DRAFT ENGINEERING DESIGN REPORT

Boeing Renton Cleanup Action Plan Implementation

Boeing Renton Facility

Renton, Washington

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ACRONYMS AND ABBREVIATIONS

AFCEE	Air Force Center for Civil and Environmental Engineering
AOCs	areas of concern
ARARs	applicable or relevant and appropriate requirements
bgs	below ground surface
Boeing	Boeing Company
Bosair	Bosair, L.L.C.
BTEX	benzene, toluene, ethylbenzene, and xylene
CAP	Cleanup Action Plan
CFR	Code of Federal Regulations
COCs	constituents of concern
CPOC	conditional point of compliance
CSU	container storage unit
CUL	cleanup level
1,1-DCE	1,1-dichloroethene
cis-1,2-DCE	*cis*-1,2-dichloroethene
Ecology	Washington State Department of Ecology
EDR	Engineering Design Report
EVO	emulsified vegetable oil
Facility	Boeing Renton Facility
fpm	feet per minute
FS Report	final Feasibility Study Report
GAC	granular activated carbon
gpm	gallons per minute
GPS	global positioning system
HDPE	high-density polyethylene
HP	horsepower
HSA	hollow-stem auger
I-405	Interstate 405
ISB	in situ bioremediation
KMN 2000	potassium permanganate/zeolite media
LEL	lower explosive limit
µg/L	microgram per liter
MA	monitored attenuation
MEK	methyl ethyl ketone
mg/L	milligrams per liter
MNA	monitored natural attenuation
MTCA	Model Toxics Control Act
NPDES	National Pollutant Discharge Elimination System
O&M	Operations and Maintenance
ORC	oxygen-releasing compound
ORC-A	Oxygen-Release Compound—Advanced®
Order	Agreed Order No. 8191

ORP	oxidation/reduction potential
OSHA	U.S. Occupational Safety and Health Act
P&ID	process and instrumentation diagram
PCE	tetrachloroethene (perchloroethylene)
PID	portable photoionization detector
PLC	programmable logic controller
POC	point of compliance
ppm	parts per million
PSCAA	Puget Sound Clean Air Agency
psi	pounds per square inch
psig	pounds per square inch gauge
PVC	polyvinyl chloride
QA	quality assurance
QC	quality control
RCRA	Resource Conservation and Recovery Act
RCW	Revised Code of Washington
RI	remedial investigation
ROI	radius of influence
SCFM	standard cubic feet per minute
SOP	standard operating procedure
SVE	soil vapor extraction
SVOCs	semivolatile organic compounds
SWMUs	solid waste management units
TCE	trichloroethene
TE&SC	temporary erosion and sediment control
TEA	terminal electron acceptor
TOC	total organic carbon
TPH	total petroleum hydrocarbons
TPH-D	total petroleum hydrocarbons, diesel-range
TPH-G	total petroleum hydrocarbons, gasoline range
TPH-MO	total petroleum hydrocarbons, motor oil range
USACE	U.S. Army Corps of Engineers
UST	underground storage tank
VC	vinyl chloride
VFD	variable frequency drive
VOCs	volatile organic compounds
WAC	Washington Administrative Code
WISHA	Washington Industrial Safety and Health Act

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1.0 INTRODUCTION

The Boeing Company (Boeing) has been working with the Washington State Department of Ecology (Ecology) to address historic releases of hazardous substances at the Boeing Renton Facility (Facility) located in the City of Renton, Washington (Figure 1). Boeing has entered into Agreed Order No. 8191 (Order) with Ecology to remediate former releases at the Facility in accordance with the Cleanup Action Plan (CAP) for the Facility dated October 2012 (AMEC, 2012). The Order was issued under the authority of the Revised Code of Washington (RCW) 70.105D.050(1) and Washington Administrative Code (WAC) 173-303-64630 and became effective on January 2, 2013.

Work that has been completed at the site includes detailed site characterization, preparation of a remedial investigation (RI) report (Weston, 2001), closure of Resource Conservation and Recovery Act (RCRA) units, interim cleanup actions, implementation of institutional controls, and quarterly and semiannual monitoring of groundwater. In addition, the final Feasibility Study Report (FS Report) (Geomatrix, 2008) was completed, evaluating alternative approaches for Facility cleanup. Ecology subsequently issued the final CAP (AMEC, 2012), which identifies the final remedies to be implemented at the Facility.

This Draft Engineering Design Report (EDR) has been prepared pursuant to the requirements of the Model Toxics Control Act (MTCA) regulations [WAC 173-340-400(4)(a)] and the Order to implement the remedies specified in the CAP. Due to the relatively straightforward nature of the remedies specified in the CAP, this EDR includes plans and specifications for construction of the remedies, which were prepared in accordance with WAC 173-340-400(4)(b), as well as an Operations and Maintenance (O&M) Plan prepared in accordance with WAC 173-340-400(4)(c). Boeing has elected to include the construction plans and specifications as Appendix A in this EDR in order to expedite implementation of the CAP remedies. This document is being submitted to Ecology for review and approval in accordance with the Order. Upon approval of the EDR, Boeing will proceed to construct and implement the final Facility remedy in accordance with the approved EDR.

1.1 PURPOSE AND SCOPE

The purpose of this EDR is to document the design, plans, and specifications for implementation of the comprehensive remedy for the Facility as specified in the CAP and to demonstrate compliance with applicable laws and regulations. The scope of the EDR includes an overview of the cleanup action design, complete plans and specifications for implementation of the CAP remedies, and a plan for implementing the selected remedy at each of the 12 solid waste management units (SWMUs) and areas of concern (AOCs) identified in the CAP as requiring cleanup. The general layout of the Facility and the locations of the SWMUs and AOCs addressed by this EDR are shown on Figure 2.

This EDR presents general plans for construction of the CAP remedy and for monitoring performance and compliance of the remedy after construction is complete. The Facility cleanup standards, which consist of the cleanup levels (CULs) defined in the CAP and the conditional points of compliance (CPOCs) that are described generally in the CAP, are documented in this EDR. The cleanup actions designed to achieve the cleanup standards and the monitoring program designed to demonstrate attainment of the cleanup standards are also described in this EDR.

1.2 OVERVIEW OF CLEANUP ACTION PLAN

The CAP documents the constituents of concern (COCs) to be addressed by the final remedies, provides the CULs applicable to soil and groundwater, describes the CPOCs, and specifies the final cleanup action for 12 separate SWMUs and AOCs at the Facility. The cleanup actions specified in the CAP include source area excavation/off-site disposal, soil vapor extraction (SVE), enhanced bioremediation, monitored attenuation (MA), and monitored natural attenuation (MNA). A summary of the COCs and remedies specified in the CAP is presented in Table 1.

The design, plans, and specifications presented in this EDR describe the excavations, bioremediation injection galleries, and SVE systems to be implemented for several SWMUs and AOCs. The plans and specifications presented in this EDR will be used to procure and install the SVE systems and bioremediation injection wells. The plans and specifications also describe the well locations and design for the groundwater monitoring system that will be constructed as part of the remedy implementation. As noted in Table 1, several SWMUs/AOCs will be remediated by MA or MNA; for these sites, monitoring programs to assess the effectiveness of biodegradation will be similar. A general monitoring approach has been designed for the MA and MNA sites, with specific details presented for individual SWMUs and AOCs.

The cleanup action specified in the CAP has also been modified for AOC-060. As noted in Table 1, MNA was specified in the CAP. As noted in the April 29, 2013, bioremediation Work Plan for Continued Interim Actions (CALIBRE, 2013), electron donor was injected into two of the wells at AOC-060 to accelerate the attenuation process. Therefore, the remedy for AOC-060 described in this EDR includes enhanced bioremediation/monitored attenuation rather than MNA.

1.3 REPORT ORGANIZATION

This EDR is organized into the following sections

- **Section 1** describes the purpose and scope of the EDR.
- **Section 2** provides a description of the Facility and provides background information for each SWMU and AOC.
- **Section 3** describes the cleanup action objectives and cleanup standards.
- **Section 4** describes the institutional controls that are a component of the cleanup actions for each SWMU and AOC addressed by the EDR.
- **Section 5** describes the cleanup plan and design for implementing MNA for the appropriate SWMUs and AOCs.
- **Section 6** presents the design and cleanup plan for implementing enhanced bioremediation and MA for both aerobic and anaerobic systems.
- **Section 7** presents the designs and plans for implementing SVE at SWMU-172/174 and the Building 4-78/79 SWMU/AOC Group.
- **Section 8** describes the implementation schedule and reporting requirements for the cleanup action.
- **Section 9** provides a list of references cited in the EDR.

Appendices to the EDR provide additional plans, specifications, and other background information regarding the cleanup action.

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2.0 SITE DESCRIPTION

The Boeing Renton Facility is located at the south end of Lake Washington within the Renton city limits, as depicted in Figure 1. Boeing manufactures the 737 airplane model at the Facility. Operations include parts preparation, mechanical assembly, coating operations, testing, and support operations associated with the final assembly of airplanes.

