sources of ignition
Evaporation Rate (ether = 1)	>1
Flammable Limits in Air (% by volume)	Lower = 4% Upper = 44%
Flash Point (closed cup)	-115.6F
Hazardous Decomposition Byproducts	Sulfur oxides formed when burned
Incompatibility	Strong oxidizing agents, many metals
Melting Point	-121F
Molecular Formula	$H_2 S$
Solubility in Water	.4%
Specific Gravity	.79 at 60F
STEL (airborne)	15 ppm
Toxicity	Highly toxic; Corrosive when moist
TWA (airborne)	1 ppm
Vapor Density (air = 1)	1.19
Vapor Pressure at 100F	394.0 psia
Health Effects	**Short-term (Acute) Overexposure:** Inhalation – May be fatal if inhaled. Depresses activity of the central nervous system, causing respiratory paralysis. Effects of overexposure include headache, dizziness, vertigo, giddiness, confusion, chest pains, olfactory fatigue, unconsciousness, and death. Rhinitis, pharyngitis, pneumonitis, pulmonary edema, and cyanosis may occur. Lack of oxygen can kill. Skin Contact– Irritates the skin, causing local redness and swelling. Liquid may be corrosive and cause frostbite, a cryogenic injury resembling a burn. Swallowing – A highly unlikely route of exposure; this product is a gas at normal temperature and pressure, but frostbite of the lips and mouth may result from contact with the liquid. Eye Contact – Irritates the eyes, causing excess redness of the conjunctiva. Prolonged exposure to vapor at low concentrations may cause painful conjunctivitis and corneal injury with vesiculation of the corneal epithelium. **Long-term (Chronic) Exposure:** Repeated exposure may cause

Parameter	Hydrogen Sulfide
	nausea, vomiting, weight loss, persistent low blood pressure, and loss of the sense of smell. **Other Effects of Overexposure:** Survivors sometimes exhibit neurologic sequelae such as amnesia, intention tremor, neurasthenia, disturbance of equilibrium, or more-serious brain stem and cortical damage. **Medical Conditions Aggravated by Overexposure:** Breathing of vapor or mist may aggravate asthma and inflammatory or fibrotic pulmonary disease.
Necessary PPE	**Ventilation Engineering Controls:** <u>Local Exhaust</u> – Use an explosion-proof, corrosion-resistant local exhaust system. <u>Mechanical (general)</u> – Inadequate. See SPECIAL. <u>Special</u> – Use only in a closed system. An explosion-proof, corrosion resistant, forced-draft fume hood is preferred. **Respiratory Protection:** Use an air-supplied respirator or a full-face, positive-pressure, self contained breathing apparatus. Respiratory protection must conform to OSHA 29 CFR 1910.134. Select per OSHA 29 CFR 1910.134 and ANSI Z88.2. **Skin Protection:** Wear work gloves when handling cylinders; neoprene, butyl rubber, or PVC gloves where contact with product may occur. **Eye Protection:** Select in accordance with OSHA 29 CFR 1910.133. **Other Protective Equipment:** Metatarsal shoes for cylinder handling; protective clothing where needed. Select in accordance with OSHA 29 CFR 1910.132 and 1910.133. Regardless of protective equipment, never touch live electrical parts.
Methods of Detecting H2S	Personal or area monitors that alarm when PEL exceeds the preset level of 20 ppm.
Safety Precautions	Toxic, flammable liquid and gas under pressure. Symptoms may be delayed. Have safety showers and eyewash fountains immediately available. Use piping and equipment adequately designed to withstand pressures to be encountered. Keep away from heat, sparks, or open flame. Can form explosive mixtures with air. Ground all equipment. Use only spark-proof tools and explosion-proof equipment. Store and use with adequate ventilation at all times. Use only in a closed system constructed only of corrosion-resistant materials When H2S monitor alarms sound, vacate the area and do not re-enter without proper respiratory protection.
Potential Locations Where Employees May Be Exposed	Drilling operations (recycling drilling mud, water from sour crude wells, blowouts); Tank gauging (tanks at producing, pipeline & refining operations); Field maintenance Note: Tank gauging (tanks at producing, pipeline & refining operations); Field maintenance Note: Potentially lethal concentrations are found in hydro-treating processes, sulfur plants and untreated systems at refineries.

Section 27: Field Safety Review Program

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Section 27: Field Safety Review Program

1.0 Field Safety Review Form

Barr employees typically conduct field work on client sites with regularly changing work conditions. To reduce the exposure to injury or loss while working on these sites, Barr expects all Project Managers to initiate a team review of the Field Safety Review form prior to beginning field work.

Completion of this form in a team setting provides an opportunity to identify safety and health hazards expected at the worksite and discuss mitigative measures to eliminate or control the hazards. The safety meeting provides a venue to discuss and confirm client safety requirements, provides an opportunity to review safety training requirements for the work, discuss best practices, provides a forum for a lessons learned discussion and provides client and project staff contact information.

Field Safety Review forms are expected to be completed for work sites where:

- Barr is beginning a new work phase at a project site.
- Conditions have changed since the form was previously completed
- New equipment and/or processes have been added to the work scope
- New staff are added to project work team
- Project field team has been working on the project for long duration (greater than 2 weeks)

Each project task should be considered in this evaluation. The completed form will be reviewed with all project field staff and be consulted during daily toolbox meetings for discussion topics.

2.0 Hazard Control Methods

Attachment AB-1 provides background information on specific hazards that may be encountered in the course of conducting project field work and suggested measures to manage these hazards.

Attachment 1
Hazard Evaluation

1.0 Safety and Health Risk Analysis for Project Tasks

TABLE AB-1: SAFETY AND HEALTH RISK ANALYSIS FOR PROJECT TASKS describes potential safety and health risks which may be encountered by Barr employees while performing the following project tasks. Other physical hazards are discussed in subsequent parts of this section.

Table 1 Safety and Health Risk Analysis for Project Tasks

Task	Task Description	Potential Chemical Hazards	Potential Physical Hazards
Reconnaissance	Walk around site, nonintrusive investigation Observe or measure topography; stake line and grade for construction; inspection of storage containers and site drainage	Potential for skin and inhalation exposure to soil which is known or suspected to contain hazardous substances	Slip, trip, or fall hazards
Observation of Remedial Construction, Observation of Other Construction Activities, and Observation of Excavation/stockpiling of soils	Observe: • Site grading, cap and liner construction • Drain installation • Various other heavy construction in contaminated and clean areas	Potential for skin exposure to soil which is known or suspected to contain hazardous substances and inhalation exposure to dust and soil gas which is known or suspected to contain hazardous substances	Heavy equipment operations, excavation cave-ins, equipment operational hazards, overhead, and underground utilities, slip, trip, or fall hazards
Observation of Intrusive Site Investigations/Test Trenching	Direct and/or Observe: • Soil boring advancement • Geoprobe advancement • Monitoring well installation • Test trenching	Potential for skin exposure to soil which is known or suspected to contain hazardous substances and inhalation exposure to dust and soil gas which is known or suspected to contain hazardous substances	Equipment operation hazards, sidewall cave-ins, slip, trip, or fall hazards, high noise levels, overhead and underground utilities
Nonintrusive Geophysical Survey	Perform electromagnetic, seismic, gravimetric, or other geophysical survey	Potential for skin exposure to soil which is known or suspected to contain hazardous substances	Lifting hazards, slip, trip, or fall hazards, low level electro-magnetic radiation exposure
Soil Gas Survey	Collect soil gas with soil probe; or perform analysis	Potential for skin exposure to soil which is known or suspected to contain hazardous substances and inhalation exposure to soil gas which is known or suspected to contain hazardous substances	Underground utilities, unknown obstructions, slip, trip, or fall hazards, pinch point hazards
Water Sample Collection	Collect water samples from surface water and monitoring	Potential for skin exposure to water which is known or	Lifting hazards, slip, trip, or fall hazards, bee

Task	Task Description	Potential Chemical Hazards	Potential Physical Hazards
	wells; or measure water levels	suspected to contain hazardous substances and inhalation exposure to volatiles in water	hives in casings, water hazards, pinch point hazards
Waste or Sludge Sample Collection	Collect waste or sludge material from waste or sludge lagoon/pit	Potential for skin exposure to concentrated waste or sludge and inhalation exposure to waste or sludge vapor which is known or suspected to contain hazardous substances	Slip, trip, or fall hazards
Soil Sample Collection	Collect and classify soil samples from surface soil, soil borings and/or trench soils; perform headspace screening	Potential for skin exposure to soil which is known or suspected to contain hazardous substances and inhalation exposure to soil gas and dust which is known or suspected to contain hazardous substances	Equipment operational hazards, slip, trip, or fall hazards
Aquifer Testing	Slug test; pumping test; monitoring well development	Potential for skin exposure to water which is known or suspected to contain hazardous substances and inhalation exposure to volatiles in water	Slip, trip, or fall hazards, lifting hazards, bee hives in casing, pinch point hazards, dismemberment
Stack Testing	Sample and analyze stack emissions	Potential for skin and inhalation exposure of hazardous emissions	Lifting hazards, slip, trip, or fall hazards, pinch point hazards, exposure to weather hazards

2.0 Chemical Hazards

Site operations may involve handling materials which are known or suspected to contain hazardous substances. Exposure to these materials may occur through one or more of the following routes.

2.1 Inhalation

Substances that primarily pose an inhalation hazard are those that volatilize easily at ambient temperatures (20-25 °C). A rule of thumb is that substances with vapor pressures greater than that of naphthalene (0.08 mm Hg) at ambient temperatures may be considered volatile. Inhalation hazards may exist when particulates containing hazardous substances become airborne.

2.2 Skin/Eye Contact

Some hazardous substances may be absorbed through the skin and be transported to the bloodstream. Many other substances are not absorbed but react with the skin surface causing irritation or burns. Absorption occurs most readily through open wounds, inflamed skin, or through eye contact. Hazardous substances noted with the “skin” notation are known to be absorbed through the skin.

2.3 Ingestion

Ingestion may occur through eating or smoking with hand to mouth contaminant transfer. Incidental ingestion of particulates containing hazardous substances may also occur under dusty conditions generated in areas known or suspected to contain hazardous substances.

2.4 Injection

Exposure may occur if a hazardous substance is injected into the skin through skin puncture or cut by a foreign object such as spikes, metal edges, wood slivers, etc.

3.0 Safety Procedures for Physical Hazards

Site operations and tasks may involve inherent physical safety hazards. The safety procedures for these hazards are described in the following paragraphs. Site-specific hazards may be discussed in the PHASP or Field Safety Review form.

3.1 Utilities

Overhead and underground utilities (e.g., electric, gas, telephone, water, sewer, drainage, etc.) and associated pipes in the project work areas must be located. Underground utilities will be located and marked by the utility owners or site owners before the start of any intrusive activity. Overhead utilities will be located and where appropriate, protected before the set-up and operation of heavy equipment, such as a drill rigs, cranes, loaders, manlifts, etc.

3.2 Heavy Equipment Operations

Site operations may involve the use of heavy equipment such as drill rigs, backhoes, dozers, loaders, scrapers, trucks, etc. by Barr’s subcontractors or the site owner’s contractors. The following information describes additional safety procedures while working around heavy equipment.

a) Stay within the line-of-sight of the operator at all times while working near the equipment. Normal operation of heavy equipment affects the operator’s ability to hear and to see all areas around the equipment.

b) Keep a safe observation distance of at least the reach of the backhoe bucket plus 5 feet except when working directly with the backhoe operator. If working within reach of operating equipment always alert operator of your position.

c) Avoid walking directly in back or to the side of heavy equipment. Avoid operator blind areas. Understand the direction the equipment is likely to move and how quickly it may make the maneuver.

d) Verify that underground and overhead utilities have been identified and located.

e) Be aware of footing and surroundings at all times.

f) Do **not** work near equipment that may appear obviously unsafe because of deterioration, missing parts, obvious defects, or improper operation. Do not permit use of such equipment by any of Barr's subcontractors if equipment appears to be unsafe.

g) If heavy equipment and other vehicles share a common roadway, Barr employees and Barr's subcontractors will be alert to this traffic and yield right-of-way. If working in an area with congested heavy equipment operations, wear a high visibility vest. Park in a clear area, not in an area obstructed from operator's view.

h) Do not operate heavy equipment.

i) Stay out of reach of cables or chains which might break while lifting or pulling objects.

3.3 Excavation Entry Procedure

Any entry to an excavation or trench will be performed in accordance with the Barr excavation entry procedure. All excavation entry will be cleared with an appropriately trained Barr employee. For excavation entry procedures, please see *Section K: Excavation Entry Procedures* of the Barr Health and Safety Program Manual. If soil samples are required from excavation materials, samples will be taken from the backhoe bucket or from the spoils pile, or other non-entry methods, whenever possible.

3.4 Lighting

Work areas must have adequate lighting for employees to see to work and identify hazards. Work will be limited to daylight hours unless artificial lighting is provided. Barr employees will carry flashlights in all normally dark areas, such as confined spaces.

3.5 Lifting

Heavy objects, such as pumps and generators, will be lifted with proper lifting techniques and preferably by at least two persons. Powerlift techniques will be used whenever possible. Material handling equipment to move the object will be used when an object is either too heavy or bulky to move normally without risk of injury.

3.6 Deteriorated/Abandoned Buildings

Abandoned buildings on site may be structurally unstable. Roof, ceiling, floors, walkways, and doors may be damaged. Hard hats, steel-toed boots and safety glasses will always be used when entering those buildings. An initial walk through with a buddy will be conducted in or near any abandoned facility to identify physical hazards. These types of buildings will be entered only if necessary and may be considered a confined space.

3.7 Electrical Power Hazards

Electrical equipment must be properly grounded or double insulated and will be inspected prior to use. Any electrical equipment in questionable condition will not be used. Operation of electrical equipment in wet conditions must be avoided unless equipment and electric service are specifically designed for water immersion.

3.8 Energized Equipment

Work on or near energized equipment will not be conducted until the equipment is appropriately locked-out. Appropriate lockout procedures prevent the equipment from being turned on while a person is working on or near the equipment.

3.9 Compressed Gas Cylinders

Compressed gas cylinders must be properly labeled and secured in an upright position with a chain or other securing devices away from heat sources. Empty containers will be marked empty, have protective valve caps securely in place, and secured in an upright position.

3.10 Slipping

Slipping on wet, muddy surfaces can be minimized by diverting water away from work area, avoiding slippery surfaces, or by providing a better surface to walk on, such as laying boards on the muddy surface. Boots with good treads or boot covers will be worn if the area is wet or muddy. Walking in puddles, drilling mud and drilling additives will be avoided. Slipping on snowy or icy surfaces will be minimized by avoiding these surfaces whenever possible. Regularly used walkways and travel ways will be sanded, salted, or cleared of snow and ice as soon as practicable to prevent slipping.

3.11 Limitations Due To Personal Protective Equipment

The use of personal protective equipment may limit visibility, hearing, or manual dexterity. In addition, wearing personal protective equipment may require additional physical exertion of the wearer. These limitations are evaluated during the preparation of the PHASP and will be re-addressed, as appropriate, prior to performing a particular task.

3.12 Noise Extremes

Noise exposure may occur on site from heavy equipment operation, especially while working in the area of operating equipment. A general rule of thumb to determine if noise levels are high enough to require hearing protection is to observe if two persons standing approximately 2 feet apart have to raise their voices to converse. If conversation cannot occur without shouting, noise levels probably exceed 85 dBA and hearing protection will be utilized. Hearing protection is available, in the form of earplugs, ear muffs, or both, and will be used when working around heavy equipment. Noise monitoring equipment is also available from the Barr Equipment Coordinator.

3.13 Ionizing Radiation

Sites that have been used by hospitals and research facilities will be particularly suspect of posing an ionizing radiation hazard. These materials may be found in drums, including lab packs, as either a solid or liquid. The best precaution for individuals working at these types of landfills is constant monitoring for ionizing radiation using a Geiger counter or similar monitoring instrument. Initial monitoring will be conducted to detect high levels of radiation where radiation is suspected to be present. If radioactive materials are suspected on site, protective measures will be discussed in the PHASP. Radiation monitoring equipment is available from the Barr Equipment Coordinator.

3.14 Nonionizing Radiation

Barr occasionally uses ground conductivity meters, such as a Geonics EM31. The frequency this device generates is 9.8 kHz. A comparison to the ACGIH TLV indicates that this frequency is not contained within the frequency ranges of concern.

3.15 Heat Stress

Four environmental factors – temperature, humidity, radiant heat (such as from the sun or a furnace) and air velocity – affect the amount of stress a worker faces in a hot work area. Perhaps most important to the level of stress an individual faces are personal characteristics such as age, weight, fitness, medical condition and acclimatization to the heat.

The body reacts to high external temperature by circulating blood to the skin which increases skin temperature and allows the body to give off its excess heat through the skin. However, if the muscles are being used for physical labor, less blood is available to flow to the skin and release the heat.

Sweating is another means the body uses to maintain a stable internal body temperature in the face of heat. However, sweating is effective only if the humidity level is low enough to permit evaporation and if the fluids and salts lost are adequately replaced.

Of course, there are many steps a person might choose to take to reduce the risk of heat stress such as moving to a cooler place, reducing the work pace or load, or removing or loosening some clothing.

If the body cannot dispose of excess heat, it will store it. When this happens, the body’s core temperature rises and the heart rate increases. As the body continues to store heat, the individual begins to lose concentration and has difficulty focusing on a task, may become irritable or sick and often loses the desire to drink. The next stage is most often fainting and then possible death if the person is not removed from the hot environment.

3.15.1 Preventing Heat Stress

Most heat-related health problems can be prevented or the risk of developing them reduced. Following a few basic precautions will lessen heat stress.

1. **Acclimatization** to the heat through short exposures followed by longer periods of work in the hot environment can reduce heat stress. New employees and workers returning from an absence of two weeks or more will have a five-day period of acclimatization. This period

should begin with 50 percent of the normal workload and normal work time the first day and gradually build up to 100 percent on the fifth day.

2. A variety of **engineering controls**, including general ventilation and spot cooling by local exhaust ventilation at points of high heat production may be helpful. Shielding is required as protection from radiant heat sources. Evaporative cooling and mechanical refrigeration are other ways to reduce heat. Cooling fans can also reduce heat in hot conditions. Eliminating steam leaks will also help. Equipment modifications, the use of power tools to reduce manual labor and using personal cooling devices or protective clothing are other ways to reduce heat exposure for workers.

3. **Work practices** such as providing a period of acclimatization for new workers and those returning from two-week absences and making plenty of drinking water – as much as a quart per worker per hour – available at the workplace can help reduce the risk of heat disorders. Training first aid workers to recognize and treat heat stress disorders and making the names of trained staff known to all workers is essential. Employers will also consider individual workers' physical conditions when determining their fitness for working in hot environments. Older workers, obese workers, and personnel on some types of medication are at greater risk.

4. Alternating **work and rest** periods with longer rest periods in a cool area can help workers avoid heat stress. If possible, heavy work will be scheduled during the cooler parts of the day and appropriate protective clothing provided. Supervisors will be trained to detect early signs of heat strain and will permit workers to interrupt their work if they are extremely uncomfortable.

5. **Employee education** is vital so that workers are aware of the need to replace fluids and salt lost through sweat and can recognize dehydration, exhaustion, fainting, heat cramps, salt deficiency, heat exhaustion and heat stroke as heat disorders. Workers will also be informed of the importance of daily weighing before and after work to avoid dehydration.

3.15.2 Heat Stress First-Aid Treatment Guidelines

TABLE AB-2: HEAT STRESS FIRST AID TREATMENT GUIDELINES describes the symptoms of the different levels of heat stress and guidelines for first aid treatment.

Table 2 Heat Stress First Aid Treatment Guidelines

Heat Cramps	
Cause: Excessive water loss	
Symptoms:	First-Aid Treatment Guidelines:
• Muscular pain in arms, legs, abdomen • Faintness, dizziness, exhaustion • Normal temp, cool, moist skin	• Administer sips of Gatorade or water (glass every 15 minutes) • Do not massage cramping muscles (unless it does not increase pain) • Relax person
Heat Exhaustion	
Cause: Large amount of water loss; blood circulation diminishes	
Symptoms:	First-Aid Treatment Guidelines:
• **Moist, clammy skin,** usually pale • Dilated pupils • Weak, dizzy, nauseous, headache • Normal or low temperatures	• Move to cool place • Apply cold, wet compresses to skin • Raise feet 8 to 12 inches • Administer sips of water or Gatorade (glass every 15 minutes) • Get medical attention
Heat Stroke	
Cause: Body overheats; temperature rises; no sweating occurs	
Symptoms:	First-Aid Treatment Guidelines:
• No sweating occurs • Dry, hot skin, usually red • Constricted pupils • Hot body temperature (105-110 °F) • Strong, rapid pulse • Unconsciousness may occur • Muscular twitching	• **Get emergency medical assistance immediately** • Remove from sunlight • Wet down body with cool water or rubbing alcohol • Elevate head/shoulders • Wrap in wet, cold wrapping • Once cooled to 102 °F, stop cooling measures

3.16 Cold Stress

Barr staff may be at risk for cold exposure when performing certain job tasks in the winter months. An assessment will be conducted to identify when an employee may be at risk for cold exposure through use of the Field Safety Review form. The Field Safety Review form will be used to address and inform employees of cold weather safety issues such as the dangers associated with working around snow and ice buildups. The form will also help identify cold weather supplies to bring to the job site. These supplies will be inspected and restocked when necessary. The buddy system will be implemented to make sure that no Barr employee is working alone when at risk for cold exposure.

Fatal exposures to cold have been reported when persons fail to escape from low environmental air temperatures or from immersion in low temperature water. Hypothermia, a condition in which the body's deep core temperature falls significantly below 98.6 °F, can be life-threatening. A drop in core temperature to 95 °F or lower must be prevented.

Air temperature is not sufficient to determine the cold hazard of the work environment. The windchill must be considered as it contributes to the effective temperature. The body's physiologic defense against cold includes constriction of the blood vessels, inhibition of the sweat glands to prevent loss of heat via evaporation, glucose (fuel) production, and involuntary shivering to produce heat by rapid muscle contraction.

The frequency of accidents increases with cold exposures as the body's nerve impulses slow down, individuals react sluggishly and numb extremities make for increased clumsiness. Additional safety hazards include ice, snow blindness, reflections from the snow, and possible skin burns from contact with cold metal.

There are certain predisposing factors that make an individual more susceptible to cold stress. It is the responsibility of the project team members to inform the Project Health and Safety Team Leader if any of the predisposing factors listed below apply to that individual. This enables the Project Health and Safety Team Leader to monitor the individual if necessary, or use other means of preventing/reducing the individual's likelihood of experiencing a cold-related illness/disorder.

3.16.1 Predisposing Factors

Predisposing factors that will increase an individual's susceptibility to cold stress are listed below.

- Dehydration - The use of diuretics and alcohol, and diarrhea can cause dehydration. Dehydration reduces blood circulation to the extremities.
- Fatigue during physical activity - Exhaustion reduces the body's ability to contract blood vessels. This results in the blood circulation occurring closer to the surface of the skin and the rapid loss of body heat.
- Age - Some elderly and very young individuals may have an impaired ability to sense cold.
- Alcohol consumption - Alcohol dilates the blood vessels near the skin surface resulting in body heat loss.
- Sedative drugs - Sedatives may interfere with the transmission of impulses to the brain thereby interfering with the body's physiological defense against cold.
- Poor circulation - Vasoconstriction of peripheral vessels reduces blood flow to skin surface.

- Heavy workload - Heavy workloads generate metabolic heat and make an individual perspire. If perspiration is absorbed by the individual’s clothing and is in contact with skin, cooling of the body will occur.

- The use of PPE - PPE usage which traps sweat inside the PPE may increase an individual’s susceptibility to cold stress.

- Lack of acclimatization - Acclimatization, the gradual introduction of workers into a cold environment allows the body to physiologically adjust to cold working conditions.

- History of cold injury - Previous injury due to cold exposures may result in increased cold sensitivity.

3.16.2 Preventing Cold Stress

There are a variety of measures that can be implemented to prevent or reduce the likelihood of employees developing cold related illness/disorders. These include acclimatization, fluid and electrolyte replenishment, eating a well-balanced diet, wearing warm clothing, the provision of shelter from the cold, thermal insulation of metal surfaces, adjusting work schedules, and employee education.

- **Acclimatization:** Acclimatization is the gradual introduction of workers into a cold environment to allow their body to physiologically adjust to cold working conditions. However, the physiologic changes are usually minor and require repeated uncomfortably cold exposures to induce them.

- **Fluid and Electrolyte Replenishment:** Cold, dry air can cause employees to lose significant amounts of water through the skin and lungs. Dehydration affects the flow of blood to the extremities and increases the risk of cold injury. Warm, sweet, caffeine-free, nonalcoholic drinks and soup are good sources to replenish body fluids.

- **Eating a Well-Balanced Diet:** Restricted diets including low-salt diets can deprive the body of elements needed to withstand cold stress. Eat high-energy food throughout the day.

- **Warm Clothing:** It is beneficial to maintain air space between the body and outer layers of clothing in order to retain body heat. However, the insulating effect provided by such air spaces is lost when the skin or clothing is wet.

- **Work Schedule Adjustment:** Schedule work during the warmest part of the day if possible; rotate personnel; and, adjust the work schedule to enable employees to recover from the effects of cold stress.

The parts of the body most important to keep warm are the feet, hands, head and face. As much as 40% of body heat can be lost when the head is exposed.

- **Recommended Clothing includes:**
  - For inner layers (t-shirt, shorts, socks), thin, thermal insulating, nonmoisture absorbent, moisture wicking material such as polypropylene is recommended.
  - Wool or thermal trousers. Denim is not a good protective fabric since it absorbs moisture very well.
  - Felt-lined, rubber-bottomed, leather-topped boots with a removable felt insole is preferred. Wool socks with polypropylene inner socks. Consider winter boots one half size larger than regular size to accommodate thick socks.
  - Wool shirts/sweaters are recommended to be worn over inner layer.
  - A wool cap is good head protection. Use a liner under a hard hat.
  - Mittens are better insulators than gloves. Wool liners for either mittens or gloves.
  - Face masks or scarves are good protection against wind.
  - Tyvek/polycoated tyvek provide good wind protection.
  - Wear loose fitting clothing, especially footwear.
  - Carry extra clothing in vehicle. Change out of wet clothes or socks.
- **Provision of Shelter from the Cold:** Shelters with heaters will be provided for the employees’ rest periods if possible. Sitting in a heated vehicle is a viable option. Care will be taken that the exhaust is not blocked and that windows are partially open to provide ventilation.

- **Thermal Insulation of Metal Surfaces:** At temperatures of 30 °F or lower, cover metal tool handles with thermal insulating material if possible.

- **Employee Education:** Signs, symptoms and treatment of cold stress will be reviewed in project safety meetings where applicable. The Buddy System will help in preventing cold stress once the employees are trained to recognize the signs and symptoms of cold stress.

3.16.3 Suggested Cold Stress Prevention Guidelines

It may not be practically or economically feasible to implement all the above prevention measures. Follow the guidelines given below when the **ambient air temperature is -5 °F or lower:**

- Contact the Project Manager or the Project Health and Safety Contact to determine if the project team should be on-site in such temperatures.

- Dress warm.

- Replenish fluids and electrolytes at regular intervals.

- Provide shelter from the cold.

- Adjusting work-rest schedules.

3.16.4 Cold Stress First-Aid Treatment Guidelines

TABLE AB-3: COLD STRESS FIRST-AID TREATMENT GUIDELINES describes symptoms of different stages in cold stress and first aid treatment guidelines.

Table 3 Cold Stress First-Aid Treatment Guidelines

Frostbite		
Stages:		
• Incipient (frost nip)	May be painless. Tips of ears, nose, cheeks, fingers, toes, chin affected. Skin blanched white.	
• Superficial	Affects skin/tissue just beneath skin; turns purple as it thaws. Skin is firm, waxy; tissue beneath is soft, numb.	
• Deep	Tissue beneath skin is solid, waxy, white with purplish tinge. Entire tissue depth is affected.	
First-Aid Treatment Guidelines:		
• Incipient	Warm by applying firm pressure—**no rubbing**; or blow warm breath on spot; or submerge in warm water (102-110EF).	
• Superficial	Provide dry coverage, steady warmth; submerge in warm water.	
• Deep	Hospital care is needed. **Don't** thaw frostbitten part if needed to walk on. **Don't** thaw if there is danger of refreezing. Apply dry clothing over frostbite. Submerge in water; **do not** rub.	
General Hypothermia		
Stages:	Symptoms of Hypothermia:	
Shivering	Muscle Tension	Coordination Loss
Indifference	Uncontrollable Shivering	Stumbling
Decreased Consciousness	Decreased Muscle Function	Fatigue
Unconsciousness	Speech Distortion	Forgetfulness
Death	Glassy Stare	Freezing Extremities
	Blue, Puffy Skin	Dilated Pupils
	Slow Pulse	Shallow Breathing
Emergency Response:		
• Keep person dry; replace wet clothing • Apply external heat to both sides of patient using available heat sources, including other • bodies • Give warm liquids—**not** coffee or alcohol—after shivering stops and if conscious • Handle gently • Transport to medical facility as soon as possible • If more than 30 minutes from a medical facility, warm person with other bodies		

3.16.5 Windchill Index

The human body senses "cold" as a result of both air temperature and wind velocity. Cooling of exposed flesh increases rapidly as the wind velocity goes up. Frostbite can occur at relatively mild temperatures if wind penetrates the body insulation. For example, when the actual air temperature of the wind is 40 °F and its velocity is 30 mph, the exposed skin would perceive this situation as an equivalent still air temperature of 13 °F.

If the actual wind speed is not known, the following examples are provided to approximate wind speed.

5 mph = Light flag moves

10 mph = Light flag fully extended

15 mph = Raise newspaper sheet

20 mph = Blowing and drifting snow

TABLE AB-4: WINDCHILL INDEX shows a chart that can help in determining the windchill index. Site work will be terminated when there is a great danger of freezing exposed flesh.

Table 4 Windchill Index

	Actual Temperature Reading (°F)											
Estimated Wind Speed (in mph)	50	40	30	20	10	0	-10	-20	-30	-40	-50	-60
	Equivalent Chill Temperature (°F)											
Calm	50	40	30	20	10	0	-10	-20	-30	-40	-50	-60
5	48	37	27	16	6	-5	-15	-26	-36	-47	-57	-68
10	40	28	16	4	-9	-24	-33	-46	-58	-70	-83	-95
15	36	22	9	-5	-18	-32	-45	-58	-72	-85	-99	-112
20	32	18	4	-10	-25	-39	-53	-67	-82	-96	-110	-121
25	30	16	0	-15	-29	-44	-59	-74	-88	-104	-118	-133
30	28	13	-2	-18	-33	-48	-63	-79	-94	-109	-125	-140
35	27	11	-4	-20	-35	-51	-67	-82	-98	-113	-129	-145
40	26	10	-6	-21	-37	-53	-69	-85	-100	-116	-132	-148
(Wind speeds greater than 40 mph have little additional effect.)	*LITTLE DANGER*In <hr with dry skin. Maximum danger of false sense of security.				*INCREASING DANGER* Danger from freezing of exposed flesh within one minute.				*GREAT DANGER* Flesh may freeze within 30 seconds.			

▨ Equivalent chill temperature requiring dry clothing to maintain core body temperature above 36 °C (96.8 °F) per cold stress TLV.

From: *Threshold Limit Values and Biological Exposure Indices*, ACGIH 1998 or most current. Developed by U.S. Army Research Institute of Environmental Medicine, Natick, MA.

3.17 Fire Extinguishers

Fire extinguishers have been provided in company vehicles and for employee use in the field. For those staff who may need to use a fire extinguisher, training will be provided on the general principles of fire extinguisher use and the hazards involved in incipient stage of fire-fighting. Training will be conducted on an annual basis. All fire extinguishers will be visually inspected on a monthly basis and will be included in an annual maintenance check. The dates of all inspections will be recorded on a tag on each fire extinguisher.

FORM 1. FIELD SAFETY REVIEW FORM

Project Name: **Field Activity:** **Attendees:** **Date:**

Potential Hazard	**Applicable**		**Mitigation Measures**	**Training Needed**
	Y	**N**		
Natural Environment				
Temperature Extremes (rest breaks, shelter, hydration)				
Uneven/Slippery/ Steep Surfaces				
Heights/Drop-offs > 6 feet				*Fall Protection*
Falling Objects/Obstructions/Overhead hazards				
Foul Weather (wind, rain, snow, lightning, flash flood)				
Fire Hazard (chemicals, combustible mtls, seasonal fire risk)				
Smoke/Dust Inhalation				*Respirator/ Fitness*
Water bodies (current, depth, access, boating)				*Water, Boat Safety*
Ice (access, thickness, materials handling)				*Ice Safety*
Local Inhabitants (people, animals, insects)				
Anthropogenic Environment				
Chemical exposure (air monitoring, PPE, action levels, decon)				*PPE*
Vehicular Traffic (railroads, parking lots, traffic flow, noise)				
Mine site (on-site training and safety procedures)				*MSHA 24 hours*
Utility Lines (underground and overhead clearance)				
Confined space (manhole, catch basin, excavation)*				*Confined Space*
Excavation >4 ft (competent person, entry, insp., site control)*				*Excavation*
Operator Qualifications (off-road, trailer, ATV, snowmobile, boat) and access*				*DOT, Water safety*
Heavy equipment (signals, pedestrian traffic, safe distance, hearing protection)				*Construction Site*
Lock-out/tag-out *				*Site specific*
Site-specific training required				*Site specific*
HAZWASTE site- (MSDS, PHASP, Appendices)				*HAZWOPER*
Human Factors				
Lifting/Carrying/Pushing/Twisting/Material handling				
Pre-Existing Physical/Medical Needs/allergies				
Respirator Use (APR, Supplied air, cartridge/filter, change-out)				*Respirator/ Fitness*
Ergonomic- repetitive tasks				
Limited/Remote Medical Services				*First aid/CPR*
Limited Communications (cell phone, satellite phone, 911)				
Fatigue – long days (driving, physically demanding tasks)				

- Obtain additional permits, checklists and forms from the portal

Additional Safety Questions	**Comments**

What conditions might warrant work stoppage or postponement?	
What should be covered during on-site safety meetings?	
How will unexpected or changing hazards be addressed in the field?	
What signal will be used on site in an emergency?	
Where will the first aid kit/eyewash/ fire extinguisher be located?	
Is there a source of potable water for decontamination procedures?	
Identify potential critical errors and error reduction techniques	
Additional hazards or safety concerns identified by team	

Contact Numbers for Sites without a Project Health and Safety Plan

Description	Name	Office Number	Cell Number	Home Number (if needed)
Field Staff				
Principal in Charge				
Project Manager				
Client Contact				
Client Site Contact				
Nearest Hospital				
Nearest Fire Rescue (911)				
Nearest MedaVac (911)				

For Remote Sites/Off-Road Driving/Working Alone

Staff Safety	Y	N
Notify remote buddy of location and work tasks daily		
Task appropriate for one person		
Additional PPE required (snake chaps, venom kit, special clothing)		
Vehicle Safety		
Identify off-road driving conditions		
Vehicle capabilities appropriate for site conditions		
Aware of catalytic converter fire hazards		

Site Address:
Nearest crossroads

Section 28: Hazardous Materials Transportation Program

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Section 28: Hazardous Materials Transportation Program

1.0 Program

Barr will transport hazardous materials in accordance with this program and in compliance with federal and international transportation requirements.

2.0 Hazardous Material Classifications and Divisions

Under the US Department of Transportation (DOT) Hazardous Materials Transportation Program, there are 11 hazard classes (hazard classes 1 through 9, plus the classes Combustible Liquids and Other Regulated Materials (ORM)). Each hazardous material is assigned to one of three packing groups (PG). Packing groups I, II and III indicate the degree of danger presented by the material (high, medium or low, respectively). All packing groups are specified in the Hazardous Materials Table (49 CFR Part 172.101).

3.0 Marking/Labeling/Placarding

All marking of packages containing hazardous materials will comply with 49 CFR Part 172 Subpart D of the Hazardous Materials Regulation (HMR). The basic marking requirement consists of the proper shipping name and identification number of the hazardous material contained in the package. Any Barr employee who offers for transportation or transports a hazardous material will make sure the package is properly labeled. General labeling requirements are contained in 49 CFR Part 172 Subpart E of the HMR.

Depending upon the quantity of the hazardous material, placards may also be required for transportation and will comply with 49 CFR Part 172.504. If applicable, Barr will offer the required placards to the carrier at the time of transport.

4.0 Loading and Unloading

When loading and unloading packages containing hazardous materials, Barr staff should follow these guidelines to make sure there is containment and packages are secured:

- Secure packages against shifting within a vehicle during transportation to prevent packaging damage and accidental release of hazardous materials during transport,

- Secure bottles of compressed gases to prevent damage to their valves,
- Load packages with orientation marks (up arrows) so that the marks remain pointed up,
- Prohibit smoking or any source of ignition on or near the vehicle when loading/unloading flammable or oxidizing materials, and
- Set the handbrake on the vehicle and chock the wheels before loading/unloading.

Only authorized Barr employees, those who have obtained training and demonstrated competency, will be allowed to operate the electric forklift/order picker equipment (mobile equipment). Barr employees are expected to inspect and check any mobile equipment prior to using, each day and report any issues (e.g., brakes, steering, lights, tires, warning signals) immediately to the Barr Equipment Manager. Malfunctioning equipment will be taken out of service until repaired.

Barr staff will meet the following guidelines when operating mobile equipment:

- Passengers will not be permitted to ride on equipment unless it is equipped to accommodate passengers safely.
- Back up alarm warning signal will sound when equipment is being used in reverse.
- Safety glasses will be worn during use.
- If mobile equipment has seat belts, these will be fastened and adjusted prior to starting the engine.
- The equipment will only be used for the purpose it was intended.
- The equipment will not be loaded beyond its established load limit and all loads will be secured for safe transport.
- Barr employees will shut off the engine of any vehicle before filling the fuel tank and will make sure that the nozzle of the filling hose makes contact with the filling neck of the tank.
- No smoking or open flames will be permitted in the immediate area during fueling operation.

5.0 Shipping Papers

Barr employees will determine the hazardous materials classification before allowing a carrier to take possession of hazardous materials for transport. All hazardous materials transported in commerce are required to be accompanied by shipping papers. Shipping papers for hazardous materials will include a proper shipping name, hazard class or division, UN or NA identification number, packing group number, total quantity of the hazardous material, emergency number, certification statement and the signature of the Barr employee offering the material for shipment.

6.0 Emergency Response Information

All hazardous material shipments (except those that do not require shipping papers) will have emergency response information on accompanying shipping papers. In the event of an accidental release of a reportable quantity or concentration of hazardous materials occurs, Barr staff will immediately report the release. In the event of a release, Barr staff will take all reasonable emergency measures to reduce or eliminate any danger to public safety that results or may reasonably be expected to result from the release.

7.0 Hazardous Waste Shipments

In the event of a hazardous waste shipment, Barr staff will complete a uniform hazardous waste manifest to accompany shipments. Copies of this hazardous waste manifest will be kept indefinitely and will be submitted to the state agency within the time frame as specified by each state. Barr will track each manifest to ensure the hazardous waste has been properly transported and disposed. Additionally, Barr will keep copies of all bill of ladings or shipping documents for hazardous materials for a period of at least two years.

8.0 Training and Information

Barr Engineering provides training for Barr staff whose job function includes any aspect of hazardous materials transportation and is required prior to performing any DOT job function. Activities that require DOT training include packaging, loading/unloading, transporting hazardous materials and completing hazardous waste manifests, bill of ladings or shipping papers. The training will be conducted at the beginning of employment or when job responsibilities change for Barr employees whose job functions involve any hazardous material tasks and once every three years thereafter. Records of attendance will be maintained. A Barr employee may perform job functions prior to the completion of training if the employee performs those functions under the supervision of a properly trained and knowledgeable Barr employee.

Section 29: Hydrogen Sulfide Protection Program

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Section 29: Hydrogen Sulfide Protection Program

1.0 Purpose

The following hydrogen sulfide protection program has been developed to provide hydrogen sulfide awareness when working on job assignments where there is potential for exposure. The purpose of this program is to:

- Protect employees from hazards associated with hydrogen sulfide and maintain hydrogen sulfide exposures below the regulatory limits.

- Comply with the OSHA Hazard Communication Standard, 29 CRF 1910.1200 for any work that might expose staff to hydrogen sulfide.

This program is applicable to staff who may be exposed to hydrogen sulfide. Barr staff are not expected to encounter hydrogen sulfide present as a pure substance, or in a mixture in a concentration over 0.1% weight and at least 10 kg of hydrogen sulfide in aggregate. Barr staff may encounter hydrogen sulfide generated from the natural biological degradation process and is not amenable to storage, handling, use or disposal practices. Barr will handle all potential hydrogen sulfide exposures as an uncontrolled release and protect Barr staff from exposures exceeding an action limit of 5 ppm real time monitoring.

2.0 Hazard Data

Brief exposures to high concentrations of hydrogen sulfide (greater than 500 ppm) can cause loss of consciousness and possibly death.

2.1 Acute Health Effects

Inhalation. May be fatal if inhaled. Depresses activity of the central nervous system, causing respiratory paralysis. Effects of overexposure include headache, dizziness, vertigo, giddiness, confusion, chest pains, olfactory fatigue, unconsciousness, and death. Rhinitis, pharyngitis, pneumonitis, pulmonary edema, and cyanosis may occur. Lack of oxygen can kill.

Skin Absorption/Eye Contact. Irritates the skin, causing local redness and swelling. Liquid may be corrosive and cause frostbite, a cryogenic injury resembling a burn. Irritates the eyes, causing excess redness of the conjunctiva. Prolonged exposure to vapor at low concentrations may cause painful conjunctivitis and corneal injury with vesiculation of the corneal epithelium.

Ingestion. A highly unlikely route of exposure; this product is a gas at normal temperature and pressure, but frostbite of the lips and mouth may result from contact with the liquid.

2.2 Chronic Health Effects

Repeated exposure may cause nausea, vomiting, weight loss, persistent low blood pressure, and loss of the sense of smell. Prolonged exposure to lower concentrations can result in olfactory fatigue.

Medical Conditions Aggravated by Overexposure: Breathing of vapor or mist may aggravate asthma and inflammatory or fibrotic pulmonary disease.

2.3 Physical Hazards

Hydrogen sulfide poses a serious fire hazard when exposed to heat or flame. Hydrogen sulfide is heavier than air and may accumulate in low areas and may travel a considerable distance to a source of ignition.

3.0 Permissible Exposure Limits

OSHA has issued two types of limits for employee exposures. The 8-hour time-weighted average permissible exposure limit (PEL) is 10 ppm and the short-term exposure limit (STEL) is 15 ppm. The action level that will be used on Barr projects is 5 ppm for 15 minutes. At this level, Barr staff are instructed to leave the work area to reassess need to upgrade to Level B respiratory protection or to stop work.

4.0 Reducing Employee Exposure to Hydrogen Sulfide

The potential for employee exposure to hydrogen sulfide shall be identified in the hazard assessment. At all times when hydrogen sulfide exposure may be anticipated, Barr staff will wear hydrogen sulfide personal gas meters. These meters will be set to an action level alarm of 5 ppm. Upon alarming, Barr staff are instructed to leave the work area and may not re-enter until levels have dropped below 5 ppm or they are wearing air supplied respiratory protection. Encountering a hydrogen sulfide release is not expected due to the nature of Barr’s work but in the event that a release did occur, Barr staff will evacuate the area immediately by moving upwind or crosswind from the release and to higher ground if possible.

5.0 Communication of Hydrogen Sulfide Hazards to Employees

5.1 Employee Information and Training

Barr employees are provided with information and training at the time of the initial assignment to a work area where hydrogen sulfide is present. The training will include information on health hazards associated with exposure to hydrogen sulfide and procedures developed to minimize worker exposure to hydrogen sulfide. Barr’s training program is in accordance with the requirements of 29 CFR 1910.1200(h) (1) and (2), and includes specific information on hydrogen sulfide for each category of information included in that section. This training will be conducted whenever work begins on a site where hydrogen sulfide exposure may be expected, when an employee transfers to another job where potential hydrogen sulfide exposure may be expected, and whenever an employee demonstrates behavior that indicates a lack of understanding of the safe work practices around hydrogen sulfide.

Project Managers are responsible for ensuring that employees with potential exposure to hydrogen sulfide receive the appropriate training prior to working with the substance. Additionally, project managers are responsible for making sure that employees are aware of and will follow provisions of client site specific contingency plans. All training is documented and records are maintained by the Barr Health and Safety Manager.

Section 30: Subcontractor Environmental, Health and Safety Program

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Forms

Form 1 Subcontractor Health and Safety Performance Questionnaire

Section 30: Subcontractor Environmental, Health and Safety Program

1.0 Safety Evaluation of Subcontractors

Barr may consider the environmental, health and safety performance of potential subcontractors in the selection of participants on a project. During this pre-qualification process, Barr may require safety information be provided on Form A: Subcontractor Health and Safety Performance Questionnaire.

2.0 Subcontractor Responsibilities

The subcontractor will be directly responsible for creating and maintaining a health and safety effort to prevent their employees from working in conditions, which are unsafe, unhealthy, or unsanitary. Additionally, the subcontractor will:

- Maintain a strong commitment towards enhanced health and safety in all their activities,
- Provide employee training that meets regulatory requirements and assures safe work practices,
- Provide documentation of employee training when requested,
- Provide documented evidence of an account in good standing with workers compensation provider when requested,
- Attend pre-work safety kick-off meetings and/or hazard assessments (pre-work safety meetings will include a site orientation that addresses health, safety, security, and environmental concerns),
- Attend daily tailgate meetings each day after the initial pre-work safety kick-off meeting,
- Abide by the owner client’s drug and alcohol policy (if applicable) at all times while working on the site (Barr will communicate these requirements to the subcontractor), and

- Report all incidents while working on the site to Barr (Barr will communicate the incident to the owner client). Additionally, all incidents will be investigated by the subcontractor.

- Be competent and capable to perform their assigned duties in a safe and environmentally sound manner.

- Have the appropriate licenses, registrations, and insurance to complete their work.

- Prior to the start of work the contractor and subcontractor will establish clear lines of communication.

- Prior to the start of work the contractor and subcontractor must define clear roles and responsibilities.

- Prior to the start of work the contractor and subcontractor will establish an emergency action plan.

- An appropriate monitoring/oversight process will be in place to verify subcontractor performance.

3.0 Subcontractor Post Job Safety Performance Reviews

Barr may conduct post job safety performance reviews on a subcontractor’s safety performance. A combination of factors may be considered during this review, including housekeeping, active participation in safety meetings, safety performance, and commitment to the recognition and mitigation of safety hazards.

Form 1. Subcontractor Health and Safety Performance Questionnaire

Barr is committed to providing a safe and healthy workplace for employees and their subcontractors. Subcontractors must provide the following information.

Subcontractor Name	
Subcontractor Project Manager and phone number	
Subcontractor Safety Representative and phone number	

1. In the table below, provide the **five most recent full years** of incident history.

	DESCRIPTION	2013	2012	2011	2010	2009	2008
A	Number of Injuries and Illnesses						
B	Number of Restricted or Transferred Workday Cases						
C	Number of Lost Workday Cases						
D	Number of Work Related Fatalities						
E	Total Number of Employees						
F	Employee Hours Worked Per Year (If unknown use # of employees × 2080)						
G	Total Recordable Incident Rate Rate = A x 200,000 ÷ F						
H	DART Rate Rate = (B +C) x 200,000 ÷F						

2. Does your company have written safety and health programs? Yes No

Please list the date that the program was last reviewed or updated: ________________

3. Has your company received any health and safety related warnings, citations, stop work orders or equivalent in the past three years? **If yes, please describe.** Yes No

____

____

____

____

4. Does your company perform documented safety audits/reviews? **If yes, provide an example and indicate frequency and corrective action procedures/process?** Yes No

____

____

____

5. Does your company hold work-site (tailgate) safety meetings? Yes No

If yes, how often?