2.1 PHYSICAL DESCRIPTION

The Facility encompasses approximately 198 acres; Boeing owns approximately 180 acres east of the Cedar River Waterway and leases the remaining 18 acres at Renton Municipal Airport from the City of Renton. The Facility is bounded on the north by Lake Washington. The Cedar River Waterway and Cedar River Trail Park separate the eastern portion of the Facility on land owned by Boeing from the western portion of the facility at Renton Municipal Airport. Two leased portions of the Facility are located on the Renton Municipal Airport. One small parcel is located adjacent to the west side of the runway, and the second parcel is located on the southeast side of the runway. The ground surface elevation within the Facility ranges from approximately 18 to 27 feet above the National Geodetic Vertical Datum of 1929.

2.2 LAND USE

The Facility layout and the location of each of the individual SWMUs and AOCs addressed in this EDR are shown on Figure 2. Effective December 1, 2003, the City of Renton rezoned portions of the Facility and some adjacent areas to allow mixed land use under the “Urban Center North” land use designation. This designation allows changes in the use of the Facility property but also allows Boeing to continue to build commercial airplanes at the Facility for the foreseeable future.

The portion of the Facility east of the Cedar River Waterway is almost entirely developed with buildings and paved with asphalt or concrete. This area meets the MTCA definition for industrial properties (WAC 173-340-200 and the additional criteria described in WAC 173-340-745). This area is zoned by the City of Renton for mixed use, including industrial uses connected to airplane manufacturing. The portion of the Facility west of the Cedar River Waterway at the Renton Municipal Airport is zoned for industrial use (see the City of Renton Comprehensive Plan [City of Renton, 2004] as amended on September 11, 2011).

Land immediately surrounding the Facility is zoned for a wide variety of land uses. Areas west and south of Renton Municipal Airport are zoned for a mixture of commercial and commercial/residential land uses. An area of mixed commercial, industrial, and residential land uses lies to the east and south of the Facility. Residential areas are located southeast of the Facility, south of North 6th Street, and east of the Facility across Logan Avenue North. Residential properties are also located within

0.25 mile to the west and south of the Renton Municipal Airport. Areas immediately east of Interstate 405 (I-405) (within 0.5 mile of the Facility boundary) also consist largely of residential properties.

As detailed in the CAP, public-use areas near the Facility include the adjoining Cedar River Trail Park and the Renton Municipal Airport. Cedar River Park and Liberty Park are located at the intersection of I-405 and the Maple Valley Highway, approximately 0.7 mile south-southeast of the Facility boundary. Gene Coulon Memorial Beach Park is located approximately 0.25 mile northeast of the Facility boundary, along the shoreline of Lake Washington. Water sport activities on Lake Washington adjacent to the Facility include fishing, boating, and water skiing.

2.3 FACILITY BACKGROUND

This section describes the background of each of the SWMUs and AOCs for the Facility. The locations of each of the SWMUs and AOCs are presented on Figure 2. The monitoring reports that have been prepared for the Facility provide a long record of groundwater conditions for each of the SWMUs/AOCs addressed in this EDR.

2.3.1 SWMU-168

SWMU-168 is located near the northeast corner of Building 5-50 on leased property at the Renton Municipal Airport. SWMU-168 consists of the area around a former underground storage tank (UST) designated URE-31 (for underground tank Renton, number 31) (see Figure 3). Former UST URE-31 was a 1,000-gallon concrete tank that was installed in 1979 and removed in September 1985. This UST was used for the storage of solvent waste generated in Building 5-50. There is no documented information regarding releases from this SWMU.

2.3.1.1 Investigation History

Soil and groundwater samples were collected during the RI at SWMU-168 in 1999 using push probes (Weston, 2001). Boeing collected another round of samples prior to development of the CAP (Geomatrix 2008). Five additional push probes were completed in April 2008 during the Pre-CAP investigation (AMEC Geomatrix, 2008). Both soil and groundwater samples were collected from these push probes. Based on the results of investigations for this SWMU, the COCs listed in Table 1 were established in the CAP.

2.3.1.2 Implemented Interim Actions

URE-31 was removed in 1985, and there was no documented soil removal at the time the tank was removed. No other interim actions have been conducted at SWMU-168.

2.3.2 SWMU-172/174

SWMU-172 and SWMU-174 are located west of the Cedar River Waterway on leased property along the eastern side of the Renton Municipal Airport (Figure 4). Both SWMU-172 and SWMU-174 are the locations of former wastewater USTs located adjacent to Buildings 5-09 and 5-08, respectively (Figure 4). SWMU-172 is associated with former UST URE-66, and SWMU-174 is associated with former UST URE-73. Both USTs were removed in 1987.

2.3.2.1 Investigation History

Soil and groundwater samples were collected during the RI in 1999 and 2000 from push probes and groundwater monitoring wells (Weston, 2001). Based on results of investigations conducted prior to releasing the CAP, the COCs listed in Table 1 were established for this site. Boeing collected another round of samples in 2008, prior to development of the CAP. Eight additional push probes were completed in April 2008 for soil and groundwater sampling. An additional seven groundwater samples were collected from existing groundwater monitoring wells at these SWMUs (AMEC Geomatrix, 2008).

The constituents found in the Pre-CAP field investigation in 2008 were similar to those found during the RI. The 2008 results showed that concentrations of benzene and chlorinated solvents in soil were higher than those detected in soil during the RI in 1999 and 2000 (AMEC Geomatrix, 2008). Three constituents (1,1-dichloroethene [1,1-DCE], *cis*-1,2-dichloroethene [*cis*-1,2-DCE], and vinyl chloride [VC]) were detected at elevated concentrations in soil during the Pre-CAP investigation. As a result, these constituents were added as COCs in the CAP. Results for the 2008 groundwater samples also exceeded CULs for several constituents.

2.3.2.2 Implemented Interim Actions

During the UST removal activities conducted in 1987 for SWMUs 172 and 174, approximately 29 cubic yards of affected soil was removed from SWMU-172, and approximately 8 cubic yards of affected soil was removed from SWMU-174. The excavations were backfilled with clean, imported fill and repaved with asphalt (Weston, 2001).

2.3.3 Building 4-78/79 SWMU/AOC Group

The Building 4-78/79 SWMU/AOC Group is located east of the Cedar River Waterway adjacent to the Cedar River Trail Park (Figure 5). Former USTs at the Building 4-78/79 SWMU/AOC Group were used to store gasoline and methyl ethyl ketone (MEK). In addition, fuel from these tanks was piped to a fuel dispenser located on the east side of Building 4-79. The USTs, the gasoline dispenser island, and associated piping were removed from this area. Former Buildings 4-61 and 4-73 were demolished in early 2004 and converted to parking facilities. Building 4-78 is currently being used for temporary storage of hazardous materials. Building 4-79 is used for painting aircraft parts.

A general description of this SWMU/AOC Group is provided below:

- ***SWMU-181:*** This SWMU was a Dangerous Waste Storage Area used for the accumulation of containerized dangerous wastes brought from other areas of the Facility prior to off-site disposal. Building 4-78 was re-constructed over the footprint of the former dangerous waste storage area for use as a new hazardous materials storage building. Building 4-78 was initially operated as a dangerous waste container storage unit (CSU) and permitted as a dangerous waste storage facility. A closure plan for the permitted CSU was approved by Ecology on November 6, 1997, and implemented later in 1997. A closure certification report was submitted to Ecology that documented closure in accordance with the approved closure plan. Building 4-78 is currently used to store new hazardous materials. As documented in the final RI Report, historical data indicate that releases of volatile organic compounds (VOCs), semivolatile organic compounds (SVOCs), and petroleum products to groundwater occurred from this SWMU.

- ***AOC-013:*** Former URE-17, a 1,000-gallon steel tank, was used to store gasoline. Soil and groundwater samples collected in the vicinity of this former UST in 1989 had detectable concentrations of VOCs and total petroleum hydrocarbons (TPH).

- ***AOC-014:*** Former URE-18, a 10,000-gallon steel tank, was used to store MEK. VOCs, MEK, and TPH were detected in groundwater samples from the vicinity. These constituents were not detected in soil samples collected near the former tank.

- ***AOC-015:*** Former URE-24, a 4,000-gallon steel tank, was used to store gasoline. The tank was removed in September 1985. Benzene, toluene, ethylbenzene, and xylenes (BTEX); TPH; MEK; and VOCs were detected in groundwater samples in the vicinity. Soil samples collected near the former tank were analyzed for BTEX, TPH, and MEK. None of the analytes were detected.

- ***AOC-026:*** Former URE-54, a 1,000-gallon steel tank, was used to store gasoline. It was removed in 1985. Dissolved-phase benzene was detected in groundwater samples adjacent to this former UST. Trichloroethene (TCE), benzene, and VC were detected in groundwater samples collected in the vicinity of this AOC.

- ***AOC-037:*** Former URE-25, a 500-gallon steel tank, was used to store MEK. URE-25 was removed in September 1987. Laboratory analyses of soil verification samples collected in 1993 were below RCRA Subpart S action limits. TCE, benzene, and VC were detected in groundwater samples collected in the vicinity of this AOC.

- ***AOC-054:*** Former URE-23, a 10,000-gallon steel tank, was used to store gasoline until it was removed in April 1989. Analysis of soil and groundwater samples identified detectable concentrations of BTEX, TPH, and VOCs.