Yes No

6. Does your company encourage employee participation in safety meetings?

If so, please explain how this is accomplished.

7. Does your company conduct accident/incident investigations? **If yes, describe the program.** Yes No

8. Does your company document, investigate, and discuss near miss accidents? **If yes, describe the program.** Yes No

9. Does your company have a Stop Work Policy for unsafe act, conditions, or behaviors? **If yes, please submit a copy of the policy.** Yes No

10. Does your company use subcontractors? Yes No

If yes, explain how you qualify/evaluate and approve subcontractor(s) safety performance and programs.

11. Please list your company's workers compensation rate for the past three years. **Please submit copies of your company's workers compensation rate sheets for the past three years.**

The above information will be used to evaluate each Subcontractor related to their safety and health performance. By signing, you are indicating that the submitted information is true and accurate.

Printed Name	Job Title	Signature (Electronic acceptable)	Date

Section 31: MSHA Safety Program

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Attachments

Attachment 1 Accident/Incident Reporting and Investigation Program

Forms

Form 1 Incident/Accident Report Form

Section 31: MSHA Safety Program

1.0 Overview

This MSHA Safety Program describes methods for safe work practices, providing mine safety training, preventing accidents, and for reporting and investigating any incidents/accidents that occur while conducting work at mine sites for Barr. This program also includes information on medical services and first aid.

2.0 General Mine Safety

Accountability of Personnel

When working at a mine site, Barr staff will sign in upon arrival and sign out when leaving. The means for this process will be specified by the mine operator.

Warning of Hazards

When work involves the potential for exposure to health or safety hazards, Barr staff will locate warning signage established by the mine operator. This signage established by the mine operator will be readily visible and legible, and display the nature of the hazard and any protective actions required.

Hazard Communication

Barr will keep on file a copy of the Barr Hazard Communication Program as long as hazardous chemicals are present at the mine sites. For more information, refer to the Hazard Communication Program (Section B) of the Barr Health and Safety Program Manual.

Fall Protection

Handrails will be provided by the mine operator for crossovers, elevated walkways, elevated ramps, stairways, or other elevated structures where there is risk of falling. Openings above, below or near travel routes, will be covered to prevent Barr staff or materials from falling in. Barr staff will implement fall protection measures (see Barr's fall protection policy) if work involves risk of falling from a height of 6 feet or more.

Proper Hygiene

Barr staff will not consume or store food or beverages in toilet room or in any area exposed to toxic materials.

Controlled Substances and Alcohol

It is the company’s policy to maintain a drug-free workplace. The unlawful manufacture, use, dispensing, possession, distribution, sale, solicitation for or being under the influence of any controlled substance is prohibited on company property, on project work sites, in company vehicles, during work time, or during any company-sponsored event. “Controlled substances” include, but are not limited to, opiates, hallucinogenic substances, depressants, stimulants, and narcotics. The use of alcoholic beverages is prohibited during work time on mine sites.

3.0 Personal Protective Equipment

Hard Hats

Hard hats are required when the potential for falling objects may create a hazard. In addition, hard hats are mandatory if required by the owner. Hardhats will meet ANSI standards at a minimum.

Eye Protection

Eye protection is required when working in an area of a mine where a hazard exists which could cause injury to unprotected eyes. Suitable protective devices may include safety glasses, goggles or face shields. Prescription safety glasses will be provided to staff who need vision correction. Protective eyewear will meet ANSI standards at a minimum.

Steel-Toed Boots

Steel-toed boots are required when in or around an area of a mine or plant where a hazard exists which could cause injury to the feet. Steel-toed boots will meet ANSI standards at a minimum.

Hearing Protection

Ear plugs or muffs will be available for employees exposed to continuous excessive noise levels. Hearing protection may be required by the client, depending upon the work location. Training will be provided by the equipment maintenance technician on proper use of hearing protection. Refer to Section 4.0 Noise Exposure for hearing conservation program.

Personal Floatation Devices (PFDs)

Barr staff are required to wear a U.S. Coast Guard-approved Type I, II, or III PFD for work where there is a danger of falling into water and where a drowning hazard exists. Only properly-fitted PFDs may be worn and the PFD must be worn properly with zippers, straps and ties fastened and all loose ends tucked in to avoid snagging. Before being worn, the PFD will be inspected for defects that could alter its strength or buoyancy. Defective units will not be used and will be returned to the equipment maintenance technician.

Respiratory Protection

Respiratory equipment will be provided for Barr staff who may be exposed to concentrations of airborne contaminants exceeding permissible levels. Respirators selected will be approved by the National Institute of Occupational Safety and Health (NIOSH).

The complete Barr Respirator Program is described in *Section G: Respirator Program, Health and Safety Program Manual.*

4.0 Noise Exposure

When working in high-noise areas, as designated by the mine operator, Barr project staff will follow established hearing conservation procedures. Barr project staff will rely on recommendations (and exposure monitoring results) from the mine operator on use of feasible engineering, administrative controls and use of hearing protectors to reduce noise exposure levels. Hearing protection will be provided at no cost and used when working in designated high-noise areas. The hearing protectors will be maintained in good condition.

Project staff routinely working in designated high-noise areas (areas where the noise exposure level equals or exceeds the action level), will participate in a hearing conservation program and will receive training within 30 days of enrollment in this program. Training will include proper use and fitting of hearing protectors in accordance with manufacturer instructions. Records certifying this training will be maintained at Barr’s corporate offices.

Audiometric testing will be provided at no cost to staff who are participating in the hearing conservation program. Staff will be notified within 10 working days upon Barr receiving results from the audiometric testing provider.

If Barr project staff participate in a noise exposure determination, they will be informed within 15 calendar days the results of the monitoring, regardless of whether it equaled or exceeded the action or permissible exposure levels.

5.0 Project Work-Site Inspections/Audits

Barr Health and Safety Coordinators have prepared a Field Safety Planning Review Form, Work Site Safety Inspection Checklist and Work Site Safety Audit Form for Barr staff to use for evaluation of the work site. These forms address planning for a safe project, administration of safety onsite, employee training, site setup and control, air monitoring, personal protective equipment, tools and equipment safety, unsafe conditions, and decontamination. These forms help identify unsafe conditions that could create a hazard so those conditions can be mitigated. Barr onsite staff trained on the elements covered in the evaluation are expected to perform this inspection/audit as appropriate.

At mine sites, a designated competent person will be responsible for examining the workplace. Corrective measures will be promptly implemented by the competent person to address any safety or health concerns.

6.0 Safety Training

New Miner 24 HR Training

All Barr project staff working unescorted on active mine property are required to complete the 24-hour New Miner Training. This training will consist of 16 hours of classroom training supplemented with eight hours of task specific training. This training will be completed prior to working unescorted on a mine site. Upon completion of training, a MSHA Form 5000-23 will be issued to each participant. Barr staff will carry proof of the required MSHA training when working on mine project sites.

Experienced Miners

All Barr project staff who already work unescorted on active mine property are required to have completed 24- hour New Miner Training and be current in their annual refresher training. If a Barr "experienced miner" leaves the mining industry for more than five years and then returns, they will take at least eight hours of experienced miner training.

Annual Refresher Training

Barr project staff who already hold a 24-hour New Miner certificate and who will be working unescorted on active mine property will obtain MSHA refresher training within 12 months of the date of their 24-hour New Miner training or within 12 months of their last MSHA refresher. If refresher course is not taken within the 12 month window then refresher training shall be taken as soon as possible and required before that staff can participate in any mine work. Upon completion of training, an MSHA Form 5000-23 will be issued to each participant. Barr staff will carry proof of the required MSHA training when working on mine project sites.

Hazard Training

If offered and required by the mine operator, all project staff will attend a site specific hazard training session that will identify safety concerns at that mine. The mine operator will determine the frequency of refresher training.

Ionizing Radiation

Barr project staff working with ionizing radiation will be provided with additional training to develop hazard awareness and mitigate exposure.

7.0 Housekeeping

During the course of work on a project site, debris will be kept from work areas, passageways, and stairs in and around buildings and structures. Combustible scrap and debris will be removed at regular intervals during the course of the project. Containers will be provided for the collection and separation of waste, trash, oily and used rags, investigation-related waste, and other refuse. Containers used for garbage and other oily, flammable, or hazardous wastes, such as caustics, acids, contaminated soils and groundwater, will be equipped with covers. Hazardous waste will be marked in accordance with applicable hazardous waste regulations. Garbage and other waste will be disposed of at frequent and regular intervals. Floors will be maintained in a clean and, as much as possible, dry condition.

8.0 Medical Services and First Aid

While on a mine site, each Barr staff will confirm the location of a first-aid kit or to provide a Barr first-aid kit for their own use, and identify the individual capable of providing first aid during their work shift. The Barr staff person may be currently certified in first aid.

Barr has established a relationship with Occupational Medicine Consultants, an occupational medicine clinic in Minnesota. Barr has also established medical relationships with occupational clinics located near Barr branch offices. These clinics provide medical surveillance and are available for advice and consultation on matters of occupational health.

Prior to initiating site operations, the location of the local hospital/clinic is identified. When Barr staff work in remote locations or work as a single employee on a work site, Barr has developed alternate means to assure available treatment. Barr staff working on these sites are required to keep cellular communication operational and to develop a call-in schedule with the Project Manager. If this schedule is not kept, the Project Manager will initiate procedures to contact the Barr employee(s) to determine their current condition and location. Information on emergency telephone numbers and the location of the nearest hospital/clinic is communicated to Barr staff at the pre-site work safety meeting.

In the event of a medical emergency, Barr staff are advised to request assistance from other onsite workers for prompt transportation to a medical facility. In the event of a life-threatening emergency, Barr staff are advised to contact 911 or other identified emergency number. While working on a construction site, Barr staff will identify the location of the postings for emergency telephone numbers for the local medical clinic, hospital or emergency service. If these numbers are not conspicuously posted, Barr staff are advised to notify the Project Manager to correct this omission and to rely on their hospital map or PHASP until the posting has been completed. In the event that there is no practical location for postings, Barr staff will keep these emergency numbers easily accessible in their vehicles. In the event that telephone communication is not available at the project site, Barr staff are expected to keep cellular communication operational. Alternate accommodations will be made in areas where cellular phones are nonfunctional.

9.0 Accident Reporting and Accident Investigation

As noted in Section 8.0, in the event of an injury, accident or other emergency, Barr staff are advised to assess the situation and obtain treatment at the nearest hospital or clinic, if necessary. As soon as the Barr employee has been treated, they are advised to follow the mine operator reporting protocol and notify the Barr Health and Safety Program Manager or a Barr Health and Safety Coordinator to complete accident reporting procedures. Accident reporting must be conducted within 24 hours or the next working day in accordance to the procedures in the Accident Reporting and Investigation Plan (Attachment AF-1).

ATTACHMENT 1
Accident/Incident Reporting and Investigation Program

Purpose

This Accident Reporting and Investigation Plan describes methods and practices for reporting and investigating incidents/accidents. In addition, it is the policy of the company to comply with MSHA accident reporting requirements.

Barr employees have the important and essential responsibility to report all accidents and near-misses immediately to their Project/Administrative Manager and participate in answering questions to complete the Incident/Accident Report Form (Form AF-1) and any subsequent incident/accident investigation documentation.

Accident Reporting Procedures

All accidents on a mine site that require immediate reporting, must be reported to MSHA and the mine operator at once, without delay and within 15 minutes of the accident occurrence. Upon notification to MSHA and the mine operator, the incident will be reported to Project/Administrative Managers as soon as possible. Reportable accidents will be reported to MSHA using Form 7000-1 within 10 days of the occurrence. Quarterly employment and incident information will be reported to MSHA and the mine operator by completing MSHA's Form 7000-2 within 15 calendar days after the end of each calendar quarter.

Accident Investigation Procedures

Thorough investigation of all incidents/accidents will lead to identification of incident/accident causes and help to develop an awareness of potential workplace problems and hazards; identify areas for process improvement to increase safety and productivity; and suggest a focus for safety program development. The extent of the incident/accident investigation shall reflect the seriousness of the incident and will use a root-cause-analysis process. Collected evidence shall be preserved and secured by the Barr Health and Safety Program Manager. Barr Safety staff will conduct the accident investigation and will follow these procedures:

1. Conduct the incident investigation at the scene of the incident/accident (if possible) and complete documentation.

2. Ask the employee involved in the incident and any witnesses, in separate interviews, to describe in their own words exactly what happened.

3. Repeat the employee's version of the event back to the employee and allow the employee to make any corrections or additions.

4. After the employee has given their description of the event, ask appropriate questions that focus on causes. Remind the employee that the purpose of the investigation is to determine the root cause and develop an action plan to prevent reoccurrence.

5. Report findings to Health and Safety Coordinator group who will determine subsequent communications.

6. Prepare lessons-learned communication for all staff.

Accident Review Committee

An Accident Review Committee may be established in the event of an incident necessitating an investigation. Membership on this committee will include the Project/Administrative leadership responsible for the project/subunit, Business/Administrative Staffing Coordinator, Business Unit Health and Safety Coordinator, Branch Office Health and Safety Coordinator (as appropriate), Health and Safety Program manager and project staff, as appropriate. The Accident Review Committee will review the Incident/Accident Investigation form and will recommend corrective measures to the respective business unit leader, safety officer and management team as appropriate. Lessons learned will be documented and communicated in business unit meetings to build staff awareness and prevent reoccurrence of similar events.

FORM 1

INCIDENT/ACCIDENT REPORT FORM

Note: Project/Administrative Managers should complete this form as soon as possible after the occurrence of an incident/accident. Completed form should be sent to Karen Stoller (KSS).

Employee Name: ____

Date & Time of Incident/Accident: ____

Business Unit: ______________________ Job Title: ______________________

Location of Incident/Accident: ____

____

Description of Incident/Accident: ____

____

____

Medical Treatment for Employee: ____

____

Witnesses: ____

Other Relevant Incident/Accident/Employee Information: ______________________

____

____

____

____

____

Form completed by: ______________________ Date: ______________________

ROUTE TO KAREN STOLLER

Section 32: Aerial Lift Safety Program

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Section 32: Aerial Lift Safety Program

1.0 Program

The nature of Barr's business may require that Barr employees work with aerial lifts. An aerial lift is any vehicle-mounted device, telescoping or articulating, or both, which is used to position personnel, including extendible boom platforms, aerial ladders, articulating boom platforms, or vertical towers. Barr staff will work with aerial lifts in accordance with this program and in compliance with client and OSHA requirements (29 CFR 1910.67). This program applies to all powered- or manually-operated personnel lifting devices being operated by Barr staff.

2.0 Operator Certification and Training

Only trained and authorized Barr staff will operate aerial lifts. Barr staff will attend classroom training regarding the safe use of aerial lifts and demonstrate adequate skill operating aerial lifts. This training and certification will be provided by a third party and will cover the following types of aerial lifts:

- **Telescoping:** Scissor lifts and vertical mast lifts. The personnel basket or platform only goes up and down. There are no hinged sections in the boom. This type is generally used indoors.
- **Articulating:** Construction-type lifts. The personnel basket or platform can be maneuvered up, down, over, and sideways. There is one or more hinged boom sections. This type is generally used outdoors.
- **Boom trucks:** The personnel basket or platform is located on a vehicle. There may or may not be hinged boom sections.

Aerial lifts not only sway during use, but bounce as well. Because of this inherent quality, a personal fall arrest system (i.e., full body harness with connecting device attached to the designated anchor point) is required to be used by the operator. The lanyard or connecting device should only be attached to the manufacturer-approved designated anchor point.

Since Barr requires personal fall arrest systems for all use on all aerial lifts, fall protection training is required for all users. Implementation of fall arrest system will use a full body harness and appropriate length lanyard attached to an approved anchor point. Refer to Section P of the Barr Health and Safety Program Manual for further guidelines on fall protection.

3.0 Proper Set-Up

Outriggers must be used, if provided. Outriggers stabilize the lift and help prevent tip over. Many types of lifts will not permit operation unless the outriggers have been set up and the lift is level. If the lift is designed to be used on a slope or incline, the wheels should be chocked to prevent inadvertent movement. When used in high traffic areas (pedestrians or vehicles), the area around the base of the aerial lift must be barricaded as well as the area below the basket. Aerial lifts can tip over if they are not set up on a firm, level surface. Barr staff will avoid using aerial lifts near drop offs, holes, uneven surfaces, in soft soil conditions, on slopes, or where there may be an uneven weight distribution.

Barr staff will operate and use aerial lifts as intended and specified by the manufacturer. If an aerial lift needs to be modified for uses other than those intended by the manufacturer, the manufacturer must provide the modification. This modification will be certified in writing by the manufacturer.

4.0 Maximum Capacity

Barr staff must be familiar with the maximum lifting capacity of their lift. It should be indicated on the lift itself, and may be expressed as pounds or the maximum number of people for the basket. When determining the load, estimate 250 pounds per person on the platform, plus the weight of and any tools, materials, and equipment that will be on the platform as well. The maximum capacity should never be exceeded.

5.0 Daily Inspection

Barr staff will conduct daily inspections of the aerial lift prior to use. Any defects will be reported to the owner of the equipment and the equipment will be placed out of use until repairs have been completed. Repairs will be made by qualified aerial lift technicians only.

When performing daily inspections, Barr staff will complete the Aerial Lift Daily Inspection Checklist (Form AG-1) to check for the following:

- Surroundings (soft ground, holes, drop-offs, ditches, slopes, debris, overhead clearances, power lines, and moving equipment) and weather (wind and lightning)
- Lockout/tagout
- Work zone warning
- Oil, hydraulic oil, coolant, and fuel levels and leaks
- Battery and charger
- Tire pressures and condition of wheels, tires, and lug nuts
- Emergency stop and/or emergency lowering device
- Steering and brakes
- Attachments or accessories
- Warning lights, backup alarm, warning buzzer, and horn
- Lift and travel controls and switches
- Placards, decals, and control ID labels
- Gauges and lights
- Operator’s manual/ANSI
- Handrails, guardrails, safety chains, and fall arrest anchor point
- Platform deck, toe boards, and steps
- Full body harness and correct lanyard or SRL
- Aerial lift certification

6.0 Working Height

The working height of a lift should never be extended by standing on makeshift devices or mid-rails, sitting on the top rail of the platform or bucket, or using ladders. The guardrail system or bucket can only protect personnel if they are within the boundaries of the system. If a lift with a greater reach is necessary, Barr will make arrangements to have one available.

7.0 Fall Protection

All lifts should have fall protection anchor and guardrail systems incorporated into their design. Barr staff should always be within the protective system (i.e., feet firmly on the floor and not over-reaching beyond the guardrail system or climbing on the rails or edge of the basket). Approved personal fall arrests systems (i.e., full body harnesses) are required when working in the boom or basket of an aerial lift.

8.0 Hazards

Barr staff will maintain minimum clearances between electrical lines and aerial lift equipment according to the following voltage guidelines:

Voltage	Minimum Clearance
less than 50 KV	10 feet
50 - 199 KV	15 feet
200 - 349 KV	20 feet
350 - 499 KV	25 feet
500 - 749 KV	35 feet
750 - 1000 KV	45 feet

These clearances apply to any part of the lift, the operator, and any tools, materials, and equipment in use. Additionally, Barr staff will not operate outdoor aerial lifts in adverse weather conditions, such as approaching thunderstorms, winds over the 28 mph ISO wind limit, or lightning in the area.

9.0 Traveling/Moving

In general, lifts are not designed to be moved to another location while the platform or basket is raised. Always lower the platform and, in some instances, exit the lift slowly prior to relocation. If the lift is designed to be driven by to the next work location, it should be done so with the platform low to the ground (2-3 feet). The lift will have a reverse signal alarm above the surrounding noise level or there will be an observer to signal and guide the operator to backup in a safe manner.

10.0 Mechanical Failure

All lifts should have auxiliary (i.e., ground) controls/emergency lower device so that the platform/basket can be safely lowered to the ground in the event that operator platform controls fail or the Barr operator cannot operate basket controls for some reason. Barr staff should never attempt to climb out of the basket or climb down the boom in the event of mechanical failure (unless there are hazardous conditions in the area that warrant immediate action). Ground controls can be operated by another Barr safety monitor, provided that permission is given by the stranded Barr operator. Permission is implied if the Barr operator is unconscious.

11.0 Ground Spotter/Safety Monitor

A ground spotter/safety monitor will be designated by Barr and must be present at all times when lifts are in use. The ground spotter/safety monitor will be responsible for controlling and monitoring the work area/zone and for watching for hazards as the operator is running the lift. In the event of an emergency, the ground spotter/safety monitor may operate ground controls for personnel retrieval.

12.0 Personal Protective Equipment

Hard Hats

Hard hats are required to be worn at all times while in or operating aerial lifts. Barr staff will wear class “G” or “E” hard hats when working with aerial lifts. Where overhead, high voltage, electrical hazards are present, class “E” hard hats will be worn. Hardhats will meet ANSI standards at a minimum.

Eye Protection

Eye protection is required to be worn at all times while in or operating aerial lifts. Suitable protective devices may include safety glasses with side shields, goggles or face shields. Prescription safety glasses will be provided to staff that need vision correction. Protective eyewear will meet ANSI standards at a minimum.

Steel-Toed Boots

Steel-toed boots are required to be worn at all times while in or operating aerial lifts. Steel-toed boots will meet ANSI standards at a minimum.

Form 1

Aerial Lift Daily Inspection Checklist

Instructions: Check box if compliant / Note NA if not applicable / Leave box empty and note below of any problem

Daily Inspection Checklist/Aerial Lift ID #: ____

Employee Name: ______________________________ **Date:** ___________________________

General Conditions:

_______ Lockout/Tagout
_______ Site specific rules and regulations
_______ Weather – wind (operation prohibited at 28 mph I.S.O. wind limit) and lightning
_______ Surroundings – soft ground, holes, drop-offs, ditches, slopes (verify maximum operation), debris, overhead clearances, power lines (less than 50 KV – 10 feet; 50 to 199 KV – 15 feet; 200 to 349 KV – 20 feet; 350 to 499 KV – 25 feet; 500 to 749 KV – 35 feet; 750 to 1000 KV – 45 feet), and moving equipment
______ Set up work zone warning

Vehicle Inspection:

_______ Oil level
_______ Hydraulic oil level
_______ Fuel level
_______ Tire pressures and condition of wheels, tires, and lug nuts
_______ Emergency stop and/or emergency lowering device
______ Coolant level
______ Battery and charger
______ Check the lift and surrounding area for leaks

Operations and Platform Lift Equipment Inspection:

Ground	Platform	
_______	_______	Steering
_______	_______	Attachments or accessories
_______	_______	Warning lights
_______	_______	Backup alarm or warning buzzer
_______	_______	Lift and travel controls and switches
_______	_______	Placards, decals, and control ID labels
_______	_______	Horn
_______	_______	Gauges
_______	_______	Lights
_______	_______	Brakes
_______	_______	Operator's manual/ANSI (by law)
	_______	Handrails, guardrails, safety chains, and fall arrest anchor point
	_______	Platform deck, toe boards, and steps

Fall Protection and Aerial Lift Certification:

_______ Full body harness
_______ Correct lanyard or SRL (anchor points may vary – see Platform Equipment)
______ Correct aerial lift certification

If the aerial lift fails any part of this inspection, remove the key and report the problem to the equipment owner. Repairs will be made by a qualified and authorized service person.
Record any malfunctions, damages, or problems here:

____

____

Section 33: Benzene Exposure Control Program

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Section 33: Benzene Exposure Control Program

1.0 Purpose

This Exposure Control Program has been prepared to meet the requirements of OSHA Benzene Standard, 29 CRF 1910.1028. This program is accessible to all affected Barr staff through the company published safety program manual. The purpose of this exposure control program is to:

- Protect employees from hazards associated with benzene and maintain benzene personal exposures below the regulatory limits.
- Comply with the OSHA Benzene Standard, 29 CRF 1910.1028 where work practices may expose staff to benzene at or above benzene action levels.