These historical activities have resulted in two separate types of source areas for the Building 4-78/79 SWMU/AOC Group:

- A chlorinated solvent source area is associated with the former dangerous waste storage facility in Building 4/78 (SWMU-181).
- Fuel and nonchlorinated solvent source areas are associated with the former USTs, the former fuel dispenser island, and the removed piping.

2.3.3.1 Investigation History

Investigations conducted prior to and during the RI for the Building 4-78/79 SWMU/AOC Group are summarized in the RI Report (Weston, 2001). Additional sampling was conducted in 2008 and 2009, and groundwater monitoring is ongoing. Based on results of investigations conducted prior to releasing the CAP, the COCs listed in Table 1 were established for this site. Many of the AOCs at this site have already been addressed through tank removal and, in some cases, limited soil removal.

Soil and groundwater samples were collected in April 2008 from 12 push probes completed during the Pre-CAP investigation. An additional seven groundwater samples were collected from existing groundwater monitoring wells (AMEC Geomatrix, 2008). An additional push probe (PP201) was completed in June 2009 to collect soil and groundwater samples and to determine impacts north of the Building 4-78 loading dock (Figure 5).

The analytical results for samples collected in 2008 suggest that the area around Building 4-78, especially the north side of the building where solvents were stored for recycling and/or off-site disposal prior to 1991, is the primary source of chlorinated VOCs for the Building 4-78/79 SWMU/AOC Group. The highest concentrations of primary VOCs were found directly north of Building 4-78 (PP178) and just west of the north end of the building (PP185 and PP188). Data from upgradient locations east of the building and loading dock (GW027D, PP179, PP180, PP181, and PP182) showed much lower concentrations, which may be the result of vapor transport from the source area.

Elevated levels of benzene and TPH in the gasoline range (TPH-G) detected in soil and groundwater samples are attributable to releases from the former USTs, the former fuel dispenser, and its former piping system. Areas to the north and south of the former piping network are generally unaffected by VOCs and TPH-G (AMEC Geomatrix, 2008).

2.3.3.2 *Implemented Interim Actions*

Previous site cleanup actions in this area have included removal of structures and/or USTs and implementation of an interim action consisting of groundwater extraction and treatment. The following site cleanup actions have occurred at this site.

- ***AOC-13:*** Former UST URE-17, used for gasoline storage, was removed in September 1985, and 50 gallons of gasoline was reported to have been removed from the tank excavation. No soil was documented as having been removed from the excavation.
- ***AOC-14:*** Former UST URE-18 contained MEK and was removed in March 1987. During the tank removal, approximately 290 cubic yards of soil was removed from the excavation for off-site disposal.
- ***AOC-15:*** Former UST URE-24 was removed in September 1985, and approximately 50 gallons of gasoline was reportedly recovered from the excavation.
- ***AOC-26:*** Former UST URE-54 was removed in September 1985, and holes were noted in the bottom of the tank. An unspecified amount of contaminated soil was removed from the excavation, and an unknown quantity of floating hydrocarbon product was extracted from the excavation.
- ***AOC-037:*** Former UST URE-25 was removed in September 1987. No soil was documented to have been removed during the excavation.
- ***AOC-054:*** Former UST URE-23 was removed in April 1989, and approximately 200 cubic yards of soil was excavated.
- ***Building 4-78/79 SWMU/AOC Group:*** A hydraulic containment interim measure addressing the entire site was installed in 1991. The hydraulic containment system consisted of two extraction wells, an air stripper, and a monitoring well network. The groundwater hydraulic containment system was operated continuously until it was shut down in November 2003 to allow site hydrogeologic conditions to recover to static conditions and support evaluation of potential remedial alternatives.

2.3.4 Former Fuel Farm

The Former Fuel Farm consisted of three steel USTs (URE-033, URE-034, URE-035) and one concrete waste oil and hydraulic fluid UST (URE-036) located near the south end of Renton Municipal Airport, about 200 feet southeast of Building 5-02 (Figure 6). URE-033 and URE-034 had capacities of 50,000 gallons; URE-035 and URS-036 had capacities of 12,000 gallons. The three steel USTs were installed in 1956 and 1957 and were removed during closure activities at the Former Fuel Farm in 1993. The concrete UST was installed in 1950 and deactivated in October 1987. Areas of residual petroleum hydrocarbons remaining in soil associated with the three former steel fuel storage tanks have been identified as AOC-046, AOC-047, and AOC-048, respectively. The concrete UST (URE-036) is associated with SWMU-164.

Boeing formerly leased the Former Fuel Farm area from the City of Renton, but the majority of this area is now leased by a third party (Ace Aviation, or Bosair, L.L.C. [Bosair]) for servicing and parking of aircraft. Bosair is planning to construct a larger hangar facility in the vicinity of the Former Fuel Farm. Due to declining contaminant concentrations, and to accommodate the planned redevelopment, Boeing abandoned all air sparge and bioventing wells and three other monitoring wells that were located near the planned construction area during May 2012. The biovent/biosparge lines were left in place, but will likely be removed as part of the redevelopment construction. In addition, groundwater monitoring wells GW101S, GW102S, GW 219S, and GW220S were abandoned in May 2013. It is currently expected that Bosair redevelopment construction will start in Spring 2014. Ecology has requested that Boeing install three wells after the site has been redeveloped: one located near GW220S, one between GW219S and GW102S, and one between GW224S and GW102S.

2.3.4.1 Investigation History

Soil sampling performed in 1994 assessed the lateral and vertical extent of TPH-affected soil near this area. A total volume of approximately 4,400 cubic yards (5,200 tons) of soil was estimated to be above the MTCA Method A cleanup level. Chromatograms from soil samples suggested the presence of Jet A Fuel petroleum products (Weston, 1994). The Former Fuel Farm was also investigated during the RI in 1999 to 2000 (Weston, 2001). Based on the results of the 1994 and RI investigations, the COCs listed in Table 1 were established.

Groundwater samples were collected in 2008 as part of the Pre-CAP investigation. In 2011, after the Final Draft CAP (AMEC Geomatrix, 2010) had been distributed for public comment, Boeing became aware of Bosair’s redevelopment plans in the Former Fuel Farm area. To ensure that this expansion would not adversely affect cleanup of the area and that the Former Fuel Farm would not adversely affect the redevelopment, Boeing conducted additional soil and groundwater investigations in this area in 2011 and 2012, before the CAP was finalized. Results from the 2011-2012 investigation were included as Appendix D of the CAP (AMEC, 2012).

2.3.4.2 Implemented Interim Actions

Previous cleanup actions in this area have included removal of USTs, excavation and off-site disposal of affected soil, and implementation of an interim action in the Former Fuel Farm site. All three of the former Jet A Fuel USTs were removed in 1993. Approximately 5,200 tons of TPH-affected soil was excavated for off-site disposal during UST removal. The area excavated is shown on Figure 6.

An interim action consisting of air sparging and bioventing was conducted at the Former Fuel Farm AOC Group. The interim measure was initiated in May 1995 and operated until it was shut down in May 2011. Monitoring during the interim measure included collection of groundwater samples from monitoring wells and collection of soil samples to monitor degradation of soil COCs.

2.3.5 AOC-001/002

AOC-001 and AOC-002 are located near the northwest corner of Building 4-81 in the northern portion of the Facility (Figure 7). The Lake Washington shoreline is approximately 350 feet northwest of the two AOCs. AOC-001 and AOC-002 were originally associated with former USTs URE-01 and URE-02, respectively. Both USTs were 500-gallon steel tanks installed in 1980 for storage of MEK and toluene; both tanks were placed within a cylindrical concrete vault for secondary containment. After these USTs were removed in July 1986, toluene was detected in the water within the secondary containment structure. Subsequent subsurface investigations identified toluene and VC in groundwater samples collected in the area adjacent to URE-01 and URE-02 and in a large area just to the southwest. Investigation of the releases related to these AOCs identified primary and secondary source areas for chlorinated solvents, with a groundwater plume extending into the tow path used to move partially completed aircraft from Buildings 4-81 and 4-82 to other portions of the Facility.

The primary source area is located in the vicinity of PP138, and the secondary source area is located in the vicinity of PP011, adjacent to the location of former URE-01 and URE-02 (Figure 7). In general, the primary source area had higher COC concentrations than the secondary source area. Both source areas are affected by chlorinated VOCs, and the primary source area is also affected by TPH-G. Affected soil was removed from the primary source area as part of a 2005 interim measure (Section 2.3.5.2). Affected groundwater extends downgradient from the area identified as the primary soil source area.

The RI report (Weston, 2001) and the FS Work Plan (Geomatrix 2004b) grouped AOC-003 with AOC--001/002 because of their proximal locations and similar COCs. However, AOC-003 is located several hundred feet upgradient of AOC-001/002, and data collected subsequent to the RI suggest that there is no commingling of contaminants from AOC-003 with AOC-001/002. For these reasons, the CAP and this EDR address AOC-001/002 and AOC-003 as separate entities.

2.3.5.1 Investigation History

This area was investigated during several phases of the RI and post-RI investigation to further delineate the nature and extent of affected soil and groundwater. Based on results of investigations conducted prior to releasing the CAP, the COCs listed in Table 1 were established for AOC-001/002. Subsequent investigation has shown that affected groundwater associated with AOC-001/002 was present near the primary source area and at PP081 and PP098 near the CPOC. A push-probe soil and groundwater investigation was conducted in October 2005 just prior to implementing an interim action at the primary source area in order to delineate the extent of affected soil and groundwater (Geomatrix, 2006).