This program is applicable to work operations where benzene is present in 0.1% or greater concentration in a mixture and there is potential for exposure at or above the benzene action level (29 CFR 1910.1028(a)(2)(v)).

2.0 Responsibilities

Barr Health and Safety Program Manager is responsible for:

- developing and implementing the Benzene Exposure Control Program (Program)
- reviewing and updating the program annually or as deemed necessary;
- monitoring compliance with the OSHA Standard, 29 CFR 1910.1028;
- providing general benzene awareness safety training to staff covered by this Program;
- conducting exposure assessments and evaluating exposure control measures as necessary for staff covered by this Program;
- investigating incidents related to benzene exposure; and
- maintaining employee benzene exposure records.

Barr Project Managers are responsible for:

- project compliance with all the procedures outlined in this program, including staff training for staff who have the potential for benzene exposure above the benzene action level.

Barr Employees are required to:

- understanding the Barr Benzene Exposure Control Program;

- reporting incidents related to benzene exposure; and
- using personal protective equipment and utilizing engineering controls when recommended and provided.

3.0 Hazard Data

Benzene exposure has been associated with aplastic anemia and blood cancer. Benzene can affect the human body through inhalation, skin/eye contact or accidental ingestion. Benzene has a pleasant, sweet odor, but the odor does not provide adequate warning of its hazard. Exposure levels to benzene determine the type and degree of health effects.

3.1 Acute Health Effects

Inhalation. Exposure to high concentrations of benzene may cause breathlessness, irritability, euphoria, headache, dizziness, nausea, intoxication or giddiness. It may cause severe irritation of the eyes, nose and respiratory tract. Severe exposures can lead to convulsions and loss of consciousness. Aspiration of small amounts of liquid benzene into the lungs immediately causes pulmonary edema and hemorrhage of pulmonary tissue.

Skin Absorption/Eye Contact. Contact with benzene may cause severe irritation of the skin and eyes. Benzene can be absorbed into the skin and cause dermatitis and erythema. Direct eye contact may result in temporary corneal damage.

Ingestion. Benzene ingestion may cause nausea, vomiting, headache, dizziness and gastrointestinal irritation.

3.2 Chronic Health Effects

Chronic exposure to benzene may cause various blood disorders, ranging from aplastic anemia to leukemia (blood cancer) that may appear over a relatively long period of time, usually after repeated and prolonged exposure to benzene above the OSHA permissible exposure limit (PEL). Benzene has caused cancer in humans such as myeloid leukemia, acute lymphocytic and/or myelogenous leukemia, hairy cell leukemia, myelodysplastic syndrome, Hodgkin’s disease and lymphomas. The hematopoietic (blood forming) system is the chief target for benzene’s chronic toxic effects.

3.3 Physical Hazards

Benzene poses a serious fire and explosion hazard when exposed to heat or flame. Benzene vapor is heavier than air and may collect in low areas. Vapors can also travel for some distance and may come into contact with ignition sources. The flame may then be propagated along the vapor trail back to the source and cause an explosion.

4.0 Permissible Exposure Limits

OSHA has issued several types of limits for employee exposures to trigger various regulatory requirements. These are specified as the action level (AL), the 8-hour time-weighted average permissible exposure limit (PEL), and the short-term exposure limit (STEL).

Exposure limits are specified in the Benzene Standard (29 CFR 1910.1028).

5.0 Employee Exposure Assessments

Whenever benzene is present at a worksite in concentrations equal to or greater than 0.1% in a mixture and there is the potential for exposure at or above the benzene action level, the Barr Health and Safety Program Manager or Project Manager will monitor the air to determine employee exposures. Measurements of employee exposures will be representative of a full shift or STEL, and will be taken for each job classification in each work area.

If employee exposures are found to be at or above the benzene action level but below the PEL, Barr’s Health and Safety Manager or Project Manager will repeat air monitoring annually. If exposures are above the PEL, air monitoring will be conducted every 6 months. If exposures are above the STEL, air monitoring will be conducted at least once per year. Monitoring will continue until exposures can be reduced below these levels by engineering or administrative controls.

Air monitoring will be conducted promptly in a work area if employees are experiencing signs or symptoms of benzene exposure. Air monitoring will be repeated in an area each time there is a change in equipment, processes or controls which may result in additional exposure to benzene. Barr's Health and Safety Program Manager must be notified to conduct this monitoring.

6.0 Reducing Employee Exposure to Benzene

When benzene exposures are over the PEL, Barr's Health and Safety Program Manager will establish and implement a written plan to reduce employee exposure to or below the PEL. Engineering and work practice controls will be the primary method to reduce exposure. Barr's written plan will include a schedule for development and implementation of engineering and work practice controls. The Barr Health and Safety Program Manager will keep the plan current by reviewing and revising the plan as determined appropriate based on the most recent exposure monitoring data.

6.1 Substitution

When possible, substitution of a less hazardous chemical or process will be used to reduce or eliminate benzene exposures.

6.2. Engineering Controls and Administrative Controls

Barr will utilize engineering and work practice controls to eliminate or minimize benzene exposure to employees at or below the permissible exposure limits. Where occupational exposure remains after institution of these controls, respiratory protection shall be utilized.

If engineering controls cannot be implemented, alteration of work practices will be used to reduce exposures to benzene. This could include limiting the amount of time employees spend working in high exposure areas by rotating personnel.

6.3 Personal Protective Equipment (PPE)

PPE is provided to Barr employees at no cost and meets the requirements of 29 CFR 1910.133. Contact with the eyes or skin with liquids or soils containing benzene will be prevented by the use of protective garments and equipment which are impervious to benzene. The Barr Health and Safety Program Manager will provide guidance on the appropriate PPE needed to minimize exposure.

If employee exposures are found to exceed the PEL or STEL, NIOSH approved respirators will be provided until feasible engineering or administrative controls can be implemented. Respirator protection is required when engineering controls and work practices are not feasible and in emergencies. Barr personnel will follow Barr's written respiratory protection program which meets the requirements of 29 CRF 1910.134. Respirator use and type will be determined by the Barr Health and Safety Program Manager, based on air monitoring results or condition of use. If respirator use is necessary, employees are required to be medically cleared by a physician to wear a respirator, fit-tested and trained by the Barr Health and Safety Program Manager before using a respirator.

Barr staff will not work in areas where the benzene concentration is unknown or greater than 1,000 ppm, and where full body protective clothing and Self-Contained Breathing Apparatus (SCBA) or supplied air respirators are required.

All PPE must be inspected by Barr employees prior to each use. PPE must be stored in a clean and sanitary manner. Respirators should be inspected by supervisors each month to ensure they are being used, stored and cleaned properly.

7.0 Communication of Benzene Hazards to Employees

7.1 Regulated Areas at Client Sites

Barr staff will not enter a client's regulated area unless in compliance with the client's and Barr's program.

7.2 Employee Information and Training

Barr employees are provided with information and training at the time of the initial assignment to a work area where benzene is present in 0.1% or greater concentration in a mixture and there is potential for exposure at or above the benzene action level. If exposure limits are above the benzene action level, Barr employees will be provided with information and training annually. Barr's training program is in accordance with the requirements of 29 CFR 1910.1200(h) (1) and (2), and will include specific information on benzene when benzene is present in 0.1% or greater concentration in a mixture and there is potential for exposure at or above the benzene action level. Barr's training program also meets the requirements of 29 CFR 1910.1028.

This training will be conducted whenever work begins on a site where benzene is present in 0.1% or greater concentration in a mixture and there is potential for exposure at or above the action level, when an employee transfers to another job where benzene is present in 0.1% or greater concentration in a mixture and there is potential for exposure at or above the action level, and whenever an employee demonstrates behavior that indicates a lack of understanding of the safe handling of benzene.

Project Managers are responsible for ensuring that project staff with potential exposure to benzene at or above the action level receive the appropriate training from the Barr Health and Safety Program Manager prior to working with the substance. All training is documented and records are maintained by the Barr Health and Safety Program Manager.

8.0 Medical Surveillance

Employees found to have benzene exposures that exceed the benzene action level for 30 or more days per year, above the PEL and/or the STEL for ten or more days per year or more than 10 ppm of benzene for 30 or more days in a year prior to the effective date of the standard when employed by Barr, are included in a medical surveillance program. These employees are required to complete a medical questionnaire annually and receive a physical examination by a physician. The physical includes blood tests to determine if any blood disorders may exist.

Employees exposed to benzene where it is present in 0.1% or greater concentration in a mixture and there is potential for exposure at or above the action level are required to receive medical attention under the following circumstances:

- whenever an employee has developed signs or symptoms associated with exposure to benzene; and/or
- whenever an employee is involved in a spill, leak or other occurrence resulting in a possible overexposure to benzene.

If any of three specific blood abnormalities are found as a result of blood tests, the employee will be referred to a hematologist or internist by a physician. The employee will also be removed from work areas where benzene exposures exceed the action level, PEL or STEL for the duration recommended by the physician and hematologist. If physician determines that the symptoms may be the result of a possible overexposure, the Barr Health and Safety Program Manager will evaluate the work area to determine if further control measures are necessary.

Section 34: Asbestos Awareness Program

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Section 34: Asbestos Awareness Program

1.0 Purpose

Bar Engineering has developed this program to help staff recognize where job assignments may involve potential exposure to asbestos containing materials (ACM). The purpose of this program is to:

- Protect employees from hazards associated with asbestos or ACM and maintain asbestos exposures below the regulatory limits.
- Comply with the OSHA Asbestos Standard, 29 CFR 1910.1001 for any work that might expose staff to asbestos or ACM.

This program is applicable to all employees who may be exposed to asbestos, including employees who may perform housekeeping activities during and after construction activities.

2.0 Hazard Data

Inhalation to asbestos may cause asbestosis, resulting in loss of lung function. It may also cause cancer of the lung and other diseases, such as mesothelioma, a disease of the pleura of the lungs.

3.0 Permissible Exposure Limits

OSHA has promulgated asbestos permissible exposure limits (PELs) an 8-hour time-weighted average (TWA) of 0.1 fiber per cubic centimeter of air and a short-term exposure limit (STEL) is 1 fiber per cubic centimeter of air (averaged over a sampling period of 30 minutes).

4.0 Reducing Employee Exposure to Asbestos

The Barr Project Manager and Barr Health and Safety staff will conduct an initial assessment when ACM is suspected to be present on a project work site. Based on this assessment, engineering and work practice controls shall be used to eliminate or minimize exposure whenever possible as a first line of defense. When controls fail to reduce exposure, the appropriate PPE (coveralls, gloves, head coverings, foot coverings, face shields, vented goggles and/or respirators) will be selected and provided to employees at no cost. Information on available PPE and their limitations will be provided to employees. PPE guidelines and procedures are described in *Section F: Personal Protective Equipment (PPE) Program* of this Manual.

NIOSH approved respirators and powered, air-purifying respirators will be made available to staff and used when engineering and work practice controls cannot reduce exposure. Respirators may also be used in emergency situations. Respiratory protection is described in *Section G: Respirator Program* of this Manual.

If applicable or if the TWA and/or STEL are exceeded, project specific site plans shall address possible locations where employees may become exposed to ACM on a project site and describe engineering controls, recommended work practices and personal protective equipment use. When applicable, the plan will require air monitoring using breathing zone air samples (8-hour TWA and 30-minute STEL). Air monitoring will be documented to demonstrate staff are not exposed to airborne concentration of asbestos in excess of 1.0 fiber per cubic centimeter of air in 30 minutes or time weighted average of 0.1 fiber per cubic centimeter. Areas that exceed these limits will be regulated and access will be limited. Signs/labels that meet OSHA requirements will be posted in regulated areas. Barr employees shall abide to all warning signs/labels and use caution so as not to disturb any ACM when working at client sites. Sampling of suspect ACM will be conducted by qualified staff.

5.0 Communication of Asbestos Hazards to Employees

Asbestos awareness training is required prior to the project work and annually thereafter for any Barr employee who may be exposed to ACM while working at a client site. The training will include the health effects associated with exposure to asbestos, and information regarding the relationship between smoking and exposure to asbestos. All training will be documented and the employee will receive a certificate upon completion.

Project Managers are responsible for making sure that employees with potential exposure to ACM receive the appropriate training prior to working in those areas. Additionally, project managers are responsible for making sure that employees are aware of and will follow provisions of client site specific contingency plans.

Section 35: Fall Protection

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Attachments

Preamble

Barr’s approach to *fall protection* is described in Sections 1.0, 2.0, and 3.0. Equipment and related inspection is described in Section 4.0. Training requirements are provided in Section 5.0. Accident investigation procedures are described in Section 6.0. Definitions of applicable terms identified in *italics* are provided in Section 7.0.

Section 35: Fall Protection

1.0 Introduction

1.1 Policy Statement

Barr’s safety policy is to take every reasonable precaution to protect the health and safety of employees. Implicit in the safety policy is the requirement that employees shall use effective *fall protection* systems when working in any situation that presents a foreseeable exposure to a *fall hazard*.[1]

1.2 Approach

Safety planning for *fall protection* components of a project should start with the “tiered” concept described in Section 2.0 and be developed in accordance with the flowchart in Section 3.0. The flowchart begins with the identification of a *fall hazard* and provides associated mitigation options. Once a *fall protection* system has been selected, a Fall Protection Site Specific Checklist should be completed and can be found in Attachment 1.

1.3 Content

This program describes the use of *fall protection* systems at Barr. The purpose of this program is to provide protection to staff from *fall hazards* with the general approach defined in ANSI/ASSE Z359.2-2007. It should be noted that the program does not conform specifically to the requirements of ANSI/ASSE Z359.2-2007 because strict adherence is not feasible (i.e. the standard is developed primarily for an owner and not necessarily a consultant that typically performs “non-routine” tasks). However, the general approach of ensuring a proactive approach to *fall protection* has been incorporated, where applicable.

The following conditions are examples for when *fall protection* should be used.

- Working at a location where a fall of four (4) feet or more is possible or other *fall hazards* exist.

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[1] “Policies, Duties, and Training”, ANSI/ASSE Z359.2-2007.

- Working from elevated platform/bucket on an *Aerial Lift*.
- Performing work on a ladder or working around unprotected sides of scaffold.
- Working above dangerous equipment to prevent falling into or onto dangerous equipment.
- Working within a confined space or excavation where access is only from above.

2.0 Hierarchy of Fall Protection

Barr's approach[2] to *fall protection* involves a "tiered" system of finding the safest way to complete work tasks while mitigating *fall hazards* in accordance with the flowchart in Section 3.0.

Tier 1 – Elimination or Substitution

The best method available to complete a work task is to remove the *fall hazard*. Examples of this include moving the work task to a different location or changing the access method entirely.

Tier 2 – Passive Fall Protection Systems

If *fall hazards* cannot be eliminated entirely, the next best method is the use of *passive fall protection systems*. These systems are designed to isolate persons from *fall hazards*. Examples of this include the use of *guardrails* at a rooftop edge.

Tier 3 – Fall Restraint Systems

If *passive fall protection systems* are not available, the use of *fall restraint systems* should be considered for implementation. These systems consist of equipment design to prevent a person from reaching a *fall hazard*.

Tier 4 – Fall Arrest Systems

If all of the mitigation systems described in the preceding sections are determined to be unavailable or not feasible, *fall arrest systems* should be considered. These systems generally consist of equipment designed to stop a fall of a person after a fall has begun.

Additional mitigating systems are allowed by OSHA (29 Code of Federal Regulations, Subpart M, 1926). However, Barr expects that *fall protection* described above can be used and other mitigating systems (i.e. warning line systems, controlled access zones, safety monitoring systems, etc.) will not be required. If these systems are believed to be required, further evaluation should be completed in consultation with a Health and Safety Coordinator and a *Competent Person*.

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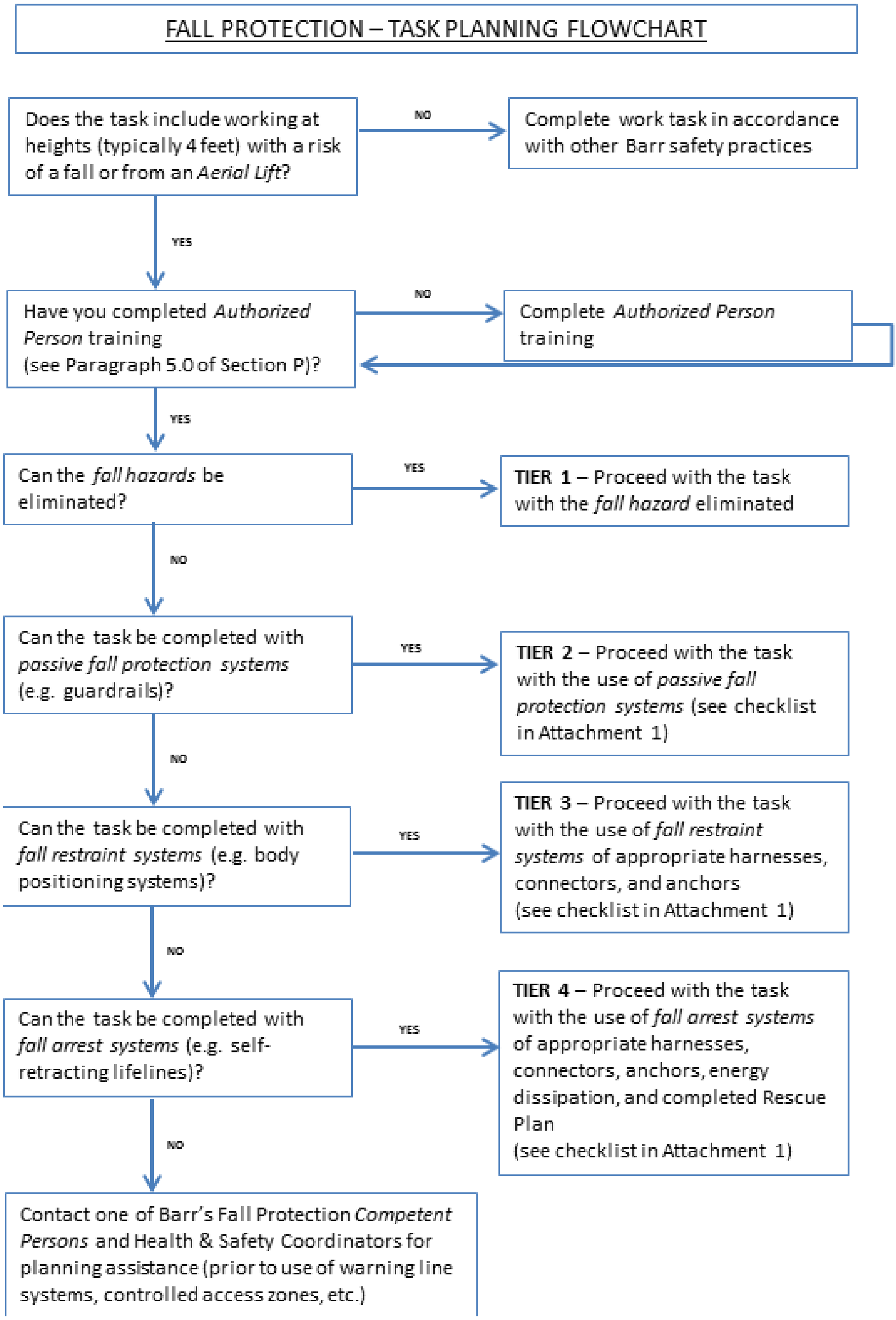
[2] "Fall Protection – Competent Person Course", Document ID 9700263, Rev. E, Capital Safety 2011. (P. 4)

3.0 Fall Protection Project Safety Planning

Safety planning for *fall protection* components of a project should start with the flowchart shown in Figure 1 below.



FALL PROTECTION – TASK PLANNING FLOWCHART

Does the task include working at heights (typically 4 feet) with a risk of a fall or from an *Aerial Lift*?

Complete work task in accordance with other Barr safety practices

Have you completed *Authorized Person* training (see Paragraph 5.0 of Section P)?

Complete *Authorized Person* training

Can the *fall hazards* be eliminated?

TIER 1 – Proceed with the task with the *fall hazard* eliminated

Can the task be completed with *passive fall protection systems* (e.g. guardrails)?

TIER 2 – Proceed with the task with the use of *passive fall protection systems* (see checklist in Attachment 1)

Can the task be completed with *fall restraint systems* (e.g. body positioning systems)?

TIER 3 – Proceed with the task with the use of *fall restraint systems* of appropriate harnesses, connectors, and anchors (see checklist in Attachment 1)

Can the task be completed with *fall arrest systems* (e.g. self-retracting lifelines)?

TIER 4 – Proceed with the task with the use of *fall arrest systems* of appropriate harnesses, connectors, anchors, energy dissipation, and completed Rescue Plan (see checklist in Attachment 1)

Contact one of Barr's Fall Protection *Competent Persons* and Health & Safety Coordinators for planning assistance (prior to use of warning line systems, controlled access zones, etc.)

Figure 1 – Fall Protection Task Planning Flowchart

3.1 Planning Documents

The Fall Protection Site Specific Checklist should be prepared by an *Authorized Person* in consultation with a Health and Safety Coordinator or a *Competent Person* and developed specifically for the site where the work will be performed. Any changes to the Fall Protection Site Specific Checklist should be approved by a *Competent Person*. A copy of the Fall Protection Site Specific Checklist, with all approved changes, should be maintained at the job site.

3.2 Importance of Rescue Consideration

A worker who has fallen may suffer from suspension trauma while hanging in a harness. Suspension trauma, also known as harness-induced pathology, occurs when the leg straps of a harness constrict the veins, causing blood to pool in the legs. This condition is caused by lack of motion in the lower portion of the body. The muscles are not contracting on the veins and therefore cannot help circulate blood back to the heart. Suspension trauma does not always result in long-term injuries. In fact, there have been documented cases of workers who have been suspended for over an hour and, when rescued, were in good health. But the very real possibility of suspension trauma necessitates getting fallen workers to the ground in a timely manner.[3]

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3 “Fall Protection – Competent Person Course”, Document ID 9700263, Rev. E, Capital Safety 2011. (P. 51)

4.0 Equipment and Inspection

4.1 Typical Equipment

The typical equipment that is used is described in more detail in the following sections. Equipment described below and used by Barr staff should meet or exceed the requirements identified in ANSI/ASSE Z359-2007.

Full Body Harness

Straps which may be secured about the employee in a manner that will distribute the fall arrest forces over at least the thighs, pelvis, waist, chest and shoulders with means for attaching it to other components of a personal *fall arrest system*. All harnesses should be equipped with suspension trauma straps.

Lanyard

A flexible line of rope, wire rope, or strap which generally has a connector at each end for connecting the body belt or body harness to a deceleration device, lifeline, or anchorage.

Tie-Off Adapter

A device in which is used to connect parts of the personal fall arrest system to an anchorage point. These are typically a strap or wire rope.

Snap Hook

A connector comprised of a hook-shaped member with a normally closed keeper, or similar arrangement, which may be opened to permit the hook to receive an object and, when released, automatically closes to retain the object.

Carabiner

A metal loop with a spring-hinged side that can quickly connect and disconnect components in a safety system.

Self-Retracing Lifeline/Lanyard

A deceleration device containing a drum-wound line which can be slowly extracted from, or retracted onto, the drum under slight tension during normal employee movement, and which, after onset of a fall, automatically locks the drum and arrests the fall.

Lifeline

A component consisting of a flexible line for connection to an anchorage at one end to hang vertically (vertical lifeline), or for connection to anchorages at both ends to stretch horizontally (horizontal lifeline), and which serves as a means for connecting other components of a personal fall arrest system to the anchorage.