Additional investigation was completed at this area in April and May 2008 to evaluate VOC concentrations in soil and groundwater at the secondary source area. COCs were not present above cleanup levels in the secondary source area. Results from deeper groundwater samples indicated that groundwater beneath the silty peat layer has not been affected by COCs.

2.3.5.2 Implemented Interim Actions

A series of interim actions have been conducted for AOC-001/002. The first was implemented in 1986, when the USTs in the source areas were removed. A subsequent interim action included excavation of soil from the primary source area and implementing a bioremediation program to promote reductive dechlorination of COCs. These interim actions are described briefly below.

1986 Interim Action

Both USTs at AOC-001/002 were removed in July 1986. A total of 130 cubic yards of soil was removed from the excavations for URE-01 and URE-02 following removal of the tanks and secondary containment vault. Groundwater near the tanks had contained elevated concentrations of dissolved toluene. Approximately 4,600 gallons of water was pumped from the URE-01 and URE-02 excavation in an effort to remove the affected groundwater.

Excavation and Bioremediation Injections

An interim measure was implemented for AOC-001/002 in October/November 2005 to address affected soil in the source area and to enhance bioremediation of groundwater constituents (Geomatrix, 2006). The interim measure included:

- Excavation and off-site disposal of approximately 340 cubic yards of affected soil from the primary source area;
- Recovery and treatment of approximately 35,000 gallons of groundwater from the source area excavation;
- Installation of two injection lines in the primary source area for future injection of electron donor to enhance bioremediation;
- Placement of 4,800 pounds of food-grade sodium lactate and 6,300 pounds of emulsified food-grade vegetable oil to promote reductive dechlorination of COCs in groundwater in the primary source area;
- Collection and analysis of soil samples to confirm attainment of cleanup levels;
- Backfill and restoration of the tarmac above the excavation; and
- Installation of eight new groundwater monitoring wells.

Soil confirmation samples indicated that soil exceeding cleanup levels for AOC-001/002 had been removed. Groundwater monitoring data collected subsequent to the interim action indicate that biodegradation is active and that concentrations of chlorinated VOCs have decreased substantially.

Three additional shallow injection wells (GW213S, GW214S, and GW215S) were installed in April 2008 during drilling related to the Pre-CAP investigation (AMEC Geomatrix, 2008). The wells were installed to expand the bioremediation area and provide capability to inject electron donor within the secondary source area. However, analysis of VOCs in these three injection wells indicated that concentrations were below cleanup levels. Therefore no substrate injections were performed in this secondary area. Additional follow-up doses of electron donor (sugars, vegetable oil, and/or lactate) were injected at the primary AOC-001/002 source area in June 2007, June 2012, and May 2013 (after completion of quarterly sampling).

2.3.6 AOC-003

AOC-003 is located at the north side of the Facility between Buildings 4-20 and 4-82, as shown on Figure 8. AOC-003 represents the former UST URE-03, which was located just west of Building 4-81. The former UST at AOC-003 was installed in 1980 and was used to store MEK and toluene. The UST was constructed of steel within a cylindrical concrete vault for secondary containment and had a capacity of 500 gallons. URE-03 and soil surrounding the tank were removed in 1986. Solvents have been detected in both soil and groundwater in the immediate vicinity of former UST URE-003.

As mentioned in Section 2.3.5, this EDR addresses AOC-001/002 and AOC-003 as separate entities.

2.3.6.1 Investigation History

Following removal of URE-03 in July 1986, toluene was detected in the water found between the tank and concrete vault. Groundwater samples from the area adjacent to former URE-03 did not contain detectable concentrations of solvents.

The RI report indicated that soil samples contained TCE and groundwater samples collected at PP016 in May 1999 contained tetrachloroethene (also known as perchloroethylene or PCE) and VC. Based on results of investigations conducted prior to releasing the CAP, the COCs listed in Table 1 were established for AOC-003. Analysis of groundwater samples collected in 2007 from downgradient well GW-188S identified degradation products VC and *cis*-1,2-DCE. The presence of these degradation products indicates that biodegradation is actively occurring at AOC-003.

2.3.6.2 Implemented Interim Actions

After URE-03 was removed in 1986, a total of 74 cubic yards of soil was excavated from around the former tank location. Because groundwater samples collected near the tank contained elevated levels of dissolved toluene, approximately 3,600 gallons of groundwater was pumped from the URE-03 excavation to recover the dissolved toluene.

2.3.7 AOC-004

AOC-004 is the designation for former UST URE-04, which was a 250-gallon steel UST located approximately 10 feet east of Building 4-21 (see Figure 9). The former UST at AOC-004 was used to store gasoline and likely contained leaded gasoline prior to the mid-1970s. The installation date for the tank is unknown. The former UST URE-04 was removed in December 1986.

Soils at AOC-004 contain TPH-G and fuel-related COCs attributed to a past release from the former UST. During the Pre-CAP investigation, it was noted that Boeing had completed excavations in the area immediately surrounding AOC-004 to install footings associated with seismic upgrades for Building 4-21. These structures may limit the possibility of future excavation in the area of AOC-004.

2.3.7.1 Investigation History

AOC-004 was investigated during the RI in 1999 and 2000. During the RI, soil samples were collected from five push probes, and groundwater samples were collected from three of the push probe locations and a nearby groundwater monitoring well. Based on results from investigations conducted prior to issuing the CAP, the COCs listed in Table 1 were established for AOC-004.

Additional soil samples were collected from two push probes completed during the Pre-CAP investigation (AMEC Geomatrix, 2008). Results from the Pre-CAP investigation were generally consistent with findings from the RI Report and indicated the presence of TPH-G and individual gasoline constituents.

2.3.7.2 Implemented Interim Actions

Former URE-04 was removed in December 1986. During removal of the tank, a thin layer of floating product (gasoline) was observed on the water in the excavation. There is no documentation to indicate whether gasoline-affected soil was removed from the excavation.

2.3.8 AOC-034/035

AOC-034/035 is located next to the south side of Building 4-41 and east of the Cedar River Trail Park (Figure 10). AOC-034/035 is the location of former USTs URE-07 and URE-08. Both URE-07 and URE-08 were installed in 1980 for storage of MEK and toluene, but were reportedly never used. Each steel tank had a capacity of 500 gallons (Weston, 2001). Both USTs were removed in 1987. Results of investigations at AOC-034/035 indicate a historic release of chlorinated solvent that is naturally biodegrading. Recent data indicate that natural attenuation is active and is essentially attaining cleanup levels at the CPOC.

2.3.8.1 Investigation History

AOC-034/035 was investigated during the RI and a 2006 post-RI investigation to further delineate the nature and extent of affected soil and groundwater. Based on results of investigations conducted prior to releasing the CAP, the COCs listed in Table 1 were established for AOC-034/035.

Additional investigation was completed at this area in April and May 2008. Three shallow monitoring wells (GW216S, GW217S, and GW218S) were installed in April 2008 as part of the Pre-CAP investigation (AMEC Geomatrix, 2008). Analytical results from these wells indicate that natural attenuation is active and is essentially attaining cleanup levels at the CPOC.

2.3.8.2 Implemented Interim Actions

URE-07 and URE-08 were removed in 1987.

2.3.9 AOC-060

AOC-060 consists of a former vapor degreaser secondary containment sump located inside Building 4-42, as shown on Figure 11. The former vapor degreaser was used primarily to clean metal parts using TCE. The secondary containment sumps of the former degreaser were removed in December 1993.

Results from assessment activities conducted since December 1993 have indicated the presence of VOCs in soil and groundwater in the vicinity of the degreaser. The source of VOCs at this AOC was probably releases of TCE from the former vapor degreaser and/or its associated sumps. Ongoing degradation of the TCE is occurring at AOC-60 to form *cis*-1,2-DCE and VC. The extent of groundwater affected by dissolved VOCs extends west of the source area, where the former vapor degreaser and sumps were located. The affected groundwater is migrating to the west toward the discharge area along the Cedar River Waterway.

2.3.9.1 Investigation History

During the RI, more than a dozen monitoring wells were installed in the vicinity of AOC-060. Based on results of investigations conducted prior to releasing the CAP, the COCs listed in Table 1 were established for AOC-060. No COCs were identified for soil at AOC-060.

Quarterly or semiannual sampling and analysis of monitoring wells for COCs have been occurring for more than 10 years. TCE breakdown products are consistently detected in wells inside Building 4-42, but TCE has not been detected in any of these wells since 2006. TCE has consistently been detected in well GW147S, located immediately outside and downgradient of Building 4-42. Breakdown products *cis*-1,2-DCE and VC have been detected in wells located between Building 4-42 and the CPOC. VC has been detected in the three wells located in the Cedar River Trail Park. These data show that active biodegradation of chlorinated solvents is occurring at this site. No VOCs have been detected in samples from any of the three wells screened in the intermediate zone.

2.3.9.2 Implemented Measures

A solution of electron donor (sugar) was injected at AOC-060 using existing wells GW147S and GW012S in May 2013 to accelerate the attenuation process. The injection was conducted in accordance with a work plan submitted to Ecology on April 29, 2013 (CALIBRE, 2013).

2.3.10 AOC-090

AOC-090 is located near the southwest corner of former Building 4-64 and just east of the Cedar River Trail Park (Figure 12). Soil impacted by selected VOCs (TCE and carbon tetrachloride) as well as TPH-G, TPH in the diesel range (TPH-D), and TPH in the motor oil range (TPH-MO) was encountered during installation of an underground fire protection water line and fire hydrant in July 1999. The source of the contaminants is unknown. AOC-090 was subsequently investigated as part of the RI.

Former buildings 4-64 and 4-65 (the Gate D-30 Guard House) were demolished in early 2004 to prepare the site for construction of a new parking area. An interim action consisting of soil excavation and bioremediation was implemented in 2004 coincident with the demolition, although some affected soil was left in place. The most highly affected groundwater is located beneath the source area. Shallow groundwater is also affected beneath the Cedar River Trail Park. Groundwater monitoring data for the intermediate groundwater unit generally show localized areas affected by VC.

2.3.10.1 Investigation History

This area was investigated during several phases of RI and post-RI investigation. Based on the results of investigations conducted prior to releasing the CAP, the COCs listed in Table 1 were established for AOC-090. Results presented in the RI Report indicated that elevated VOC and TPH levels were present in soil and groundwater near Building 4-64, and VC was present at elevated concentrations in groundwater near the western Facility boundary with the Cedar River Trail Park.

Recent groundwater monitoring data have continued to show elevated concentrations of COCs in groundwater in the shallow saturated zone at the source area, although concentrations have decreased from levels observed prior to completing the interim measure. VC has been detected in groundwater from both shallow zone and intermediate zone wells at the CPOC (AMEC, 2013a).

2.3.10.2 Implemented Interim Actions

Approximately 40 cubic yards of soil was excavated in 1999 during installation of the fire protection water line. Building 4-64 and the Gate D-30 Guard House were demolished in 2004, and an interim action was conducted to remove TPH- and VOC-affected soil. Approximately 250 cubic yards of solvent-affected soil and 1,240 cubic yards of TPH-affected soil were removed during the excavation. The area of excavation extended beneath the former Building 4-64 footprint (Figure 12). Throughout the excavation, soil was excavated to the water table at a depth of approximately 7 feet below ground surface (bgs). Nearly all of the affected soil above the water table was removed, although some affected soil was left in place due to constraints on access resulting from underground utilities.

Following soil removal, 16.68 tons of molasses was added to the excavation area to act as an organic carbon source and promote ongoing biodegradation of VOCs. Perforated drainpipe was installed along the southern extent of the excavation area for use during potential future remedial action, such as reapplication of organic carbon substrate or soil venting. Subsequent monitoring of groundwater beneath and downgradient of the excavation, where the molasses was placed, indicated substantial degradation of TCE in groundwater and a substantial rise in concentration of the final, nontoxic biodegradation products (methane, ethane, and ethene) (Geomatrix, 2006).

Additional electron donor substrate (sucrose, vegetable oil, and/or lactate) was injected in the riser along the south boundary of the site and in the nine existing bioremediation wells in June 2007, April 2010, and June 2012.

2.3.11 AOC-092

AOC-092 is located along the east side of Building 4-20, as shown on Figure 13. Soil affected by petroleum hydrocarbons was discovered at this location during trenching activities for a new fire protection water line, but the affected soil was not removed at that time due to structural concerns regarding the building foundation (Boeing, 2001). Groundwater monitoring data indicate that benzene and petroleum hydrocarbons extend downgradient of the source area. The locations of the excavation area and source area for the petroleum constituents are illustrated on Figure 13.

2.3.11.1 Investigation History

After affected soil was discovered, preliminary sampling was conducted in 2001, and subsequent investigation of AOC-092 was performed in November 2005 during improvements to the adjacent Building 4-20. Based on results of investigations conducted prior to releasing the CAP, the COCs listed in Table 1 were established for AOC-092.

Elevated levels of TPH-G and benzene were detected in soil and groundwater in the vicinity of and just upgradient from the area of fire line excavation during the RI. Soil concentrations were lower at subsequent step-out locations, suggesting that the area of affected soil was of limited extent and may have been removed during installation of the fire water line. Soil and groundwater samples were subsequently collected in 2005 via direct-push borings from six locations in the area inside

Building 4-20 where the concrete slab floor was removed. The soil samples contained no detectable levels of COCs. Four of the six groundwater samples contained elevated levels of benzene, indicating migration of benzene in groundwater extending downgradient from the source area.

2.3.11.2 Implemented Cleanup Actions

The cleanup remedy specified in the CAP for AOC-092 was largely implemented in August 2013 in preparation for Facility improvements planned for the area. Work was conducted in general accordance with a Work Plan submitted to Ecology and included as Appendix B. Boeing is expanding production capabilities at the Facility, and a building addition is being constructed over AOC-092, which will also require relocation of underground utilities. Construction activities for Facility improvements in the vicinity of AOC-092 were initiated in August 2013, and construction is expected to be completed by January 2014.

Except for a small area of inaccessible soil located under a seismic structural support (Figure 13), soil affected by TPH-G was removed from AOC-092. A report documenting the cleanup action is included in Appendix C.

2.3.12 AOC-093

AOC-093 is located north of Building 4-20, near the shore of Lake Washington (Figure 7). AOC-093 was discovered while conducting downgradient sampling for AOC-001/002, and therefore AOC-093 is shown on the larger map for AOC-001/AOC-002.

2.3.12.1 Investigation History

AOC-093 was not discovered until after completion of the RI. A single push probe encountered TPH contamination during investigations downgradient of AOC-001/002 in January 2003. During the Pre-CAP field investigation, a single push probe was installed next to PP081, and two soil samples were collected for additional analyses. These Pre-CAP soil samples contained detectable levels of TPH-G and related fuel hydrocarbons, but none of these results exceeded applicable soil cleanup levels.

Based on the recent Pre-CAP sample results, concentrations of TPH-G in the soil are below the soil cleanup levels, and groundwater samples collected in this area did not contain any detectable TPH-G.

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3.0 CLEANUP ACTION OBJECTIVES AND CLEANUP STANDARDS

This section outlines cleanup action objectives and presents the cleanup standards for soil and groundwater for the SWMUs and AOCs.

3.1 CLEANUP ACTION OBJECTIVES

The overall objective for Facility cleanup is to protect human health and the environment from potential impacts related to COCs present at the Facility. This will be accomplished by implementing the cleanup actions specified in the CAP. The cleanup actions specified in the CAP are intended to achieve the CULs at the CPOCs specified in the CAP.

Cleanup objectives have been established that are applicable to all AOCs and SWMUs at the Facility. The cleanup action for each of the SWMUs and AOCs must achieve the Facility cleanup objectives that are necessary to address specific remediation concerns or issues. The Facility cleanup objectives are as follows:

- Protect human health and the environment from risks related to the constituents present in soil and groundwater at AOCs and SWMUs.
- Attain a cleanup standard meeting the requirements specified in the MTCA regulations.
- Prevent the release of COCs in soil and groundwater from AOCs or SWMUs to Lake Washington or the Cedar River waterway at concentrations that may adversely affect human or ecological receptors.
- Protect current and future uses of the City of Renton's Cedar River Trail Park from releases originating at the Boeing site. After notification to Boeing of any changes in planned use of the park property by the City, ongoing environmental monitoring programs will be re-evaluated by Boeing to account for the planned change in use. Ecology approval is needed for re-evaluation of any ongoing monitoring programs.
- Prevent exposure of on-site workers to soil and groundwater constituents at levels that may cause adverse human health impacts.
- Attain soil cleanup levels protective of continued industrial use of the Facility.
- Minimize potential disruption of ongoing Facility activities and installations.
- Support continued use of the Facility for industrial purposes.
- Comply with applicable state and federal regulations for site cleanup, health and safety, and waste management.

The above objectives apply to the cleanup actions for each SWMU and AOC addressed in this EDR.

3.2 CLEANUP STANDARDS

Cleanup standards have been established for each of the 12 SWMUs and AOCs addressed in this EDR. The MTCA regulations (WAC 173-340-200) require that the cleanup standard specify the following:

- Cleanup levels defined in accordance with MTCA regulations;
- The point of compliance (POC) established in accordance with MTCA regulations; and
- Additional regulatory requirements that apply to the specific cleanup action and POC.

A cleanup standard addressing the above three general requirements has been established for each of the sites addressed in this EDR. The cleanup levels for each site are presented in Section 3.2.1. The other elements of the cleanup standard for each of the 12 sites, namely the POC and applicable regulatory requirements, were discussed in the CAP. For the Renton Facility, the POCs consist of conditional points of compliance established in the CAP for each of the SWMUs and AOCs, as discussed in more detail in Section 3.2.2. The cleanup standard applicable to all SWMUs and AOCs addressed by this EDR consist of attaining the cleanup levels described below at the CPOC identified in the CAP for each site. Additional regulatory requirements, if any, are addressed in the cleanup plans for each SWMU and/or AOC.

3.2.1 Cleanup Levels

Cleanup levels for soil and groundwater at each SWMU or AOC were established in the CAP and are presented in Table 2.