Rope Grab

A deceleration device which travels on a lifeline and automatically, by friction, engages the lifeline and locks so as to arrest the fall of an employee. A rope grab usually employs the principle of inertial locking, cam/level locking, or both.

Retrieval

A device that typically applies a mechanical advantage to allow lifting or lowering of suspended personnel.

4.2 Inspections

Inspections of *fall protection* equipment should be completed on a 6-month basis by a *Competent Inspector* and before use by each user.

5.0 Fall Protection Training

5.1 Training

Fall protection training will be provided to Barr staff that will be exposed to *fall hazards*. Three types of training related to *fall protection* are currently offered and include *Authorized Person*, *Competent Person*, and *Competent Inspector*. These training offerings are described in more detail in the following sections.

Authorized Person

This training is intended for individuals who will be working at heights or exposed to *fall hazards* and can be documented in the training checklist found in Attachment 2. The minimum initial training to be considered an *Authorized Person* will consist of an in-person training session with a non-Barr training vendor.

When projects require Barr staff to work without access to an in-person training session, a 1-hour training video can be viewed in conjunction with a site-specific discussion with a Barr *Competent Person*. This will qualify the individual to work on a specific project with a previously trained *Authorized Person* after a project-specific discussion with a *Competent Person*.

Training will cover the elements listed below:

- General nature of *fall hazards* on Barr projects.
- Correct procedures for selecting *fall protection* equipment.
- Correct procedures for erecting, operating, and disassembling the *fall protection* equipment used.
- Correct procedures for the inspection, handling, and storage of *fall protection* equipment used.

Training for all staff qualified as an *Authorized Person* is required on an annual basis.

Competent Person

This training is intended for individuals who will be consulting on projects where *Authorized Persons* will be working. The minimum initial training to be considered a *Competent Person* will consist of a 2.5 day training session with a non-Barr training vendor.

Training will cover the elements listed below:

- General nature of *fall hazards* on Barr projects.
- Correct procedures for selecting *fall protection* equipment.
- Correct procedures for erecting, operating, and disassembling the *fall protection* equipment used.
- Correct procedures for the inspection, handling, and storage of *fall protection* equipment used.
- Correct procedures for the supervision of *Authorized Persons.*

A 1-day refresher training for all staff qualified as a *Competent Person* is required on 2-year basis.

A list of Barr staff who have completed the *Competent Person* training can be found in Attachment 3.

Competent Inspector

This training is intended for individuals who will inspect *Fall Protection* equipment. The minimum initial training to be considered a *Competent Inspector* will consist of a 4-hour training session with a non-Barr training vendor.

Training will cover the elements listed below:

- Correct procedures for establishing inspection programs.
- Correct procedures for the inspection, handling, and storage of *fall protection* equipment used.

A refresher training for all staff qualified as a *Competent Inspector* is required on a 2-year basis.

A list of Barr staff who have completed the *Competent Inspector* training can be found in Attachment 3.

5.2 Training Documentation

Records of training will be recorded in Barr’s Human Resources Information System and will include their name, the date of training, and the specific type of *Fall Protection* training.

6.0 Accident Investigation

In the event an employee falls or some other related serious incident occurs (e.g., a near miss), Barr will investigate the circumstances of the fall or other incident to determine if the *fall protection* program described herein needs to be changed (e.g., new practices, procedures, or training) and will implement those changes to prevent similar types of falls or incidents.

A link to Barr's investigation practices can be found **here** (*link not currently active*).

7.0 Fall Protection Definitions

Aerial Lift – A vehicle which is used to position personnel that contains mechanized components such as telescoping boom platforms.

Authorized Person – Individuals who have completed training described in Section 5.0 and will be working at heights or exposed to *fall hazards*.

Competent Person – Individuals who have completed training described in Section 5.0 and will be consulting on projects where *Authorized Persons* will be working.

Competent Inspector – Individuals who have completed training described in Section 5.0 and will be inspecting *Fall Protection* equipment.

Fall Arrest Systems – A system of equipment that complies with the requirements of OSHA 1926.502(d). Generally these systems consist of a full body harness, energy dissipation equipment, equipment connectors, and an anchorage point.

Fall Hazards – Anything in a working area that could cause a worker to lose proper balance or bodily support and result in a fall.

Fall Protection [4] – The methods used to minimize injury and the associated costs, both human and monetary, due to falls.

Fall Restraint Systems – A system of equipment that restrict the travel of a worker so that the potential for a fall does not exist.

Guardrail – A system of barriers that complies with the requirements of OSHA 1926.502(b).

Passive Fall Protection Systems – *Guardrails* or other barriers that isolate workers from *fall hazards*.

---

[4] “Fall Protection – Competent Person Course”, Document ID 9700263, Rev. E, Capital Safety 2011. (P. 5)

FALL PROTECTION SITE SPECIFIC CHECKLIST

Project Information

Project Name: ____Date: _______________

Project Number: __________________________Participant(s) Initials: _____________________________

HSC/Competent Person's Name: __________________________Contact Info: ______________________

Site Location: ____

Specific Area: ____Elevation: ___________

#1 Phone Location: ______________________________#2 Phone Location: ________________________

Emergency Site Contact Info: ____

General

- ☐ Individuals participating in project tasks have completed *Authorized Person* training.
- ☐ Full-body harnesses and site-appropriate Personal Protective Equipment is being used.
- ☐ The Fall Protection Task Planning Flowchart has been reviewed.

Passive Fall Protection Systems (if used or N/A ☐)

- ☐ Guardrail systems are installed.

Fall Restraint Systems (if used or N/A ☐)

- ☐ Equipment has been inspected within the last 6 months by a Barr competent inspector and documented on equipment.
- ☐ Equipment has been inspected by the user prior to use.
- ☐ Equipment is able to restrict travel of workers from falling to lower levels (e.g. 6-foot lanyard anchor 10-feet from a roof edge).
- ☐ Anchor points meet requirements for fall restraint use (i.e. 1,000 lbs or twice the anticipated load).

List equipment used ____

Fall Arrest Systems (if used or N/A ☐)

- ☐ Equipment has been inspected within the last 6 months by a Barr competent inspector (as documented on equipment).
- ☐ Equipment has been inspected by the user prior to use.
- ☐ Anchor points meet requirements for fall arrest use (i.e. 5,000 lbs per employee or engineered with a safety factor of two).

☐ A Rescue Plan has been developed (see next section) with multiple rescue methods [e.g. self rescue, assisted, mechanically aided, assisted (high angle)] that can be completed promptly after a fall event.

☐ Energy dissipation has been incorporated (e.g. self-retracting lifelines, shock absorbers, etc.) into the fall arrest system.

☐ Appropriate connectors are being used (e.g. auto-locking, certified for 5,000 lbs).

☐ Fall clearances have been evaluated (by fall distance calculations) and determined acceptable for the proposed fall arrest system.

Fall clearance _____feet Fall arrest distance _____feet

☐ Swing fall dangers have been eliminated for the proposed fall arrest system.

List equipment used ____

____

Rescue Plan (if used or N/A ☐) Hierarchy Discussion

Types

☐ 1. Self rescue will be utilized as a primary method of rescue. This method generally consists of a fallen worker climbing back up to the level from where the fall occurred.

☐ 2. Assisted rescue will be utilized as an alternate method of rescue. This method generally consists of a fallen worker being escorted to a safe area by a co-worker.

☐ 3. Mechanically aided rescue will be utilized as an alternate method of rescue. This method generally consists of a fallen worker being moved by mechanical devices (i.e. pulleys, aerial lifts, etc.) while still alert, without another worker using fall protection.

☐ 4. Assisted rescue (high angle rescue) will be utilized as an alternate method of rescue. This generally consists of a fallen worker being moved by mechanical devices (i.e. pulleys, aerial lifts, etc.) while un-alert or unconscious, with another worker using fall protection.

List rescue equipment and location (examples: lifts, ladders, rescue systems) __________

____

Timing

☐ A fallen worker can be rescued promptly after a fall event with use of the rescue plan hierarchy.

☐ Employees have discussed the individual stepwise procedures involved in the rescue types.

Equipment Training

☐ Employees have project specific equipment training.

FALL PROTECTION AUTHORIZED PERSON TRAINING CHECKLIST

Employee Information

Name: ____________________________ Date: _____________________________

Business Unit: ______________________ Office: ____________________________

Preferred Training Method

The *Preferred Training Method* is intended for individuals who will be working at heights or exposed to *fall hazards*. The minimum initial training to be considered an *Authorized Person* will consist of in-person training session conducted at a Barr office.

☐ Employee has completed in-person training session with a non-Barr training vendor

Employee initials _____________

Alternate Training Method

When projects require Barr staff to work without access to the *Preferred Training Method* the individual can be qualified to work on a project through the *Alternate Training Method* with another *Authorized Person* current on being trained through the *Preferred Training Method*. The *Alternate Training Method* shall consist of the following:

☐ View 1-hour training video followed by Q and A and a site-specific discussion with a Barr *Competent Person*

Barr *Competent Person* initials _____________

☐ Hands on demonstration with a Barr *Competent Person* of fall protection equipment expected to be used on project work. Demonstration shall occur at Barr office or Barr field office

Barr *Competent Person* initials _____________

☐ Complete project work using buddy system with *Authorized Person* current on being trained through the *Preferred Training Method*

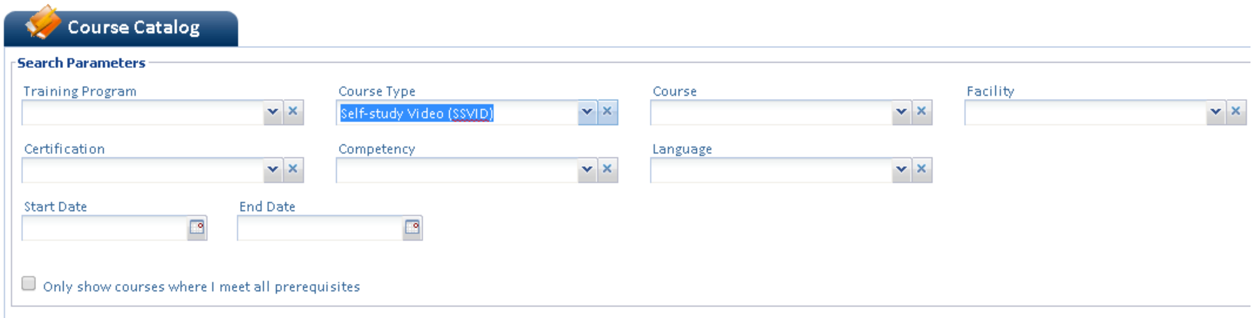
Buddy initials _____________

☐ Plan to attend the next scheduled Fall Protection Authorized Person training session on Training date _________

Finding the 1-hour Alternate Training Method training video:

- Go to **HRIS Employee Self Service**: http://hrisweb/BE2600Prod/default.aspx?Tab=626605ff-30e8-4cc0-9cfa-5bd75d08dab1

- Go to the **Course Catalog** section and search **Self Study Video (SSVID)** under the **Course Type** drop down menu :



Course Catalog

Search Parameters

Training Program:

Course Type: Self-study Video (SSVID)

Course:

Facility:

Certification:

Competency:

Language:

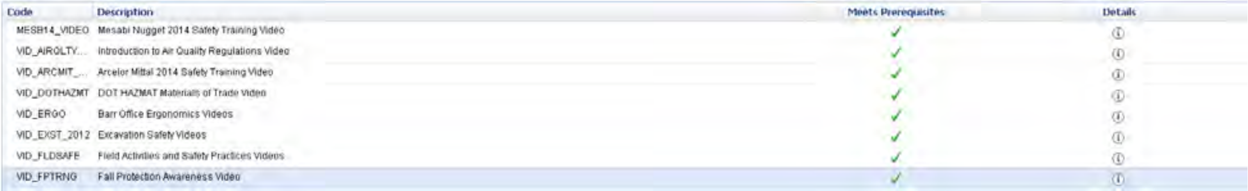
Start Date:

End Date:

☐ Only show courses where I meet all prerequisites

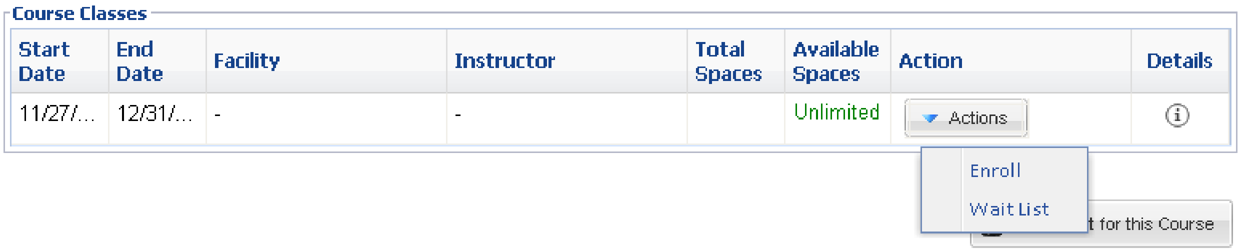
- Click **Search** in the far right corner of the **Course Catalog** section

- Select the **Fall Protection Awareness Video** and click on the **Details** icon:



Code	Description	Meets Prerequisites	Details
MESB14_VIDEO	Mesabi Nugget 2014 Safety Training Video	✓	ⓘ
VID_AIRQLTY...	Introduction to Air Quality Regulations Video	✓	ⓘ
VID_ARCMIT_...	Arcelor Mittal 2014 Safety Training Video	✓	ⓘ
VID_DOTHAZMT	DOT HAZMAT Materials of Trade Video	✓	ⓘ
VID_ERGO	Barr Office Ergonomics Videos	✓	ⓘ
VID_EXST_2012	Excavation Safety Videos	✓	ⓘ
VID_FLDSAFE	Field Activities and Safety Practices Videos	✓	ⓘ
VID_FPTRNG	Fall Protection Awareness Video	✓	ⓘ

- Click **Actions** on the pop-up screen and then **Enroll**:

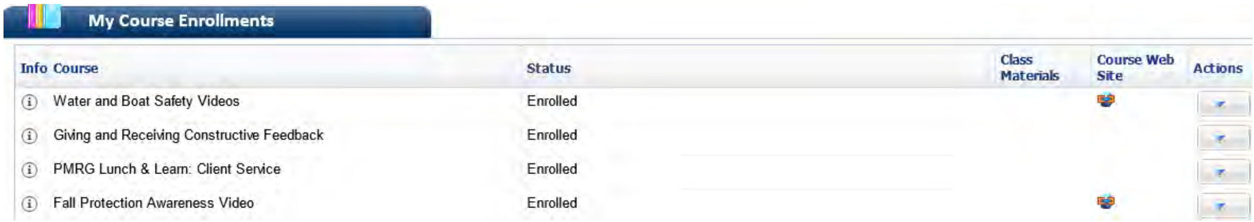


Course Classes

Start Date	End Date	Facility	Instructor	Total Spaces	Available Spaces	Action	Details
11/27/...	12/31/...	-	-		Unlimited	Actions	ⓘ

- Click **Submit** on the next pop-up screen and **Yes**:

- Go back to **HRIS Employee Self Service** and click the **Course Web Site** icon under **My Course Enrollments**:



My Course Enrollments

Info	Course	Status	Class Materials	Course Web Site	Actions
ⓘ	Water and Boat Safety Videos	Enrolled		●	▾
ⓘ	Giving and Receiving Constructive Feedback	Enrolled			▾
ⓘ	PMRG Lunch & Learn: Client Service	Enrolled			▾
ⓘ	Fall Protection Awareness Video	Enrolled		●	▾

- Enter your Barr login credentials and watch the video(s)

FALL PROTECTION – LIST OF PERSONNEL

Competent Person

- ☐ Brian Tri (Minneapolis Office)
  btri@barr.com
  952-832-2637
- ☐ Christopher Marr (Minneapolis Office)
  cmarr@barr.com
  952-842-3525
- ☐ Thomas Leier (Hibbing Office)
  tleier@barr.com
  218-262-8679
- ☐ Jason Saari (Hibbing Office)
  jsaari@barr.com
  218-262-8637
- ☐ Kevin Miller (Hibbing Office)
  kmiller@barr.com
  952-832-8677
- ☐ Pete Lawless (Edina Field Office)
  plawless@barr.com
  952-832-2607

Competent Inspector

- ☐ Pete Lawless (Edina Field Office)
  plawless@barr.com
  952-832-2607
- ☐ Jason Saari (Hibbing Office)
  jsaari@barr.com
  218-262-8637

Section 36: Lead Awareness Program

1.0 Introduction

Barr Engineering has developed this program to help provide lead awareness when working on job assignments where there is a potential for exposure. Potential locations where employees could be exposed to lead include demolition projects. In addition, employees should be aware and follow the provisions of site specific contingency plans.

Table 1 provides lead awareness information.

Table 1. Lead Awareness Information

Parameter	**Lead**
Lead definition (OSHA 29 CFR 1910.1025 (b))	Lead is defined as metallic lead (CAS#7439-92-2), all inorganic lead compounds, and organic lead soaps. All other organic lead compounds are excluded from this definition.
Appearance & Color	A heavy, ductile, soft gray metal
Boiling Point (760 mm Hg)	3164ºF (1740ºC)
Conditions to Avoid	Avoid contact with oxidizers (such as perchlorates, peroxides, permanganates, chlorates and nitrates), and chemically active metals (such as potassium, sodium, magnesium, zinc) as violent reactions may occur.
Flash Point (closed cup)	Non-combustible in bulk form. Dusts can be moderately explosive when exposed to heat or flame.
Hazardous Decomposition Byproducts	Highly toxic lead fumes
Vapor Pressure at 1832ºF (1000ºC)	1.77 mm Hg
Incompatibilities	Strong oxidizers, hydrogen peroxide and acids. Ground mixtures of sodium carbide and lead can react vigorously.
Melting Point	621ºF (327ºC)
Solubility in Water	Insoluble, dissolves slowly in water containing a weak acid
Specific Gravity at 20F?/4C	11.34
NIOSH Immediately Dangerous to Life and Health (IDLH)	100 mg/m^3
OSHA Action Level (AL) [1]	0.030 mg/m^3 (30 µg/m^3) (8 hour time weighted average)

Parameter	**Lead**
OSHA (airborne permissible exposure level (PEL)).[2] No employee shall be exposed to lead at a concentration above the PEL.	0.050 mg/m^3 (50 μg/m^3) (as averaged over 8 hours)
ACGIH Threshold Limit Value (TLV)	0.050 mg/m^3 (50 μg/m^3) (as averaged over 8 hours)
ACGIH Biological Exposure Index (2014)	0.030 mg of lead/100 mL blood (30 μg of lead/100 mL blood)
NIOSH Recommended Exposure Limit (REL)	0.050 mg/m^3 (50 μg/m^3) (as averaged over 8 hours)
Health Effects	See attachment AA-1: Substance data sheet for potential health effects from occupational exposure to lead
PPE Overview	Employees must follow the appropriate work practices should not disturb lead containing materials. All PPE is provided to Barr employees at no cost.Barr Health and Safety Program Manager will provide guidance on the appropriate PPE needed to minimize exposure. All PPE must be inspected by Barr employees prior to each use. PPE must be stored in a clean and sanitary manner. PPE for eye and face protection will meet the requirements of 29 CFR 1910.133. Barr personnel will follow Barr's written respiratory protection program which meets the requirements of 29 CFR 1910.134. If respirator use is necessary, employees are required to be medically cleared by a physician to wear a respirator, fit-tested and trained by the Barr Health and Safety Program Manager before using a respirator. Respirator use and type will be determined by the Barr Health and Safety Program Manager, based on air monitoring results or condition of use. Respirators should be inspected by supervisors each month to ensure they are being used, stored and cleaned properly
Necessary PPE	Respirators - Barr will provide employees with appropriate respirators, including powered, air purifying, NIOSH certified respirators (PAPRs) at no extra cost to the employee. A PAPR respirator will be used during the time period necessary to install or implement engineering or work practice controls and during emergencies.. If respirators are worn, they must have National Institute for Occupational Safety and Health (NIOSH) seal of approval, and cartridge or canisters must be replaced before the end of their service life, or the end of the shift, whichever occurs first. . Protective Clothing Wear appropriate clothing to prevent eye and skin contact. Appropriate work clothing and equipment will be provided to employees in a clean and dry condition (at least weekly) at no cost to the employee. PPE will be cleaned, laundered, properly disposed and repaired or replaced as necessary.

Parameter	Lead
Safety Precautions	Workers must wash hands and face after contact with lead containing materials. Workers should wash daily at the end of the shift and before eating, drinking, smoking, etc. If work clothes may have become contaminated the clothing should be changed to uncontaminated clothing prior to leaving the premises. Work clothing that becomes wet or significantly contaminated should be removed or replaced. Smoking is prohibited in areas where lead is used or stored.
The following warning signs shall be posted in each work area where the PEL is exceeded (as per 29 CFR 1910.1025(m)(2)(i)). Employees will be advised to pay attention to all warning signs. Signs must meet the requirements of 29 CFR 1910.1025(m)(2)(ii).	**DANGER** **LEAD** **MAY DAMAGE FERTILITY OR THE UNBORN CHILD** **CAUSES DAMAGE TO THE CENTRAL NERVOUS SYSTEM** **DO NOT EAT, DRINK OR SMOKE IN THIS AREA**
As per 29 CFR 1910.1025 (m)(2)(v), before June 1 2016, employers may post the following signs in lieu of the text specified in 29 CFR 1910.1025(m)(2)(i).	**WARNING** **LEAD WORK AREA** **POISON** **NO SMOKING OR EATING**

Information compiled from the NIOSH Pocket Guide to Chemical Hazards, Department of Health and Human Services, Centers for Disease Control and Prevention, National Institute of for Occupational Safety and Health, Toxnet http://toxnet.nlm.nih.gov/.

[1] The Action Level means employee exposure, without regard to the use of respirators, to an airborne concentration of lead of 30 μg/m^3 averaged over an 8-hour period.

[2] The OSHA permissible exposure limit (PEL) is an 8 hour time weighted average concentration above which no employee can be exposed. If an employee is exposed to lead for more than 8 hours in any work day, the permissible exposure limit, as a time weighted average (TWA) for that day shall be reduced according to the following formula: Maximum permissible limit (in μg/m^3)= 400 divided by hours worked in the day (29 CFR 1910.1025(c)(2)). See 29 CFR 1910.1025 for additional requirements.

2.0 Lead Exposure and Monitoring

2.1 Employee Training

Each employee that has potential exposure to lead will attend lead awareness training prior to the time of each project assignment and an annual refresher. Training documentation will be kept in the Barr health and safety administrative files and will include the employee name, the date of the training, and the name of the trainer. Employees will be informed of:

1) the content of OSHA 29 CFR 1910.1025 & its appendices

2) the specific nature of the operations which could result in exposure to lead above the action level (employee exposure, without regard to the use of respirators, to an airborne concentration of lead of 30 micrograms per cubic meter of air (30 µg/m(3)) averaged over an 8-hour period)

3) the purpose, proper selection, fitting, use, and limitation of respirators

4) the purpose and a description of the medical surveillance program and the medical removal program including information concerning the adverse health effects associated with excessive exposure to lead (with particular attention to the adverse reproductive effects on both males and females and hazards to the fetus and additional precautions to employees who are pregnant)

5) the engineering controls and work practices associated with the employee’s job assignment

6) the contents of any compliance plan in effect

7) instructions to employees that chelating agents should not routinely be used to remove lead from their bodies and should not be used at all except under the direction of a licensed physician

8) the employee’s right of access to records under OSHA 29 CFR 1910.20

2.2 Employee Exposure/Air Monitoring

Barr will assure that no employee is exposed to lead at concentrations greater than fifty micrograms per cubic meter of air (50 µg /m(3)) averaged over an 8-hour period by examining employee’s airborne exposure to lead in the workplace and conducting industrial hygiene measurements necessary to determine employee exposures.

If monitoring reveals that employee exposure is at or above the action level or above the permissible exposure limit (PEL), Barr will implement corrective actions (e.g. address/implement engineering/work practice controls and PPE) to reduce exposure to acceptable limits and will conduct required monitoring as specified under OSHA 29 CFR 1910.1025(d) and 1926.62(d). If initial air monitoring results are at or above the action level, air monitoring will be conducted every six months until two consecutive results are below the action level. Air monitoring results will be provided to the employee in written format. Wherever all feasible engineering and work practice controls that can be instituted are not sufficient to reduce employee exposure to acceptable limits, Barr will nonetheless use them to reduce employee exposure to the lowest feasible level and shall supplement them by the use of respiratory protection. Barr will demonstrate and document the reasons that such controls are not feasible in reducing exposure to acceptable limits.

2.3 Written (Site Specific) Compliance Program

Prior to commencement of a job where lead exposure is anticipated, Barr will establish and implement a site specific written project health and safety plan (PHASP) to reduce lead exposures to below the PEL which will include:

1) a description of each operation in which lead may be emitted

2) a description of the specific means that will be employed to achieve compliance

3) air monitoring data which documents exposure levels

4) a work practice program which includes PPE, housekeeping, medical surveillance and other relevant work practice requirements

5) a description of arrangements made among contractors on multi-contractor sites with respect to informing affected employees of potential exposure to lead and with respect to responsibility for compliance with this section as set-forth in 29 CFR 1926.16

The written program will be revised and updated as appropriate to reflect the current status of the program and will be available at the worksite.

2.4 Medical Surveillance

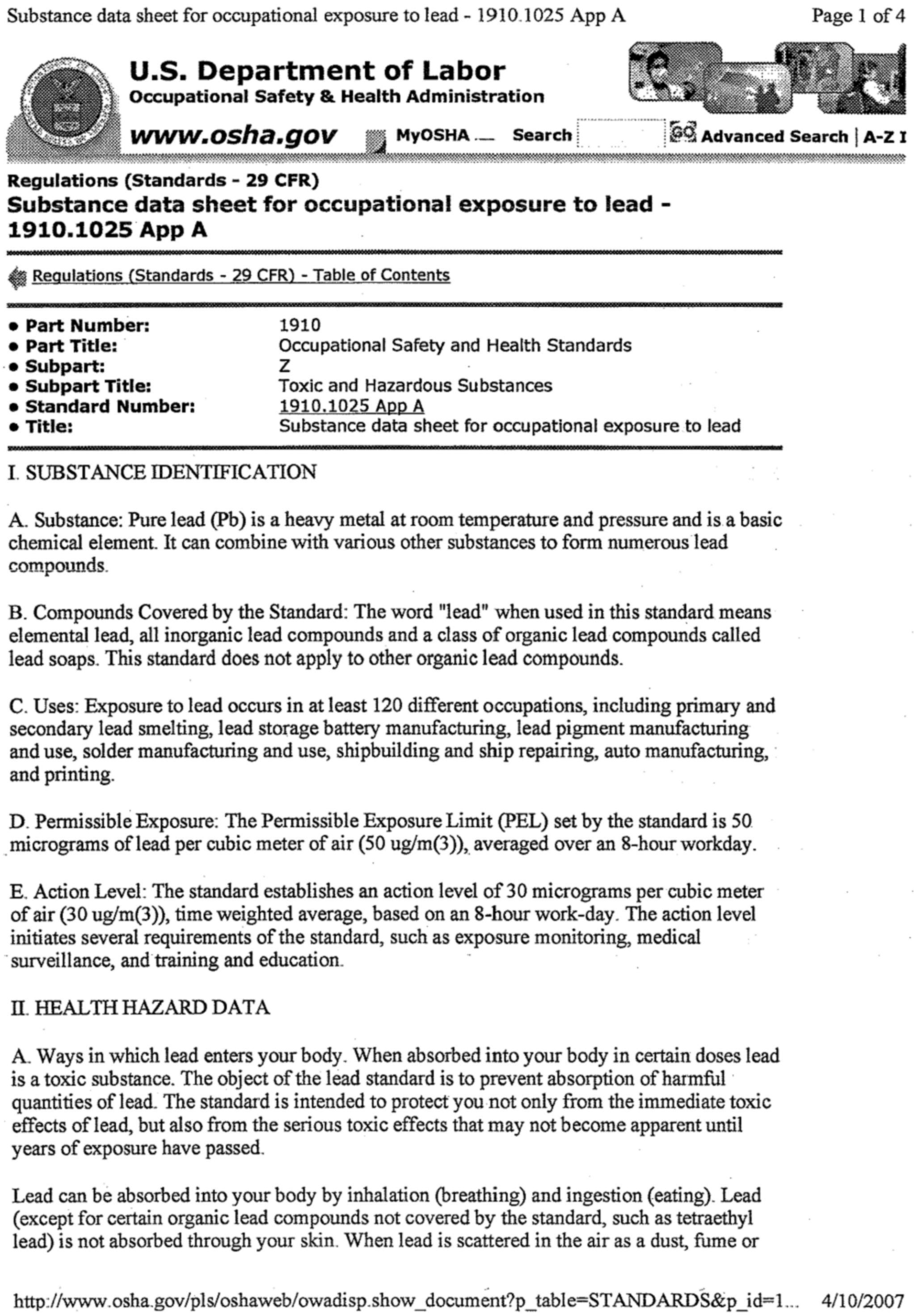
Barr will provide medical surveillance for all employees who are or may be exposed at or above the action level for more than 30 days per year. Required medical surveillance will be performed by or under the supervision of a licensed physician without cost to the employee.

Blood sampling, monitoring, employee notification and medical benefits as required under OSHA 29 CFR 1910.1025(j)(2), 29 CFR 1910.1025(j)(3) and 1926.62(j)(2) will be followed. Employees with elevated blood levels will be notified in writing within 5 working days after Barr receives monitoring results and will be temporarily removed with Medical Removal Protection benefits.

2.5 Facilities

Decontamination areas provided to employees. Employees will be advised to wash their hands and face if they come in contact with lead materials. Changing and hygiene facilities and a lunchroom will be provided if employee exposure exceeds the action level (AL) of 30 ug/m^3.

ATTACHMENT 1
Substance Data Sheet for Occupational Exposure to Lead



Substance data sheet for occupational exposure to lead - 1910.1025 App A Page 1 of 4

U.S. Department of Labor
Occupational Safety & Health Administration
www.osha.gov MyOSHA Search GO Advanced Search | A-Z I

Regulations (Standards - 29 CFR)

Substance data sheet for occupational exposure to lead - 1910.1025 App A

Regulations (Standards - 29 CFR) - Table of Contents

• **Part Number:**	1910
• **Part Title:**	Occupational Safety and Health Standards
• **Subpart:**	Z
• **Subpart Title:**	Toxic and Hazardous Substances
• **Standard Number:**	1910.1025 App A
• **Title:**	Substance data sheet for occupational exposure to lead

I. SUBSTANCE IDENTIFICATION

A. Substance: Pure lead (Pb) is a heavy metal at room temperature and pressure and is a basic chemical element. It can combine with various other substances to form numerous lead compounds.

B. Compounds Covered by the Standard: The word "lead" when used in this standard means elemental lead, all inorganic lead compounds and a class of organic lead compounds called lead soaps. This standard does not apply to other organic lead compounds.

C. Uses: Exposure to lead occurs in at least 120 different occupations, including primary and secondary lead smelting, lead storage battery manufacturing, lead pigment manufacturing and use, solder manufacturing and use, shipbuilding and ship repairing, auto manufacturing, and printing.

D. Permissible Exposure: The Permissible Exposure Limit (PEL) set by the standard is 50 micrograms of lead per cubic meter of air (50 ug/m(3)), averaged over an 8-hour workday.

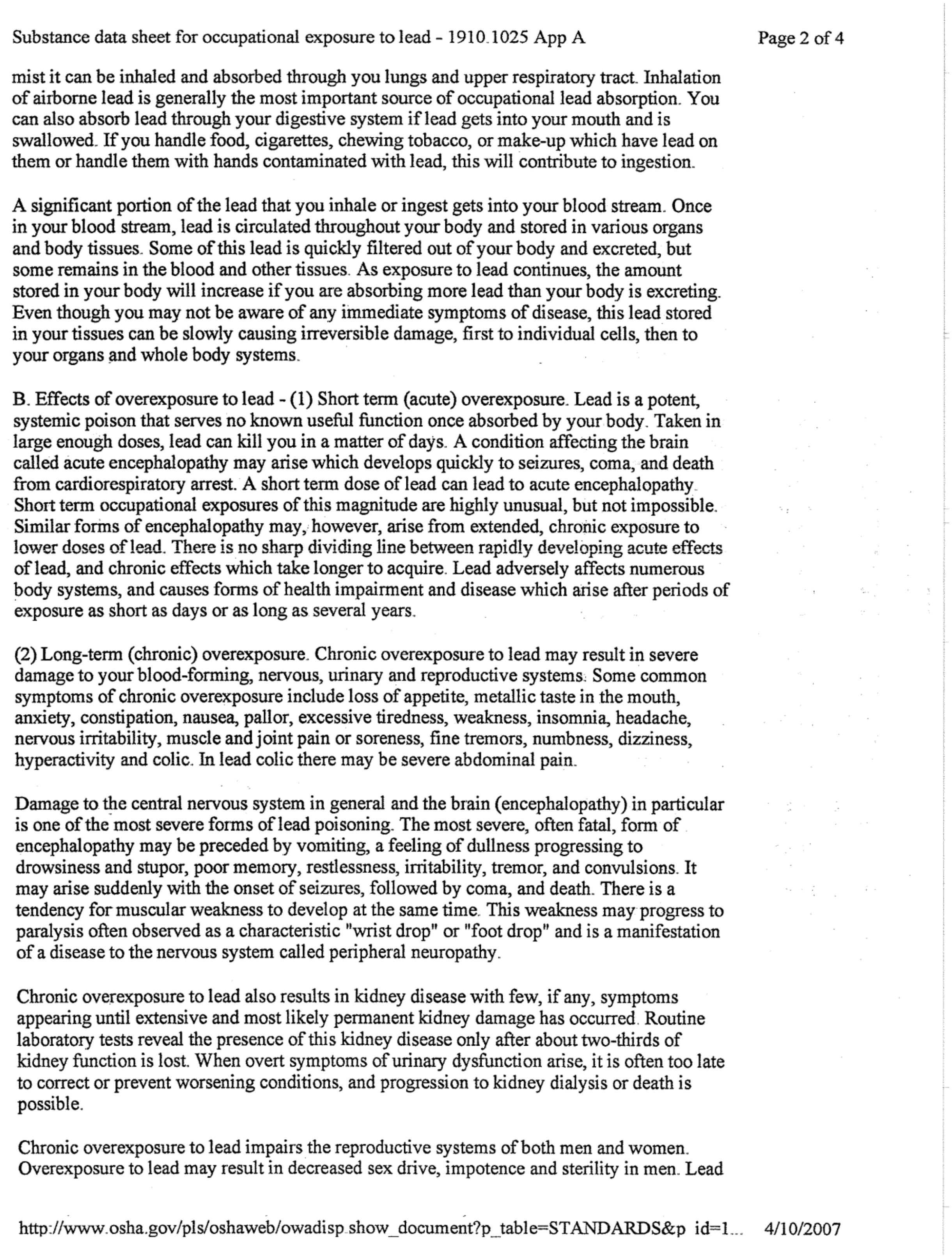
E. Action Level: The standard establishes an action level of 30 micrograms per cubic meter of air (30 ug/m(3)), time weighted average, based on an 8-hour work-day. The action level initiates several requirements of the standard, such as exposure monitoring, medical surveillance, and training and education.

II. HEALTH HAZARD DATA

A. Ways in which lead enters your body. When absorbed into your body in certain doses lead is a toxic substance. The object of the lead standard is to prevent absorption of harmful quantities of lead. The standard is intended to protect you not only from the immediate toxic effects of lead, but also from the serious toxic effects that may not become apparent until years of exposure have passed.

Lead can be absorbed into your body by inhalation (breathing) and ingestion (eating). Lead (except for certain organic lead compounds not covered by the standard, such as tetraethyl lead) is not absorbed through your skin. When lead is scattered in the air as a dust, fume or

http://www.osha.gov/pls/oshaweb/owadisp.show_document?p_table=STANDARDS&p_id=1... 4/10/2007



mist it can be inhaled and absorbed through you lungs and upper respiratory tract. Inhalation of airborne lead is generally the most important source of occupational lead absorption. You can also absorb lead through your digestive system if lead gets into your mouth and is swallowed. If you handle food, cigarettes, chewing tobacco, or make-up which have lead on them or handle them with hands contaminated with lead, this will contribute to ingestion.

A significant portion of the lead that you inhale or ingest gets into your blood stream. Once in your blood stream, lead is circulated throughout your body and stored in various organs and body tissues. Some of this lead is quickly filtered out of your body and excreted, but some remains in the blood and other tissues. As exposure to lead continues, the amount stored in your body will increase if you are absorbing more lead than your body is excreting. Even though you may not be aware of any immediate symptoms of disease, this lead stored in your tissues can be slowly causing irreversible damage, first to individual cells, then to your organs and whole body systems.

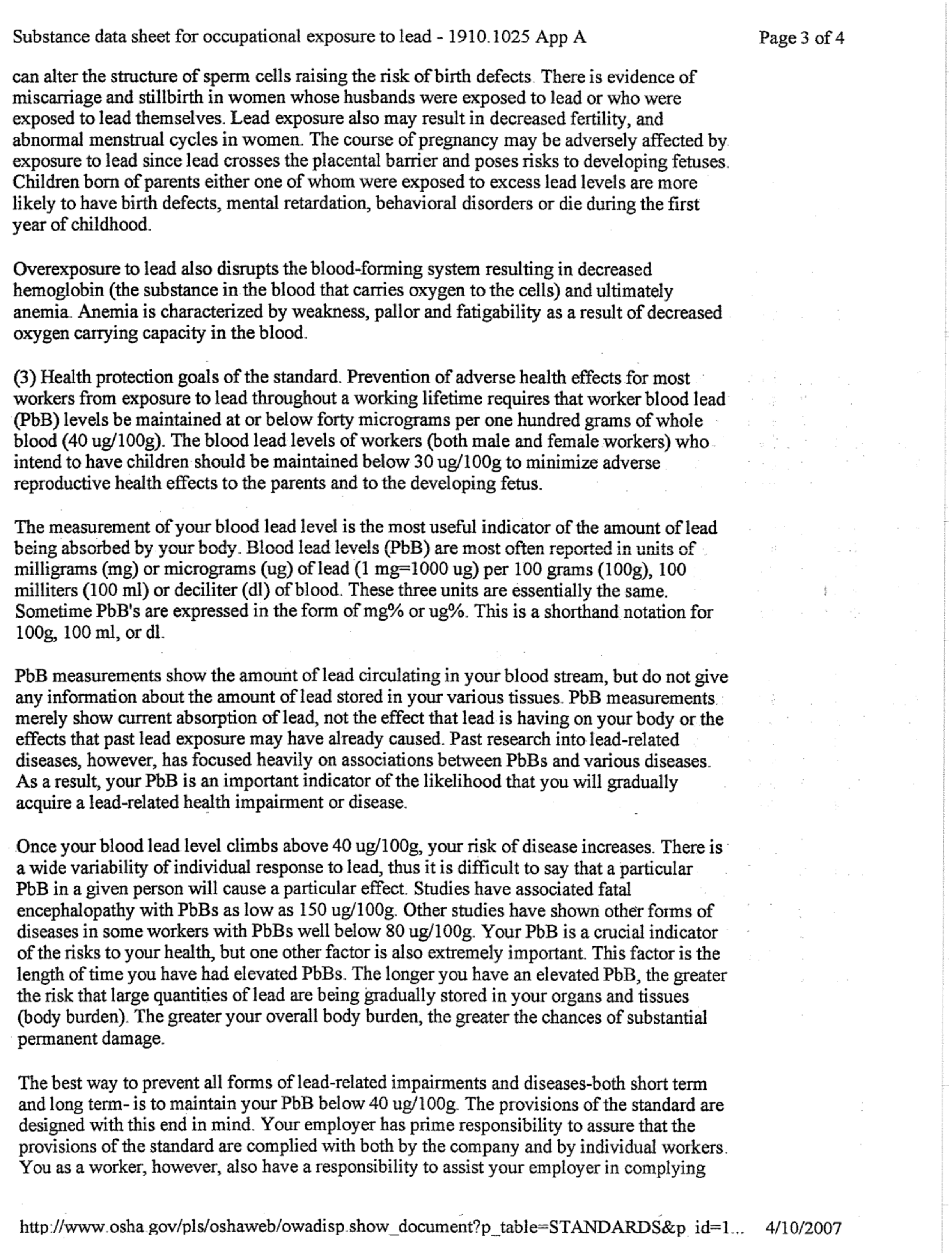
B. Effects of overexposure to lead - (1) Short term (acute) overexposure. Lead is a potent, systemic poison that serves no known useful function once absorbed by your body. Taken in large enough doses, lead can kill you in a matter of days. A condition affecting the brain called acute encephalopathy may arise which develops quickly to seizures, coma, and death from cardiorespiratory arrest. A short term dose of lead can lead to acute encephalopathy. Short term occupational exposures of this magnitude are highly unusual, but not impossible. Similar forms of encephalopathy may, however, arise from extended, chronic exposure to lower doses of lead. There is no sharp dividing line between rapidly developing acute effects of lead, and chronic effects which take longer to acquire. Lead adversely affects numerous body systems, and causes forms of health impairment and disease which arise after periods of exposure as short as days or as long as several years.

(2) Long-term (chronic) overexposure. Chronic overexposure to lead may result in severe damage to your blood-forming, nervous, urinary and reproductive systems. Some common symptoms of chronic overexposure include loss of appetite, metallic taste in the mouth, anxiety, constipation, nausea, pallor, excessive tiredness, weakness, insomnia, headache, nervous irritability, muscle and joint pain or soreness, fine tremors, numbness, dizziness, hyperactivity and colic. In lead colic there may be severe abdominal pain.

Damage to the central nervous system in general and the brain (encephalopathy) in particular is one of the most severe forms of lead poisoning. The most severe, often fatal, form of encephalopathy may be preceded by vomiting, a feeling of dullness progressing to drowsiness and stupor, poor memory, restlessness, irritability, tremor, and convulsions. It may arise suddenly with the onset of seizures, followed by coma, and death. There is a tendency for muscular weakness to develop at the same time. This weakness may progress to paralysis often observed as a characteristic "wrist drop" or "foot drop" and is a manifestation of a disease to the nervous system called peripheral neuropathy.

Chronic overexposure to lead also results in kidney disease with few, if any, symptoms appearing until extensive and most likely permanent kidney damage has occurred. Routine laboratory tests reveal the presence of this kidney disease only after about two-thirds of kidney function is lost. When overt symptoms of urinary dysfunction arise, it is often too late to correct or prevent worsening conditions, and progression to kidney dialysis or death is possible.

Chronic overexposure to lead impairs the reproductive systems of both men and women. Overexposure to lead may result in decreased sex drive, impotence and sterility in men. Lead



can alter the structure of sperm cells raising the risk of birth defects. There is evidence of miscarriage and stillbirth in women whose husbands were exposed to lead or who were exposed to lead themselves. Lead exposure also may result in decreased fertility, and abnormal menstrual cycles in women. The course of pregnancy may be adversely affected by exposure to lead since lead crosses the placental barrier and poses risks to developing fetuses. Children born of parents either one of whom were exposed to excess lead levels are more likely to have birth defects, mental retardation, behavioral disorders or die during the first year of childhood.

Overexposure to lead also disrupts the blood-forming system resulting in decreased hemoglobin (the substance in the blood that carries oxygen to the cells) and ultimately anemia. Anemia is characterized by weakness, pallor and fatigability as a result of decreased oxygen carrying capacity in the blood.

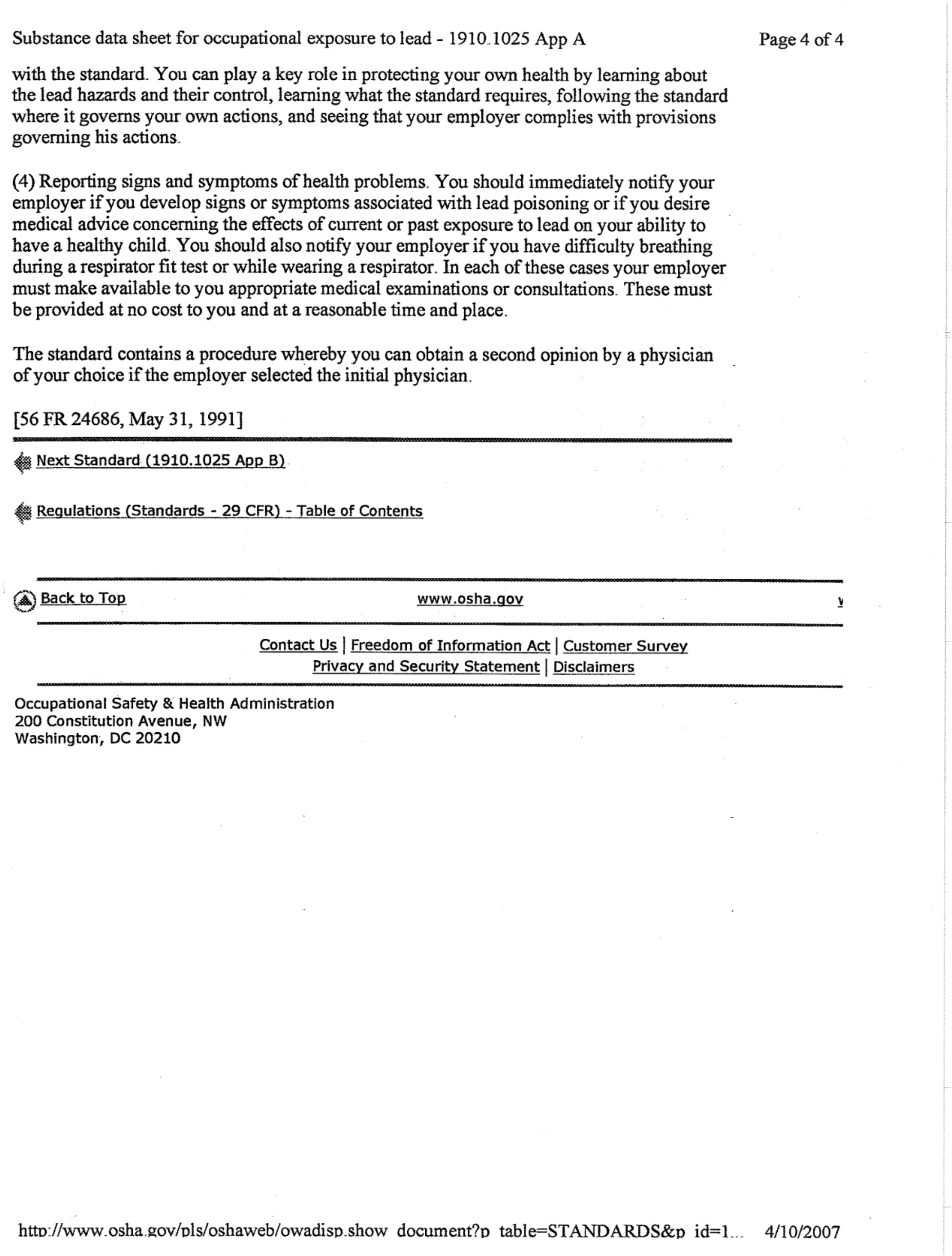
(3) Health protection goals of the standard. Prevention of adverse health effects for most workers from exposure to lead throughout a working lifetime requires that worker blood lead (PbB) levels be maintained at or below forty micrograms per one hundred grams of whole blood (40 ug/100g). The blood lead levels of workers (both male and female workers) who intend to have children should be maintained below 30 ug/100g to minimize adverse reproductive health effects to the parents and to the developing fetus.