The soil cleanup levels in Table 2 are either (1) MTCA Method A cleanup levels for industrial properties for TPH constituents or (2) standard or modified MTCA Method C cleanup levels for other COCs. These cleanup levels were established in accordance with WAC 173-340-745.

Groundwater cleanup levels were specified in the CAP for each COC at each SWMU and/or AOC. These cleanup levels are also listed in Table 2. The groundwater cleanup levels presented in this EDR were established in accordance with the MTCA regulations. MTCA Method A cleanup levels were used for petroleum hydrocarbons. The cleanup levels for other constituents were established as specified in the MTCA regulations to be protective of both human health and ecological receptors in surface water.

3.2.2 Points of Compliance

Cleanup levels are applied at the POC to assess compliance with the cleanup standard, as specified in the MTCA regulations. CPOCs were established in the CAP for each SWMU and AOC in accordance with MTCA regulations. The CPOCs are specific to each SWMU and AOC addressed in this EDR. The locations of the groundwater CPOCs for each SWMU/AOC addressed in the EDR are shown on Figures 3 through 13 and in the relevant design drawings in Appendix A. Off-Facility CPOCs were established for the Former Fuel Farm, AOC-060, and AOC-090. All other CPOCs are located on property either owned or leased by Boeing. Soil cleanup levels are applicable at the standard POC, as defined in the MTCA regulations (WAC 173-340-200).

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4.0 INSTITUTIONAL CONTROLS

Institutional controls are a component of the remedial actions to be implemented for the SWMUs and AOCs addressed by this EDR. Institutional controls will be established for the Facility in accordance with WAC 173-340-440 and the requirements specified in Section VIII of the Order. Institutional controls include measures taken to secure the facility, establish use restrictions, provide for maintenance of engineered controls, provide information regarding Facility contamination for the general public and Facility workers, and provide financial assurance for the remedial action. This section describes the institutional controls for the remedial actions addressed by the CAP.

4.1 SITE SECURITY

Existing security systems are effective in limiting access to the Facility by the public, and these existing security features are recognized components of the remedial action. The Boeing Facility is an active industrial plant with an existing, effective security program. Security is provided by perimeter fencing, electronic surveillance, and a manned security workforce. Entrances and exits to the Facility are manned by security personnel 100 percent of the time that the entry and egress points are open. Boeing property is monitored on a 24-hour basis by security personnel using electronic surveillance and patrols to maintain site security. Boeing's security program has proven to be effective during the time the Renton Plant has been in operation. This ongoing security program will provide adequate security for the remedial actions addressed by this EDR.

4.2 USE RESTRICTIONS

In accordance with requirements specified in the MTCA regulations and the Order, use restrictions will be established for contaminated soil and groundwater within the Facility. These restrictions will be implemented for those portions of the Facility that are owned by Boeing by recording the Environmental Restrictive Covenant included as Exhibit D of the Order. The Environmental Restrictive Covenant will be recorded after receipt of Ecology notice that the remedial action addressed in this EDR has been completed. The portions of the Facility owned by Boeing are presently used for industrial purposes, and no land use changes are anticipated. This Environmental Restrictive Covenant establishes use restrictions for contaminated soil and groundwater within those portions of the Facility owned by Boeing. A copy of the Environmental Restrictive Covenant will be provided to Ecology within 30 days after it is recorded.

Boeing will also work with the City of Renton in accordance with the Order to record a similar Environmental Restrictive Covenant for the portions of the Facility that are not owned by Boeing; these areas include portions of the Renton Airport that are no longer leased by Boeing and portions of the Cedar River Trail Park. Boeing will provide Ecology with a copy of the Environmental Restrictive Covenant recorded for the City of Renton in accordance with the Order. If Boeing is not able to record an Environmental Restrictive Covenant for portions of the Facility that are not owned by Boeing, written documentation of efforts made to record the Environmental Restrictive Covenant will be provided to Ecology.

Boeing has been working with the City of Renton to ensure that the portions of the Cedar River Trail Park that have been affected by releases from AOC-060 and AOC-090 do not adversely impact users of the Park. Appendix C of the CAP includes a copy of an Access Agreement that provides Boeing access to the affected portions of the Cedar River Trail Park to implement actions specified by the CAP or by future amendments to the CAP. The Access Agreement also requires that Boeing provide copies of bimonthly progress reports, including copies of laboratory data for sampling performed under the CAP, to the City. These communications, in addition to communications conducted to date, will ensure the City is aware of the status of the cleanup action and of groundwater conditions within the Cedar River Trail Park. The CAP also specifies that Boeing must re-evaluate the groundwater monitoring program as appropriate if the City of Renton provides notice of any changes in use of the Cedar River Trail Park; the Compliance Monitoring Plan (Appendix D) requires that Boeing revise the monitoring program to address changes in Park use.

4.3 HAZARD COMMUNICATIONS

Facility contamination is limited to affected soil and groundwater. The Facility is currently an industrial facility; future land use will be restricted to industrial use, as described in Exhibit D to the Order. Boeing has an established and effective program for communicating potential hazards related to Site contamination. Site contamination extending beyond Facility boundaries onto property owned by the City of Renton has been fully disclosed to the City; detailed maps showing the extent of contamination on Renton property have been provided to the City, and updated maps are provided on a regular basis, providing results from the ongoing groundwater monitoring program. These communications will continue until Ecology concurs that monitoring data indicate that CULs have been achieved on City of Renton property. Boeing also has an established program of working with the City of Renton to monitor contamination and protect workers and the community whenever subsurface work must be conducted within contaminated areas.

Boeing also has established programs for protection of Facility workers. The Facility is almost entirely covered by pavement and buildings, which prevent direct contact of workers to contaminated soil or groundwater within the Facility. Indoor air within Facility buildings used for airplane manufacturing and production are regularly monitored for compliance with air quality standards established under the Washington Industrial Safety and Health Act (WISHA) and the U.S. Occupational Safety and Health Act (OSHA). This program for compliance with WISHA and OSHA standards ensures that indoor air quality meets applicable standards. Construction workers potentially exposed to contaminated soil or groundwater are protected by a rigorous program that requires review of every project requiring subsurface work for potential exposure to areas of known subsurface contamination. This program has been proven effective in identifying potential exposure and for protecting construction workers. All projects requiring subsurface work are reviewed by Boeing; approval is required to conduct all subsurface work. Whenever a construction or maintenance project requires excavation of any soil impacted by contaminants from AOCs identified in the CAP, the Facility Environmental coordinator is notified, and an environmental construction contractor is retained to complete the subsurface work in accordance with HAZWOPER requirements specified in Title 29 of the Code of Federal Regulations (CFR), Part 1910.120, and in accordance with WISHA requirements. Additionally, any contaminated soil and/or groundwater is managed in accordance with applicable regulations for handling, storage, and disposal of solid and/or dangerous waste.

The Environmental Restrictive Covenant included as Exhibit D of the Order provides for a source of information for the public. A repository of reports and documents describing the remediation program for the Site is maintained at the Ecology Northwest Regional Office in Bellevue. This information describes the nature and extent of Site contamination and the remediation program addressing the contamination. This EDR will be included in the repository. All information in the repository is available to the general public.

4.4 FINANCIAL ASSURANCE

Boeing has established and will maintain financial assurance in accordance with requirements specified in the Order and in WAC 173-303-64620 for implementation of the remediation plans documented in the CAP and as presented in this EDR. As the final remedy for the Site is implemented, Boeing will revise the cost estimate for work remaining to implement the final remedy and request Ecology's approval of the revised financial assurance amount. Additionally, Boeing will revise the remediation cost estimate annually to adjust for inflation; inflation adjustments will be done in accordance with 40 CFR 264.142(b).

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5.0 CLEANUP PLAN: MONITORED NATURAL ATTENUATION

This section describes the cleanup plans for the five SWMUs/AOCs listed in Table 1 in which MNA is the cleanup action specified in the CAP. A network of groundwater monitoring wells will be used to assess MNA and assess attainment of CULs at the CPOC for each of these areas.

The monitoring well network and sampling and analysis schedule have been designed to meet the requirements of the CAP. Section 5.1 provides a brief overview of the areas where MNA is the primary component of the cleanup action. The monitoring programs for the MNA sites are described in Section 5.2. Monitoring well installation procedures are described in Section 5.3.

5.1 OVERVIEW OF MNA AREAS

MNA relies upon intrinsic bioremediation to achieve cleanup objectives. *Intrinsic bioremediation* occurs due to indigenous, naturally occurring microorganisms present in affected soil and groundwater that actively degrade released contaminants. Typically, source removal interim actions have been completed at these areas, and no further active remediation is necessary; periodic monitoring of COC concentrations and groundwater chemistry is performed to monitor and evaluate natural biodegradation of the COCs. MNA can be effective in dealing with both non-chlorinated and chlorinated organic compounds.