The measurement of your blood lead level is the most useful indicator of the amount of lead being absorbed by your body. Blood lead levels (PbB) are most often reported in units of milligrams (mg) or micrograms (ug) of lead (1 mg=1000 ug) per 100 grams (100g), 100 milliters (100 ml) or deciliter (dl) of blood. These three units are essentially the same. Sometime PbB's are expressed in the form of mg% or ug%. This is a shorthand notation for 100g, 100 ml, or dl.

PbB measurements show the amount of lead circulating in your blood stream, but do not give any information about the amount of lead stored in your various tissues. PbB measurements merely show current absorption of lead, not the effect that lead is having on your body or the effects that past lead exposure may have already caused. Past research into lead-related diseases, however, has focused heavily on associations between PbBs and various diseases. As a result, your PbB is an important indicator of the likelihood that you will gradually acquire a lead-related health impairment or disease.

Once your blood lead level climbs above 40 ug/100g, your risk of disease increases. There is a wide variability of individual response to lead, thus it is difficult to say that a particular PbB in a given person will cause a particular effect. Studies have associated fatal encephalopathy with PbBs as low as 150 ug/100g. Other studies have shown other forms of diseases in some workers with PbBs well below 80 ug/100g. Your PbB is a crucial indicator of the risks to your health, but one other factor is also extremely important. This factor is the length of time you have had elevated PbBs. The longer you have an elevated PbB, the greater the risk that large quantities of lead are being gradually stored in your organs and tissues (body burden). The greater your overall body burden, the greater the chances of substantial permanent damage.

The best way to prevent all forms of lead-related impairments and diseases-both short term and long term- is to maintain your PbB below 40 ug/100g. The provisions of the standard are designed with this end in mind. Your employer has prime responsibility to assure that the provisions of the standard are complied with both by the company and by individual workers. You as a worker, however, also have a responsibility to assist your employer in complying



with the standard. You can play a key role in protecting your own health by learning about the lead hazards and their control, learning what the standard requires, following the standard where it governs your own actions, and seeing that your employer complies with provisions governing his actions.

(4) Reporting signs and symptoms of health problems. You should immediately notify your employer if you develop signs or symptoms associated with lead poisoning or if you desire medical advice concerning the effects of current or past exposure to lead on your ability to have a healthy child. You should also notify your employer if you have difficulty breathing during a respirator fit test or while wearing a respirator. In each of these cases your employer must make available to you appropriate medical examinations or consultations. These must be provided at no cost to you and at a reasonable time and place.

The standard contains a procedure whereby you can obtain a second opinion by a physician of your choice if the employer selected the initial physician.

[56 FR 24686, May 31, 1991]

Next Standard (1910.1025 App B)

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Occupational Safety & Health Administration
200 Constitution Avenue, NW
Washington, DC 20210

Section 37: Subcontractor Environmental, Health and Safety Program

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Forms

Form 1 Subcontractor Health and Safety Performance Questionnaire

Section 37: Subcontractor Environmental, Health and Safety Program

1.0 Safety Evaluation of Subcontractors

Barr may consider the environmental, health and safety performance of potential subcontractors in the selection of participants on a project. During this pre-qualification process, Barr may require safety information be provided on Form A: Subcontractor Health and Safety Performance Questionnaire.

2.0 Subcontractor Responsibilities

The subcontractor will be directly responsible for creating and maintaining a health and safety effort to prevent their employees from working in conditions, which are unsafe, unhealthy, or unsanitary. Additionally, the subcontractor will:

- Maintain a strong commitment towards enhanced health and safety in all their activities,
- Provide employee training that meets regulatory requirements and assures safe work practices,
- Provide documentation of employee training when requested,
- Provide documented evidence of an account in good standing with workers compensation provider when requested,
- Attend pre-work safety kick-off meetings and/or hazard assessments (pre-work safety meetings will include a site orientation that addresses health, safety, security, and environmental concerns),
- Attend daily tailgate meetings each day after the initial pre-work safety kick-off meeting,
- Abide by the owner client’s drug and alcohol policy (if applicable) at all times while working on the site (Barr will communicate these requirements to the subcontractor), and

- Report all incidents while working on the site to Barr (Barr will communicate the incident to the owner client). Additionally, all incidents will be investigated by the subcontractor.

3.0 Subcontractor Post Job Safety Performance Reviews

Barr may conduct post job safety performance reviews on a subcontractor's safety performance. A combination of factors may be considered during this review, including housekeeping, active participation in safety meetings, safety performance, and commitment to the recognition and mitigation of safety hazards.

Form 1. Subcontractor Health and Safety Performance Questionnaire

Barr is committed to providing a safe and healthy workplace for employees and their subcontractors. Subcontractors must provide the following information.

Subcontractor Name	
Subcontractor Project Manager and phone number	
Subcontractor Safety Representative and phone number	

1. In the table below, provide the **five most recent full years** of incident history.

	DESCRIPTION	**2013**	**2012**	**2011**	**2010**	**2009**	**2008**
A	Number of Injuries and Illnesses						
B	Number of Restricted or Transferred Workday Cases						
C	Number of Lost Workday Cases						
D	Number of Work Related Fatalities						
E	Total Number of Employees						
F	Employee Hours Worked Per Year (If unknown use # of employees × 2080)						
G	Total Recordable Incident Rate Rate = A x 200,000 ÷ F						
H	DART Rate Rate = (B +C) x 200,000 ÷F						

2. Does your company have written safety and health programs? Yes No

Please list the date that the program was last reviewed or updated: ________________

3. Has your company received any health and safety related warnings, citations, stop work orders or equivalent in the past three years? **If yes, please describe.** Yes No

____

____

____

____

4. Does your company perform documented safety audits/reviews? **If yes, provide an example and indicate frequency and corrective action procedures/process?** Yes No

____

____

____

5. Does your company hold work-site (tailgate) safety meetings? Yes No

If yes, how often?

Yes No

6. Does your company encourage employee participation in safety meetings?

If so, please explain how this is accomplished.

7. Does your company conduct accident/incident investigations? **If yes, describe the program.** Yes No

8. Does your company document, investigate, and discuss near miss accidents? **If yes, describe the program.** Yes No

9. Does your company have a Stop Work Policy for unsafe act, conditions, or behaviors? **If yes, please submit a copy of the policy.** Yes No

10. Does your company use subcontractors? Yes No

If yes, explain how you qualify/evaluate and approve subcontractor(s) safety performance and programs.

11. Please list your company's workers compensation rate for the past three years. **Please submit copies of your company's workers compensation rate sheets for the past three years.**

The above information will be used to evaluate each Subcontractor related to their safety and health performance. By signing, you are indicating that the submitted information is true and accurate.

Printed Name	Job Title	Signature (Electronic acceptable)	Date

Section 38: Ammonia Awareness Program

1.0 Introduction

Barr Engineering has developed this program to help provide ammonia awareness when working on job assignments where there is a potential for exposure. Exposure may occur while working near operations where compressed liquefied gas cylinders of ammonia, fertilizers, and/or cleaning solutions containing ammonium hydroxide are used. In addition to this information, employees should be aware of and follow the provisions of site specific contingency plans.

2.0 Ammonia

Ammonia is one of the most widely produced industrial chemicals in the United States. Ammonia is used as a refrigerant, a fertilizer, in the mining industry, in food production, in petroleum refining as a neutralizing agent, in cleaning solutions, to make plastics and fibers and in other products. Ammonia in its pure form (as NH_3) is also referred to as anhydrous ammonia. Ammonia can exist in the following forms:

- as a colorless gas under ambient conditions (NH_3)
- as a compressed liquefied gas under pressure (NH_3)
- as vapors from compressed liquefied gas and from liquid solutions
- in liquid solution as ammonium hydroxide (NH_4OH) (ammonia gas dissolved in liquids)
- as mists from liquid solutions

Ammonia gas can be compressed to form a clear compressed liquefied gas under pressure. Containers of compressed liquefied ammonia therefore contain ammonia as a compressed liquefied gas and ammonia vapors. Ammonia is an eye, nose, throat and upper respiratory tract irritant. Contact with compressed ammonia liquefied gas can chill or freeze tissue and cause frostbite. Ammonia gas can be dissolved in liquids such as water to form corrosive solutions of ammonium hydroxide.

Ammonia also poses physical hazards. Ammonia as a compressed liquefied gas is under pressure and cylinders/tanks can explode if heated. Ammonia is considered a flammable gas and can be an explosion hazard, especially in confined spaces. Ammonia gas and vapors can decompose at very high temperatures and form very flammable hydrogen gas. Table 1 provides ammonia awareness information regarding exposure to ammonia.

Table 1. Ammonia Awareness Information

Parameter	**Ammonia**
Appearance & Color	Clear colorless
Odor	Pungent, suffocating sharp odor (like drying urine)
pH	Liquid ammonium hydroxide solutions: 10.6 for 0.01N solution, 11.1 for 0.1N solution and 11.6 for 1.0N solution
Auto Ignition Temperature	1205ºF (651.6ºC)
Boiling Point (760 mm Hg)	-28ºF(-33.35ºC)
Conditions to Avoid	High temperatures, open flames, sparks, static discharge, heat and other ignition sources, high energy sources (e.g. welding arcs).
Evaporation Rate (ether = 1)	Not available
Flammable Limits in Air (% by volume)	16-28%
Flash Point (closed cup)	Not applicable
Hazardous Decomposition Byproducts	Nitrogen oxides, hydrogen gas, nitrogen gas and toxic gases
Vapor pressure	8500 mm Hg at 68ºF (20ºC)
Vapor density (air =1)	0.5967
Incompatibilities	Oxidizing agents (e.g. peroxides) acids, halogens (e.g. chlorine, hypochlorite, and chlorine bleach), copper, mercury, salts of silver and zinc, corrosive to copper and galvanized surfaces. Do not mix ammonium hydroxide solutions with chlorine containing materials.
Melting Point	-107.8ºF (-77ºC)
Solubility	Gas is very soluble in water, alcohol, ether and chloroform
Specific Gravity (air = 1)	0.77 at 32ºF (0ºC) Liquid ammonium hydroxide solutions: 0.957 at 25ºC for 10% ammonia in water
Odor threshold-low	0.038 ppm (0.0266 mg/m^3)
Odor threshold-high	56.9 ppm (39.6 mg/m^3)
NIOSH-IDLH	300 ppm (208.6 mg/m^3)
STEL (ACGIH and MN OSHA) (airborne)	35 ppm (27 mg/m^3)
OSHA-TWA(airborne)	50 ppm (35 mg/m^3)
ACGIH-TLV and NIOSH-REL	25 ppm (18 mg/m^3)

Parameter	**Ammonia**
Health Effects	**Short-term (Acute) Overexposure:** Inhalation: All forms can cause severe irritation or burns to the nose, throat and lungs. Signs/symptoms of overexposure may include difficulty breathing, coughing, chest pain, chest tightness, and wheezing. Inhalation can lead to pulmonary edema-which can be fatal. Symptoms may occur hours after exposure. Severe short term exposure can cause long term damage. Eye contact: All forms can cause severe irritation or burns to the eyes which can result in permanent damage such as blindness. Other signs/symptoms include with excessive tearing, Contact with the compressed liquefied gas can cause frostbite to the eyes which can cause blindness. Skin contact: All forms of ammonia can cause severe irritation or burns to the skin resulting in permanent damage. Skin contact with the liquefied compressed gas can cause frostbite with a burning sensation and stiffness. Severe cases may result in blistering, tissue death and infection. Swallowing: Swallowing liquefied compressed gas or liquid ammonium solutions can cause burns to the mouth, esophagus and stomach. Swallowing ammonia gas or vapor is unlikely, but if it does occur, burns may result. **Long-term (Chronic) Exposure:** Repeated exposure may cause chemical pneumonitis, occupational asthma. Neurological effects have been observed in humans who experienced severe burns from exposure to anhydrous ammonia **Medical Conditions Aggravated by Overexposure**: Generally asthma, chronic respiratory disease, dermatitis, and eye disease.
Necessary PPE	Respirators - Respirators are required for those operations in which engineering controls or work practice controls are not feasible to reduce exposure to the workplace permissible level. Respirators must be worn if the ambient concentration of ammonia exceeds workplace exposure limits. A respiratory protection program that meets the requirements of OSHA 29 CFR 1910.134, ANSI Z88.2, or MSHA 30 CFR 72.710 (where applicable) requirements must be followed whenever workplace conditions warrant respirator use. If respirators are worn, they must have joint Mine Safety and Health Administration and the National Institute for Occupational Safety and Health (NIOSH) seal of approval, and cartridge or canisters must be replaced before the end of their service life, or the end of the shift, whichever occurs first. For emergencies or instances with unknown exposure levels, use a self-contained breathing apparatus. Protective Clothing You must wear appropriate protective clothing (such as boots, gloves, sleeves, aprons, full body suit, etc.) over any parts of your body that could be exposed. Safety-toed shoes and work gloves are required for cylinder handling.

Parameter	**Ammonia**
	Eye and Face Protection Wear safety glasses when handling cylinders; vapor proof goggles, a face shield and respirator during cylinder change out or whenever contact with ammonia gas or liquefied compressed gas is possible. Safety glasses, goggles, or face shields should be worn during operations in which ammonia might contact the face or eyes.
Safety Precautions	Store containers of anhydrous ammonia in a cool, dry well-ventilated area away from heat and ignition sources. Cylinders exposed to fire may vent and release toxic and/or corrosive gas through pressure relief devices. When heated, ammonia can form hydrogen- an explosive gas. All sources of ignition should be controlled. Smoking is prohibited in areas where ammonia is used or stored.
Potential Locations Where Employees May Be Exposed	Food processing and/or ethanol facilities with anhydrous liquid ammonia in tanks or cylinders. Facilities storing ammonia as fertilizer. Use of solutions which contain ammonium hydroxide (e.g. cleaning solutions).

Information is compiled from: Toxnet-Hazardous Substances Databank (HSDB), OSHA https://www.osha.gov/SLTC/etools/ammonia_refrigeration/ammonia/, NIOSH Pocket Guide to Chemical Hazards, NIOSH http://www.cdc.gov/niosh/docs/81-123/pdfs/0028-rev.pdf, Proctor and Hughes, Chemical Hazards of the Workplace, 4th edition, 2012 Emergency Response Guidebook.

Section 39: Electrical Safety Program

July 2015

Contents

List of Appendices

1.0 Program Statement

The Barr Engineering Co. (Barr) safety program's purpose is to take every reasonable precaution to protect the health and safety of its employees. Implicit in this program is the requirement that employees follow electrically safe work practices and wear proper personal protective equipment (PPE) when present/working in any situation that presents potential exposure to any hazard involving electrical energy. In practical terms, Barr's policy is to follow and implement the standards and practices outlined in NFPA 70E – Standard for Electrical Safety in the Workplace.

2.0 Purpose

The Electrical Safety Program (ESP) for Barr employees is established to conform to OSHA/NFPA requirements regarding workplace safety and in accordance with NFPA 70E. The ESP provides procedures and work practices relative to electrical hazards in the workplace with the purpose of establishing a safe work environment for Barr employees (ref. NFPA 70E – 110.3 and OSHA 1910.132). It is imperative that all Barr employees follow the principles and procedures outlined in this document. Each Barr employee is responsible for following the program for his or her safety and the safety of others.

3.0 Scope

This ESP addresses electrical safety requirements necessary for the practical safeguarding of Barr employees during on-site field activities where electrical hazards may be present. Injuries and fatalities due to electrical hazards are preventable. It is the company's responsibility under OSHA/NFPA that all workers be properly trained and educated about risks and hazards associated with their job, and if such hazards are present, provide procedures and personal protective equipment (PPE) to address them. Barr personnel must be trained and educated regarding potential electrical hazards and the limits to tasks and jobs they can perform.

Because most Barr personnel are not licensed electricians, for purposes of this document they are considered "non-qualified" persons (see Section 4.5). Furthermore they may not be familiar with the client's equipment. (Voltage measurements may be taken by unqualified persons, however, in coordination with client electricians wherever possible.) Failure to comply with the ESP will result in disciplinary action, up to and possibly including termination of employment.

The primary consensus industrial standards referenced in development of the ESP are:

- NFPA 70E, "Standard for Electrical Safety in the Workplace", 2015 edition.
- IEEE Standard 1584-2002, "Guide for Performing Arc Flash Hazard Calculations"
- IEEE Standard 3007.3, "Recommended Practice for Electrical Safety in Industrial and Commercial Power Systems"
- OSHA 29 CFR 1910, Subpart I: Personal Protective Equipment

- OSHA 29 CFR 1910, Subpart S: Electrical
- OSHA 29 CFR 1910.147, "The Control of Hazardous Energy (Lockout/Tagout)."

4.0 Electrical Safety Staff Responsibilities

4.1 Electrical Safety Team

The Electrical Safety Team (EST) is made up of Barr's Health and Safety Program Manager (HSPM), at least two (2) electrical professionals from the Electrical Engineering Practice Group (one of whom will serve as EST chair), and at least one (1) non-electrical field staff representative. The EST's responsibilities include:

- Managing development of electrical safe work practices and maintaining the ESP.
- Coordinating communication of this ESP to Barr employees.
- Coordinating provision of electrical safety training, PPE, and tools.
- Auditing effectiveness and adherence to the ESP and training of Barr personnel, including maintenance of appropriate records.

4.2 Company Management

- Promotion of Barr's safety culture which encompasses the Barr ESP.
- Financial provision necessary to fulfill the ESP.
- General oversight of Barr's safety culture.

4.3 Project Principal In Charge and Project Manager

- For the projects they lead, making themselves aware of known and potential electrical hazards which may be encountered in the field.
- Communicating the known and potential electrical hazards for projects they lead to Barr staff assigned to work on those projects, as well as to Barr sub-consultants and/or sub-contractors.
- Coordinating adherence to Barr's ESP with reference to electrical safety hazards which may be present for the projects they lead.

4.4 Barr employees, subcontractors, and sub-consultants

- Each person is responsible for his or her own safety and for the safety of others.
- Adhering to all safe work practices set forth by Barr and our clients and exemplifying the highest safety standard.
- Notifying the HSPM, ESP, PIC, or Project Manager when safe work conditions are not available.

- It is your right to refuse to work in hazardous conditions if proper safety cannot be achieved.
- Verifying all persons have the necessary tools to perform their jobs or tasks safely.

4.5 Definitions of Qualified Person and Unqualified Person

4.5.1 Qualified

According to NFPA 70E, a qualified person (in reference to electrical hazards in the workplace) is "One who has demonstrated skills and knowledge related to the construction and operation of electrical equipment and installations, and has received safety training to identify and avoid the hazards involved."

OSHA 1910.399 includes two notes regarding this definition:

"Note 1 to the definition of 'qualified person:' Whether an employee is considered to be a 'qualified person' will depend on various circumstances in the workplace. For example, it is possible and, in fact, likely for an individual to be considered 'qualified' with regard to certain equipment in the workplace, but 'unqualified' as to other equipment."

"Note 2 to the definition of 'qualified person:' An employee who is undergoing on-the-job training and who, in the course of such training, has demonstrated an ability to perform duties safely at his or her level of training and who is under the direct supervision of a qualified person is considered to be a qualified person for the performance of those duties."

4.5.2 Unqualified

According to NFPA 70E, an unqualified person (in reference to electrical hazards in the workplace) is simply: "A person who is not a qualified person."

In accordance with NFPA 70E 130.4(C), an unqualified person shall not be permitted to approach nearer than the Limited Approach Boundary unless the requirements of NFPA 70E 130.4(C)(3) are met.

5.0 Training Requirements

The requirements of OSHA and NFPA 70E dictate that employees who may be exposed to energized or potentially energized electrical circuitry of fifty (50) volts to ground or greater in the course of their work, regardless of their job function and/or qualifications, shall be trained in electrical safe work practices and Arc Flash hazards. This requirement applies regardless of whether an employee is considered a 'qualified person.' When a new employee is hired, the level and nature of their training is to be verified and documented prior to performance of any field work in relation to this requirement. If the employee does not have adequate training as deemed by the Electrical Safety Team or HSPM, then they shall be provided training as soon as possible after being hired.

Sub-contractors or sub-consultants possibly exposed to energized or potentially energized electrical circuitry of fifty (50) volts to ground or greater will be required to submit documentation showing they have received training in electrical safety including Shock and Arc Flash Hazards. All documentation of training session attendance shall be kept in permanent record (via Barr HRIS).

Training of each employee in relation to this requirement shall have regular training at intervals not more than three (3) years. Training shall be in accordance with the requirements of NFPA 70E and OSHA 1910 Subpart S.

6.0 Principles of Electrical Safety

- Barr employees are not to engage in altering existing, or installing new circuitry, whether energized or de-energized. Barr is not a contractor and not licensed to do so.

- If Barr personnel are present at client facilities with energized work to be performed by client's or third-party qualified persons, then Barr personnel must be made aware of all potential hazards and appropriate applicable PPE which must be worn, as well as be made aware of all relevant NFPA 70E and OSHA requirements. Request a copy of the client's "Energized Work Permit" prior to proceeding on site.

- Identify the hazards. Assess risks. Identify steps that could create electric shock or arc-flash hazards.

- Implement risk control. De-energize any equipment wherever possible, lock-out, tag-out (see OSHA 1910.333(a) and (b). If not possible, then insulate, or isolate exposed live parts so contact cannot be made. Always wear proper personal protective equipment (PPE) when within the arc-flash boundary, and use properly insulated tools. Refer to Appendix B of this ESP and NFPA 70E – 130.7-15(A)(a) which provides guidance on when PPE is required.

- Anticipate problems. If it can go wrong, it might. Make sure the proper PPE and tools are immediately available for the worst-case scenario.

- Obtain training. Make sure all involved employees are appropriately trained. Any employees (including Barr employees) not considered qualified may not approach beyond the "Limited Approach Boundary", and must be accompanied by a qualified person (both with proper PPE) if they approach beyond the "Arc Flash Boundary."

7.0 Procedures

The procedures/actions itemized below involving work on electrical circuits would not generally involve Barr personnel, but are understood to be part of standard work practices by a client's electrical staff, and are included here for the interest of clarity.

7.1 General

- Understand the ESP. Ask Barr's HSPM or EST if you feel unsure about the situation at hand.
- Review single-line diagrams, verifying that they are correct and up-to-date.
- De-energize whenever possible, lock-out, tag-out (see OSHA 1910.333(a) and (b))
- Verify that a work plan has been developed, and determine your role in that plan.

- Create a safe work environment for yourself and others around you. Take the necessary steps to provide safety for everyone.
- Select proper Personal Protective Equipment. Inspect equipment for damage areas. Document inspection.
- Review equipment-specific lockout/tagout, grounding, etc. procedures and apply appropriate procedure to job.
- If there isn't an approved procedure available for your assignment, see Barr's HSPM.
- Follow approved procedures for energized electrical work and voltage testing.
- Set up approach boundaries as defined in NFPA 70E. Understand and abide by the requirements and implications associated with the approach boundaries

7.2 Electrical Safety Program Controls

- Barr has established programs, including training, and Barr employees are to apply them.
- All Barr employees who encounter electrical installations in the course of their field work must be trained for working in an environment influenced by the presence of electrical energy.
- Procedures are to be used to identify the electrical hazards and to develop plans to eliminate those hazards or control the risk for those hazards that cannot be eliminated.
- Every electrical conductor or circuit part is considered energized until proven otherwise.
- De-energizing an electrical conductor or circuit part and making it safe to work on is, in itself, a potentially hazardous task.
- No work is should be performed on or near systems 50 volts or greater without risk assessment and proper procedures as outlined in this safety plan and as required per NFPA 70E.
- Precautions appropriate to the working environment are to be determined and taken.
- Minimum AFHR/Category 2 PPE (8 cal/cm^2) is to be worn at all times on work around energized electrical equipment, unless labeled higher than a Category 2.
- Complete, or verify completion of appropriate documents for energized or de-energized electrical work. (i.e. Job Planning Check List, Energized Electrical Work Permit, Lockout / Tagout, etc.) Request that the client provide copies of these for Barr reference where applicable.