The CAP specified MNA as the remedy for several of the SWMUs and AOCs addressed by this EDR. MNA is the specified cleanup action for the following three SWMUs/AOCs where fuel hydrocarbons are the primary COCs:

- ***Former Fuel Farm SWMU/AOC Group –*** This area is located at the Renton Municipal Airport on property formerly leased by Boeing from the City of Renton. It contained several USTs and has been affected by releases of jet fuel. An interim cleanup measure incorporating air sparging and bioventing operated for 17 years, until April 2012, substantially reducing the concentration of COCs in soil and groundwater. Groundwater monitoring has been performed at this site since the interim action commenced.
- ***Building 4-78/79 SWMU/AOC Group*** – The Building 4-78/79 SWMU/AOC Group is located east of the Cedar River Trail Park, in the west-central portion of the main Boeing property. Gasoline and benzene present at this site will be remediated by MNA. COCs for this SWMU/AOC group also include PCE, TCE, and their degradation products, which will be remediated using bioremediation and MA, as discussed in Section 6, and by SVE, as described in Section 7. The groundwater monitoring program for the Building 4-78/79 SWMU/AOC Group area is presented in Section 6.5.1.2 along with the discussion of MA.

- ***AOC-093 –*** This small AOC is located at the north side of the Facility, on the apron north of Building 4-20 and adjacent to Lake Washington. Gasoline is present in soil and groundwater at this AOC.

The CAP also specified MNA as the cleanup action for chlorinated VOCs at the following SWMUs/AOCs:

- ***SWMU-168 –*** This small AOC is located at the northeast corner of Building 5-50, on leased property at the Renton Municipal Airport. COCs for this site include methylene chloride in soil and VC in groundwater.
- ***AOC-034/035 –*** These AOCs are located along the south side of Building 4-41, in the northern part of the Facility. The two COCs for this site are *cis*-1,2-DCE and VC, which are degradation products of chlorinated solvents.

Cleanup actions relying on MNA typically consist of a network of groundwater monitoring wells that are sampled on a regular basis to assess degradation of COCs and to monitor water chemistry and geochemical conditions.

The MNA monitoring programs for the two types of COCs addressed by MNA are different due to differences in the microbiology and chemistry of the biodegradation pathways. Fuel hydrocarbons are generally more readily biodegradable under aerobic conditions, whereas chlorinated COCs are generally more readily biodegraded under anaerobic conditions. Fuel hydrocarbons are more likely to be present in shallow groundwater than deep groundwater because the released fuels are less dense than water, so any residual soil contamination is likely to be present near or above the groundwater table. The presence of degradation products of PCE and TCE at the SWMUs and AOCs at which chlorinated solvents have been released indicates that intrinsic biodegradation of chlorinated solvents is active within the Facility.

Typical COCs and geochemical indicators used to monitor MNA for the two types of sites are summarized in Table 3.

5.2 COMPLIANCE MONITORING FOR MNA SITES

The MNA compliance monitoring program for the MNA sites is summarized in this section. The groundwater monitoring network and groundwater sampling and analysis schedule for each of the MNA sites are described in Section 5.2.1. The data evaluation and reporting protocol for MNA sites is presented in Section 5.2.2. The monitoring program is documented in the Compliance Monitoring Plan presented in Appendix D.

The MNA compliance monitoring program for each of the SWMUs or AOCs utilizing MNA as a cleanup action component is based on Ecology's guidance for MNA at sites affected by petroleum-related COCs (Ecology, 2005) and incorporates requirements specified in the CAP. To the extent appropriate, monitoring concepts in the Ecology guidance document for petroleum sites have been applied to the MNA monitoring for the SWMUs and AOCs with solvent or other non-petroleum-related COCs.

5.2.1 Groundwater Monitoring Network and Sampling and Analysis Schedule

This section presents the groundwater monitoring network and sampling and analysis schedule for each SWMU and AOC to be addressed by MNA. The layout of the groundwater monitoring network for these areas is shown on the appropriate engineering drawing presented in Appendix A. The Compliance Monitoring Plan is presented in Appendix D.

5.2.1.1 Former Fuel Farm SWMU/AOC Group

The majority of the Former Fuel Farm property is no longer leased by Boeing; it is currently leased from the City of Renton by another party. Construction of an expanded hangar is planned by the current lessee, as has been discussed with Ecology. Hangar construction commenced in mid-May 2014 and is projected for completion early in 2015. The redevelopment in this area has required abandonment of several monitoring wells within areas designated for construction. Five groundwater monitoring wells (GW101S, GW102S, GW219S, GW220S, and GW222S) were abandoned to avoid well damage during redevelopment construction.

When the air sparge and biovent system was in operation, groundwater elevations and flow directions were highly variable. Since the sparge/biovent system was shut down in April 2012, groundwater levels have shown consistent elevations, with groundwater flow toward the southwest. Due to the historic variability in the direction of groundwater flow, the CPOC was placed to extend around the north, west, and southwest sides of the source area. One of the abandoned wells, GW222S, was located on the northern portion of the CPOC.

Drawing C-9 (Appendix A) shows the layout of the groundwater monitoring network for the Former Fuel Farm, including the locations of existing monitoring wells, the biovent/sparge wells and monitoring wells that were abandoned to allow redevelopment, and the wells to be included for the MNA monitoring network. Three new shallow source area wells (GW255S, GW256S, and GW257S) and one new shallow CPOC well (GW258S) will be installed to replace the wells abandoned for the planned redevelopment. The replacement wells will be installed in accordance with the well design presented in Drawing C-17 and the methods described in Section 5.3.

The groundwater monitoring well network for the Former Fuel Farm will consist of the following wells:

- ***Source Area Wells –***New shallow wells GW255S, GW256S, and GW257S; and

- ***CPOC wells –*** Existing wells GW183S, GW184S, GW221S, GW211S, GW212S, GW224S, and GW225I and new shallow well GW258S to replace GW222S.

Following approval of this EDR, the frequency of sampling will be semiannual, consistent with the current monitoring schedule for the Former Fuel Farm wells. Water levels and field water quality measurements will be collected during each semiannual sampling event, as described in the Compliance Monitoring Plan (Appendix D). The groundwater samples collected during the first semiannual sampling event each year will be analyzed for the groundwater COCs (TPH-Jet A and TPH-D) and both the primary and secondary geochemical indicators for fuel-related hydrocarbons listed in Table 3. The groundwater samples collected during the second semiannual sampling event each year will be analyzed only for the COCs and the primary geochemical indicators listed in Table 3.

The semiannual monitoring results will be evaluated after each monitoring event to assess progress toward achieving the cleanup standard and the effectiveness of MNA (see Section 5.2.2). Results of this evaluation will be provided to Ecology in groundwater monitoring reports as described in Section 8. The compliance monitoring program for the Former Fuel Farm is documented in the Compliance Monitoring Plan (Appendix D).

5.2.1.2 Building 4-78/79 SWMU/AOC Group

The cleanup action for the Building 4-78/79 SWMU/AOC Group consists of MNA for gasoline and benzene and institutional controls, bioremediation/MA, and SVE for chlorinated COCs. The groundwater monitoring network for this area is shown on Drawing C-4 in Appendix A and is presented in detail in Section 6.5.1.2 with the discussion of MA.

5.2.1.3 AOC-093

AOC-093 is located near the CPOC for AOC-001/002, as shown in Drawing C-10. Compliance monitoring for this AOC will be performed in conjunction with monitoring conducted for AOC-001/002.

The groundwater monitoring well network for this site will consist of a newly installed monitoring well:

- ***Source Area and CPOC Well –*** GW245S (to be installed).

Drawing C-10 shows the location of the AOC-093 compliance monitoring well and the CPOC for AOC-093. The new well will be installed in accordance with the monitoring well design shown on Drawing C-17 and the procedures described in Section 5.3.

Groundwater samples from the monitoring well at AOC-093 will be collected quarterly, in conjunction with the quarterly AOC-001/AOC-002 groundwater sampling schedule. Groundwater flow directions for AOC-093 will be determined using the quarterly groundwater levels from the broader network of monitoring wells associated with AOC-001/AOC-002. The quarterly groundwater sample from the AOC-093 monitoring well will be analyzed for TPH-G and the primary geochemical indicators for fuel-related hydrocarbons identified in Table 3. Once annually, during the second quarterly sampling event, samples will also be analyzed for the secondary geochemical indicators identified in Table 3 for fuel-related hydrocarbons.

Field and laboratory results from quarterly groundwater sampling for AOC-093 will be evaluated to assess attainment of the cleanup standard described in Section 3 and to evaluate the effectiveness of MNA (see Section 5.2.2). Results for field and laboratory measurements and data evaluation will be reported to Ecology in groundwater monitoring reports, as described in Section 8. The compliance monitoring program for AOC-093 is documented in the Compliance Monitoring Plan (Appendix D).

5.2.1.4 SWMU-168

Drawing C-1 shows the layout of the groundwater monitoring network and the locations of the monitoring wells at this SWMU. Since no groundwater monitoring wells currently exist at SWMU-168, three shallow groundwater monitoring wells (GW228S, GW229S, and GW231S) and one intermediate monitoring well (GW230I) will be installed for this SWMU. These wells will be installed in accordance with the well design shown on Drawing C-17 and the procedures described in Section 5.3.

The groundwater monitoring network will consist of the following wells:

- ***Source Area Well –*** GW228S near the location of PP003 and PP167, and
- ***CPOC Wells –*** shallow wells GW229S and GW231S and intermediate-depth well GW230I, which will be installed between the two shallower monitoring wells.

An upgradient MNA well is not planned due to the low concentration of VC noted in groundwater from PP167 and the close proximity of Building 5-50.