8.0 Auditing

The ESP must be audited in accordance with NFPA 70E (ref. 110.1(i)). Both the plan itself and an annual review of program compliance by Barr employees must be performed and documented by the EST.

9.0 Program Requirements

9.1 General

- All equipment must be properly labeled and identified. If equipment at a client site for which Barr field personnel are asked to work is not so labeled, confer with Barr's HSPM.
- Single-line diagrams must be up-to-date and verified every five years for accuracy. If such line diagrams are not available at a client site for which Barr field personnel are asked to work, then confer with Barr's HSPM.
- All equipment must be in good condition, maintained, tested and reviewed for proper working condition to limit hazards to site personnel.
- Arc Flash Hazard Analysis must be completed and arc flash hazard labels applied to equipment to properly identify hazards and risk levels for a safe working environment. If equipment at a client site for which Barr field personnel are asked to work is not so labeled, confer with Barr's HSPM.
- Adhere to all codes, standards, and safe work practices.

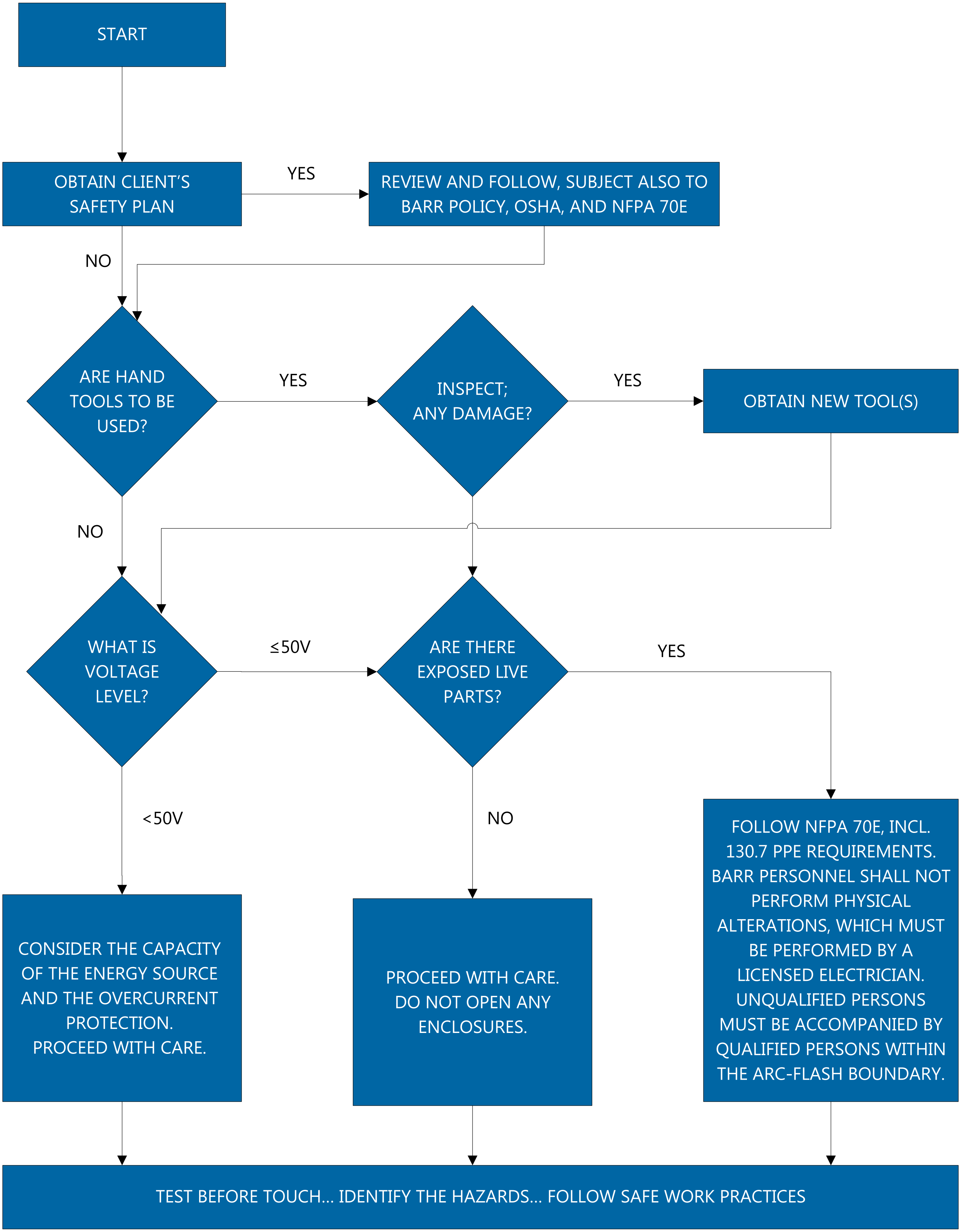
9.2 Sub-consultant and subcontractor employees

- Electrical safety programs used by sub-consultants and/or subcontractors must meet or exceed all applicable guidelines of this ESP.
- Contractors are required to comply with applicable Electrical Safety regulations such as OSHA and NFPA.
- Contractors may be required to submit copies of their Electrical Safety Program and safety training documentation to Barr's HSPM upon request.

Appendix A

Electrical Work Flow Chart

Electrical Work Flow Chart (Based on figure J.2, p. 70E-89, NFPA 70E-2015)



Appendix B

Barr Engineering Co. Electrical Hazard Personal Protective Equipment (PPE) Program

1. Barr Engineering Co. Electrical Hazard PPE Program

This program applies to Barr employees who are in the field even occasionally around energized electrical equipment (e.g., an electrical switchgear room, or motor control center MCC on a plant floor, or the like). For these employees Barr requires wearing minimum hazard category 2 (AFHR 2) PPE. If a greater hazard is known, the employee shall wear PPE appropriate for that greater hazard. In implementation of the minimum AFHR Category 2 requirement, Barr will provide the employee with PPE as necessary in accordance with Barr "Barr Guidelines for Flame Resistant Clothing"

- AFHR Category 2 pants
- AFHR Category 2 shirt
- AFHR Category 2 jacket
- AFHR Category 2 hardhat (Class E)/face-shield/balaclava
- EH rated boots
- Hearing protection
- Gloves

Employees in this category who do not have all of the PPE outlined above should refer to the "Barr Guidelines for Flame Resistant Clothing" (mentioned above), or contact the Electrical Safety Team as soon as possible to obtain this equipment for yourself.

If the tag inside your boot tongue does not display an "EH rating," or if you are unsure of your boots' rating, obtain new EH-rated boots from Barr's boot supplier. For further assistance, contact the Electrical Safety Team.

Wear heavy-duty leather work gloves (minimum thickness .03 inch/.7 mm) if you do not proceed past the limited approach boundary. If you are considered a qualified person and do proceed within the limited approach boundary, contact the Electrical Safety Team to obtain proper insulated gloves and the training to maintain them.

For higher levels of Hazard Risk Categories than HRC 2, refer to NFPA 70E Table 130.7(C)(16), and contact the Electrical Safety Team.

Employees working in areas with potential electrical hazards must be provided with and use personal protective equipment (PPE) appropriate for the specific work to be performed. The electrical tools and protective equipment must be specifically approved, rated, and tested for the levels of voltage and/or arc-flash to which an employee may be exposed.

2. Guidelines for PPE Equipment

2.1. General PPE Equipment

- Employees shall wear E-rated (nonconductive) hard-hats in the field.
- Employees shall wear protective equipment for the face whenever there is danger of injury from electric arcs, flashes, or from flying objects resulting from an electrical explosion.
- Employees shall wear rubber insulating gloves with leather protectors where there is a danger of hand or arm contact with live parts or possible exposure to arc flash.
- Face shields must have an arc rating to be used for electrical work. Safety glasses or goggles must always be worn underneath face shields.
- PPE must be selected to meet the criteria established by the American Society of Testing and Materials (ASTM) and by the America National Standards Institute (ANSI).
- PPE must be maintained in a safe, reliable condition and be inspected for damage before each day's use and immediately following any incident that can reasonably be suspected of having caused damage.
- Employees must use insulated tools and handling equipment that are rated for the voltages to be encountered when working within the Limited Approach Boundary. Tools and handling equipment must be replaced if the insulating capability is decreased due to damage. Protective gloves must be used when employees are working with exposed electrical parts above fifty (50) volts.
- Protective shields, barriers or insulating materials must be used to protect each employee from shock, burns, or other electrical injuries while that person is working near exposed energized parts that might be accidentally contacted or where dangerous electric heating or arcing might occur.

2.2. Flame-Resistant Apparel and Under-layers Guidelines

- FR apparel shall be visually inspected before each use. FR apparel that is contaminated or damaged shall not be used. Protective items that become contaminated with grease, oil, flammable liquids, or combustible liquids shall not be used.
- The garment manufacturer's instructions for care and maintenance of FR apparel shall be followed.
- When the apparel is worn to protect an employee, it shall cover all ignitable clothing and allow for movement and visibility.
- FR apparel must cover potentially exposed areas completely. FR shirt sleeves must be fastened and FR shirts/jackets must be closed at the neck.

- Non-melting, flammable garments (i.e. cotton, wool, rayon, silk, or blends of these materials) may be used as under-layers beneath FR apparel.

- Melt-able fibers such as acetate, nylon, polyester, polypropylene, and spandex shall not be permitted in fabric under-layers next to skin. (An incidental amount of elastic used on non-melting fabric underwear or socks shall be permitted).

- FR garments worn as outer layers over FR apparel (i.e. jackets or rainwear) must also be made from FR material.

2.3. Insulated Tools and Materials

- Only insulated tools and equipment are to be used within the Limited Approach Boundary of exposed energized parts. This practice applies to Barr employees as well as client or third-party personnel when a Barr employee is within the arc-flash boundary.

- Insulated tools shall be rated for the voltages on which they are used.

- Insulated tools shall be designed and constructed for the environment to which they are exposed and the manner in which they are used.

- Ropes and hand-lines used near exposed energized parts shall be nonconductive.

- Portable ladders used for electrical work shall have nonconductive side rails.

Appendix C

Definitions

1. Definitions

(Note, these definitions are excerpted from NFPA 70E, 2012 Edition, see Article 100. Not all definitions have been included here)

Arc Flash Hazard: A dangerous condition associated with the possible release of energy caused by an electric arc.

Arc Rating: The value attributed to materials that describes their performance to exposure to an electrical arc discharge. The arc rating is expressed in cal/cm^2 and is derived from the determined value of the arc thermal performance value (ATPV) or energy of breakopen threshold (E_{BT}) (should a material system exhibit a breakopen response below the APTV value). Arc rating is reported as either ATPV or E_{BT}, whichever is the lower value.

Boundary, Arc Flash: When an arc flash hazard exists, an approach limit at a distance from a prospective arc source within which a person could receive a second degree burn if an electrical arc flash were to occur.

Boundary, Limited Approach: An approach limit at a distance from an exposed energized electrical conductor or circuit part within which a shock hazard exists.

Boundary, Prohibited Approach: An approach limit at a distance from an exposed energized electrical conductor or circuit part within which work is considered the same as making contact with the electrical conductor or circuit part.

Boundary, Restricted Approach: An approach limit at a distance from an exposed energized electrical conductor or circuit part within which there is an increased likelihood of electric shock, due to electrical arc-over combined with inadvertent movement, for personnel working in close proximity to the energized electrical conductor or circuit part.

Electrical Hazard: A dangerous condition such that contact or equipment failure can result in electric shock, arc flash burn, thermal burn, or blast.

Electrical Safety: Recognizing hazards associated with the use of electrical energy and taking precautions so that hazards do not cause injury or death.

Electrically Safe Work Condition: A state in which an electrical conductor or circuit part has been disconnected from energized parts, locked/tagged in accordance with established standards, tested to ensure the absence of voltage, and grounded if determined necessary.

Incident Energy: The amount of thermal energy impressed on a surface, a certain distance from the source, generated during an electrical arc event. Incident energy is typically expressed in calories per square centimeter(cal/cm2).

Incident Energy Analysis: A component of an arc flash hazard analysis used to predict the incident energy of an arc flash for a specified set of conditions.

Qualified Person: One who has demonstrated skills and knowledge related to the construction and operation of electrical equipment and installations and has received safety training to identify and avoid the hazards involved.

Risk: A combination of the likelihood of occurrence of injury or damage to health and the severity of injury or damage to health that results from a hazard.

Risk Assessment: An overall process that identifies hazards, estimates the potential severity of injury or damage to health, estimates the likelihood of occurrence of injury or damage to health, and determines if protective measures are required.

Shock Hazard: A dangerous condition associated with the possible release of energy caused by contact or approach to energized electrical conductors or circuit parts.

Short-Circuit Current Rating: The prospective symmetrical fault current at a nominal voltage to which an apparatus or system is able to be connected without sustaining damage exceeding defined acceptance criteria.

Single-Line Diagram: A diagram that shows, by means of single lines and graphic symbols, the course of an electric circuit or system of circuits and the component devices or parts used in the circuit or system.

Unqualified Person: A person who is not a qualified person.

Working On (energized electrical conductors or circuit parts): Intentionally coming into contact with energized electrical conductors or circuit parts with the hands, feet, or other body parts, with tools, probes, or with test equipment, regardless of the personal protective equipment (PPE) a person is wearing. There are two categories of "working on": *Diagnostic (testing)* is taking readings or measurements of electrical equipment with approved test equipment that does not require making any physical change to the equipment; *Repair* is any physical alteration of electrical equipment (such as making or tightening connections, removing or replacing components, etc.).

Appendix D

Working on Energized Equipment

1. Working On or Near Energized Equipment

Working on energized equipment means working on live circuits and actually touching energized parts. Working near live circuits means working close enough to energized parts to pose a risk even though work is on de-energized parts. Common tasks where there may be a need to work on or near live circuits include:

- Taking voltage measurements
- Opening and closing disconnects and breakers
- Racking breakers on and off the bus
- Removing panels and dead fronts
- Opening electric equipment doors for inspection

2. Energized Electric Work Permit for 50 Volts and Greater

- Work related to testing, troubleshooting, and voltage measuring may be completed without a permit provided appropriate safe work practices and PPE are used.
- If live parts are not placed in an electrically safe condition, work to be performed shall be considered energized electrical work and will require an Energized Electrical Work Permit (to be provided by Barr's client on whose site Barr personnel are present).
- Energized Electrical Work Permit can be found in Appendix E of this document. The intent of this permit is to ensure that all appropriate safety precautions are taken prior to starting energized electrical work.
- The permit must be originated by the qualified electrical worker.
- Energized Work Permits shall be submitted to, approved, and filed by the appropriate supervisor for each facility.

3. De-energizing Electrical Equipment

Electrically Safe Condition: The most important principle of electrical safety is to **assume all electric circuits are energized unless each involved worker ensures they are not.** Every circuit and conductor must be tested every time work is done on them. Proper PPE must be worn until the equipment is proven to be de-energized.

- Electrically insulated shoes should be worn
- Safety glasses must be worn
- The required Arc Flash PPE must also be worn

The National Fire Protection Association (NFPA) lists six steps to ensure conditions for electrically safe work.

1. Identify all sources of power to the equipment. Check applicable up-to-date drawings, diagrams, and identification tags.
2. Remove the load current, and then open the disconnecting devices for each power source.
3. Where possible, visually verify that blades of disconnecting devices are fully open or that draw out-type circuit breakers are fully withdrawn.
4. Apply lockout/tagout devices in accordance with Barr Engineering LOTO program.
5. Test each phase conductor or circuit part with an adequately rated voltage detector to verify that the equipment is de-energized. Test each phase conductor or circuit part both phase-to-phase and phase-to-ground. Check the voltage detector before and after each test to be sure it is working.
6. Properly ground all possible sources of induced voltage and stored electric energy (such as, capacitors) before touching. If conductors or circuit parts that are being de-energized could contact other exposed conductors or circuit parts, apply ground-connecting devices rated for the available fault current.

The process of de-energizing is "live" work and can result in an arc flash due to equipment failure. When de-energizing, follow the procedures described in "Working On or Near Energized Equipment."

4. Boundary Definitions

Refer to Appendix C for definitions to these boundary terms:

- Limited Approach Boundary
- Restricted Approach Boundary
- Arc Flash Boundary

5. Other Precautions

When working on de-energized parts, but still inside the flash protection boundary for nearby live exposed parts:

- If the parts cannot be de-energized, barriers such as insulated blankets should be used to protect against accidental contact or PPE must be worn.
- Employees shall not reach blindly into areas that might contain exposed live parts.

- Employees shall not enter spaces containing live parts unless illumination is provided that allows the work to be performed safely.

- Conductive articles of jewelry and clothing (such as watchbands, bracelets, rings, key chains, necklaces, metalized aprons, cloth with conductive thread, metal headgear, shall not be worn where they present an electrical contact hazard with exposed live parts. (It recommended that eyeglasses frames be made of a non-conductive material.)

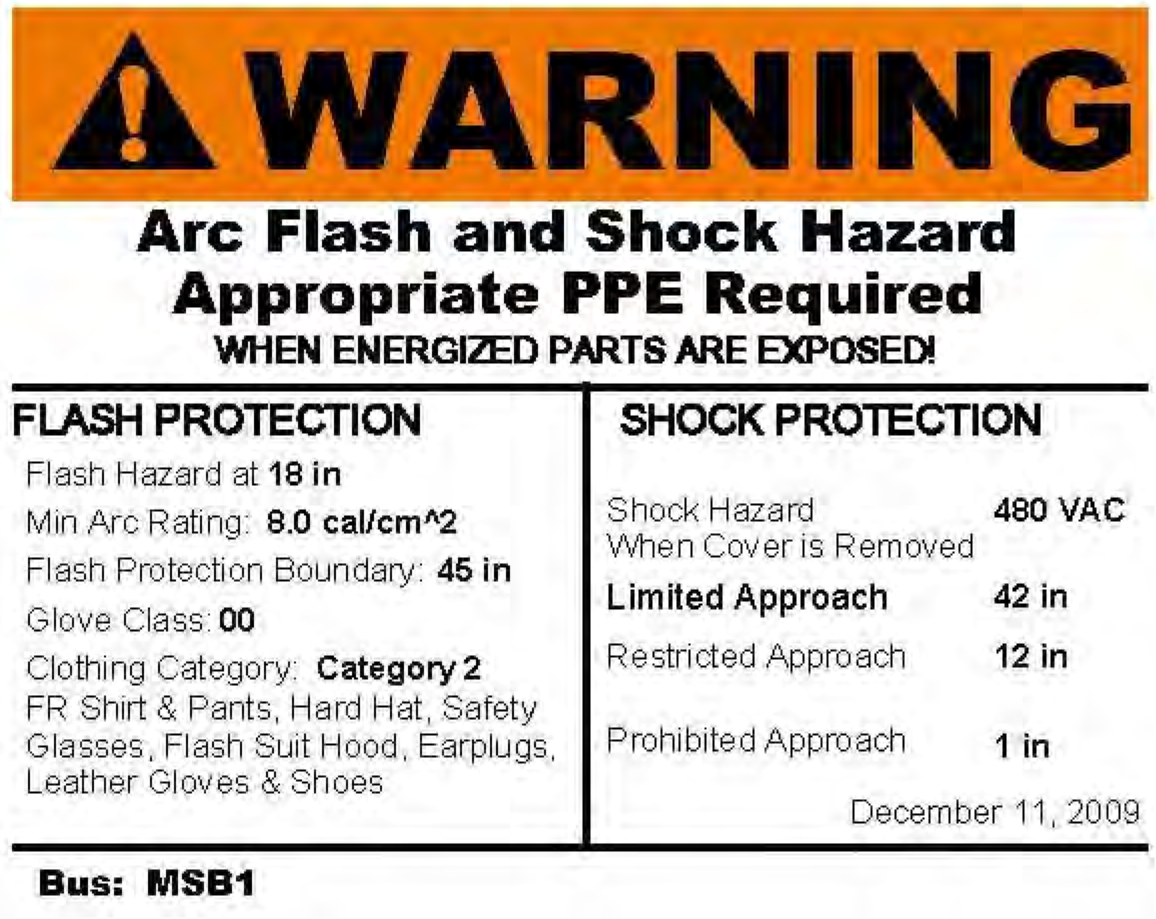
- Conductive materials, tools, and equipment that are in contact with any part of an employee's body shall be handled in a manner that prevents accidental contact with live parts. Such materials and equipment include, but are not limited to long conductive objects such as ducts, pipes, tubes, conductive hose and rope, metal-lined rules and scales, steel tapes, pulling lines, metal scaffold parts, structural members, and chains.

- Doors, hinged panels, and the like shall be secured to prevent them from swinging into employees.

6. Equipment Labeling

All switchboards, panel boards, industrial control panels, motor socket enclosures, and motor control centers must be labelled to warn workers of potential electrical hazards. Labels must be placed in a prominent location and display both maximum device voltage and warning of shock and arc fault hazards.

This is an example of a hazard warning requirement:



WARNING

Arc Flash and Shock Hazard
Appropriate PPE Required

WHEN ENERGIZED PARTS ARE EXPOSED!

FLASH PROTECTION

Flash Hazard at **18 in**

Min Arc Rating: **8.0 cal/cm^2**

Flash Protection Boundary: **45 in**

Glove Class: **00**

Clothing Category: **Category 2**
FR Shirt & Pants, Hard Hat, Safety Glasses, Flash Suit Hood, Earplugs, Leather Gloves & Shoes

SHOCK PROTECTION

Shock Hazard When Cover is Removed	**480 VAC**
Limited Approach	**42 in**
Restricted Approach	**12 in**
Prohibited Approach	**1 in**

December 11, 2009

Bus: MSB1

Appendix E

Supplemental Forms

(SAMPLE)

Energized Electrical Work Permit

1. Date_______________ Plant ______________ Time_____________

2. Description of work to be done: Attach additional sheets if needed.

3. Classification of work to be done: Prohibited______ Restricted__________

4. Can the Equipment be shut down Yes____ No____
If no, explain why not:

Next available shut down date:_________________

5. Detailed job description of work procedure to be used. Attach additional sheets if needed.

6. How will access to the area be controlled?

7. Results of Arc Flash Analysis

Voltage ________ volts
Incident Energy__________ cal/cm^2
PPE Category ___________
PPE required____

Arc Flash Protection Boundary ____________
Shock Protection Boundary_______________

8. Do you agree that work described can be completed safely and is correct

______________________________ _____________ Yes____ No___
Signature, Fully Qualified Worker Date

9. Reason for request____

10. Approval

______________________________ _____________ Yes____ No___
Signature, Facility Manager Date

JOB PLANNING CHECKLIST

This checklist is used in the development of Standard Job Plans for Electrical Work. Use as a guideline for the type of information and risks to consider when developing a plan.

Identify:

☐ Voltage Levels: __________Volts
  Any Secondary Voltage Sources: ☐ Yes ☐ No
    If yes, what are you going to do:________________

☐ Arc Flash Hazards__________________________________
  ☐ Shock Protection Boundaries:______________________
  ☐ Flash Protection Boundaries:______________________
  ☐ Incident Energy:______________________________
  ☐ PPE Required:________________________________

☐ Unusual Work Conditions:____________________________
☐ Skills Required:___________________________________
☐ Number of Personnel to Complete Task____________________
☐ Other Hazards:____________________________________

Check

☐ Facility One-Line
☐ Job Description
☐ Job Status
☐ Safety Procedures
☐ PPE Condition
☐ Vendor Instructions

Remember

☐ Lock Out – Tag Out
☐ Test for Voltage First
☐ Install and Remove Grounds
☐ Install Barriers
☐ Proper Tools
☐ Double Check Things

In Case of an Emergency

☐ Is there a Standby CPR Trained Person: ☐ Yes ☐ No
☐ Required Emergency Equipment Available: ☐ Yes ☐ No
☐ Confined Space Rescue (if Needed): ☐ Yes ☐ No
☐ Emergency Shut-Off Located:__________________________
☐ Fire Extinguisher Located:___________________________
☐ Nearest Emergency Phone:___________________________