The four wells at SWMU-168 will be monitored quarterly. The quarterly groundwater samples from the SWMU-168 wells will be analyzed for VC and the primary geochemical indicator parameters listed in Table 3. Once annually, during the second quarter sampling event, samples from these wells will also be analyzed for the secondary geochemical indicators listed in Table 3 for COCs related to chlorinated solvents.

Results from quarterly groundwater sampling at SWMU-168 will be evaluated to assess attainment of the cleanup standard described in Section 3 and to evaluate geochemical conditions that may affect biodegradation of VC at SWMU-168 (see Section 5.2.2). Results for field and laboratory measurements and data evaluation will be reported to Ecology quarterly, as described in Section 8.

The compliance monitoring program for SWMU-168 is documented in the Compliance Monitoring Plan (Appendix D).

5.2.1.5 AOC-034/035

Drawing C-13 shows the location of the monitoring wells for AOC-034/035. The MNA groundwater monitoring well network will consist of:

- ***MNA Wells:***
  - Cross-Gradient Well – GW216S;
  - Source Area Well – GW217S;
  - CPOC Wells – GW218S and GW251S; and
- ***Water Level Monitoring Wells*** – GW001S, GW004S, and GW005S.

One new shallow groundwater well (GW251S) will be installed along the CPOC near the Facility property line south of existing monitoring well GW218S. This new well will be installed in accordance with the well design shown on Drawing C-17 and the procedures described in Section 5.3.

Wells GW216S, GW217S, and GW218S have been monitored quarterly since they were installed in May 2008. Trend plots presented in 5 years of quarterly monitoring reports have defined a consistent range of COC levels in these wells. Sufficient quarterly groundwater monitoring data have been collected to determine that a semiannual sampling period will be sufficient for these AOCs, since little variability has been observed over time in concentrations of the COCs.

Groundwater samples from the four MNA wells will be collected semiannually and analyzed for *cis*-1,2-DCE, VC, and the primary geochemical indicator parameters identified in Table 3. The secondary geochemical indicators listed in Table 3 for COCs related to chlorinated solvents will be analyzed once a year during the first semiannual sampling event.

Due to the variability in water levels observed at the site, three wells (GW001S, GW004S, and GW005S) will be included in the monitoring network for measurement of groundwater elevations only. Water levels will be measured in all four MNA wells, as well as GW001S, GW004S, and GW005S, during each semiannually monitoring event. No samples will be collected from the water level wells GW001S, GW004S, and GW005S.

Field and laboratory results from semiannual groundwater sampling at AOC-034/035 will be evaluated to assess attainment of the cleanup standard described in Section 3 and to evaluate geochemical conditions for potential effects on biodegradation of COCs (see Section 5.2.2). Results for field and laboratory measurements and data evaluation will be reported to Ecology in groundwater monitoring reports, as described in Section 8. The compliance monitoring program for AOC-034/035 is documented in the Compliance Monitoring Plan (Appendix D).

5.2.2 Data Evaluation and Reporting

Field and laboratory analytical results from periodic groundwater monitoring at each of the MNA sites will be evaluated to assess attainment of the cleanup standards described in Section 3 and to evaluate geochemical conditions for potential effects on biodegradation of COCs at each location. MNA will be evaluated by tracking trends in COC concentrations and by evaluating geochemical conditions as indicated by the primary and secondary geochemical parameters. Trends in COC concentrations and geochemical parameters will be assessed graphically and, if needed, using statistical methods as outlined by Ecology MNA guidance (Ecology, 2005).

Trend plots for the geochemical indicators will be reviewed to identify long-term, seasonal, and/or short-term trends or changes. Short-term trends will be carefully reviewed, as short-term changes may indicate that conditions adverse to MNA may be occurring. Results and conclusions from this evaluation will be presented in monitoring reports, as described in Section 8 of this EDR.

Analytical results for groundwater samples collected from CPOC wells at each of the MNA sites will be compared to the site-specific CULs presented in Section 3 after each monitoring event. If the concentration of COCs in all samples collected from all CPOC monitoring wells at a given site are below the site-specific CULs for a period of eight consecutive quarters, Boeing may consider the cleanup standard to have been attained and may submit a written request to Ecology to confirm attainment of the cleanup standard and to approve cessation of compliance monitoring at that site. Monitoring will continue at each site as described in Section 5.2 until Ecology approves demonstration that the cleanup standard has been achieved for the site.

Boeing will periodically evaluate the monitoring frequency for each site and may propose changes to the MNA monitoring program as appropriate (e.g., changes in monitoring frequency or wells included in the monitoring network). Requested changes to the monitoring program will not be implemented until approved by Ecology.

Laboratory and field results from quarterly monitoring and results of data analysis will be presented in the monitoring reports prepared as described in Section 8.

5.3 GROUNDWATER MONITORING WELL INSTALLATION

Groundwater monitoring wells will be constructed based on the design and specifications presented in Drawing C-17.

Direct-push drilling methods will be used to drill the boreholes for the groundwater monitoring wells. Direct-push well installation is preferable to the more traditional hollow-stem auger (HSA) drilling methods, because the fine-grained silty sands present at the Facility are prone to sand heave that can occur when using HSA methods to install monitoring wells. In addition, lower volumes of soil cuttings are generated utilizing direct-push well installation methods.

All direct-push wells will be installed by a Washington State licensed well driller approved by Boeing. Work will be conducted in accordance with the site-specific Health and Safety Plan presented in Appendix E. The wells will be drilled using a direct-push drill rig under the supervision of a Washington State licensed geologist. The borings will be continuously logged for lithology and will be screened for contamination in the field using a hand-held photoionization detector (PID). Approximate screen interval depths for the groundwater monitoring well screens are shown in Drawing C-17. The goal of screen placement is to place the screens in a permeable stratum, such as a gravelly sand, sand, or silty sand, which serves as the primary flow pathways for COC-affected groundwater. Where a deeper well will be installed next to a shallow well, only the deeper well will be logged for lithology, and the final screen depths and screen intervals will be dictated by the lithology observed in the field.

A detailed record or log of each groundwater monitoring well will be recorded. The logs and descriptions will include at a minimum the following information:

1. Date and time of construction;
2. Drilling method and any drilling fluid used;
3. Well location (surveyed to within 0.5 foot);
4. Borehole diameter and well casing diameter;
5. Well depth (to within 0.1 foot);
6. Drilling logs and lithologic logs from the field, including a description of soil or rock types, color, weathering, texture, structure, and fractures (see Attachment 1 in the Compliance Monitoring Plan [Appendix D] for details concerning lithologic logging);
7. Casing materials;
8. Screen material and design, including screen length and slot size;
9. Well casing and screen joint type;
10. Sand pack material, including size, placement method, and approximate volume;
11. Composition and approximate volume of sealant material and method of placement;
12. Surface seal design and construction;

13. Well sediment cleanup procedures;
14. Ground surface elevation (to within 0.01 foot);
15. Top-of-casing elevation (to within 0.01 foot); and
16. Detailed drawing of well, including dimensions.

Survey locations and elevations are typically obtained after the wells have been drilled.

Groundwater monitoring well design details are provided on Drawing C-17 in Appendix A. All of the direct-push wells will be constructed using 2-inch-diameter, Schedule 40 flush-thread polyvinyl chloride (PVC) casing. All of the wells will be constructed using pre-packed well screens, in which the sand pack medium is held in place by a mesh screen secured to the outside of the well casing. After the boring has been logged, a “macro-core” 3.5-inch-diameter core casing will be driven back through the narrower direct-push boring to the total well depth. The plug at the end of the core barrel will be removed, and the pre-pack well screen and well casing will be assembled and then lowered into the core barrel.

Loose filter pack sand will be added slowly into the annulus as the core barrel is retracted. The filter pack sand is used to stabilize the well screen and casing as the core is removed. Once the loose filter pack is approximately 2 feet above the top of the prepack well screen, medium-sized bentonite chips will be used to seal the boring. The bentonite chips will be hydrated after placement. The flush-mounted well monument will then be cemented around the well to protect it.

Contaminated soil, decontamination water, and purge water from the well installations will be managed by Boeing. Soil will be shipped off site following proper characterization and disposed in accordance with applicable state and federal regulations. Any personal protective equipment and disposable material or equipment will be double-bagged and disposed in waste containers provided by Boeing.

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6.0 CLEANUP PLAN: ENHANCED BIOREMEDIATION/ MONITORED ATTENUATION SITES

This section describes enhanced bioremediation/monitored attenuation, which will be implemented as the cleanup plan or as an element of the cleanup plan for eight SWMUs/AOCs. The design drawings for implementation of enhanced bioremediation/monitored attenuation are presented in Appendix A. Specification sheets for bioremediation amendments are presented in Appendix F.

6.1 OVERVIEW OF ENHANCED BIOREMEDIATION/MONITORED ATTENUATION AREAS

Enhanced bioremediation involves addition of amendments to soil and/or groundwater via injection wells to enhance microbial activity, and thereby increase the rate of biodegradation for COCs. Monitored attenuation consists of routine monitoring of groundwater to assess geochemical conditions, track biodegradation of COCs, and evaluate the need for injection of additional amendment to support biodegradation of the COCs.

Areas at the Facility where enhanced bioremediation/MA will be implemented can be categorized based on which of the following two types of COCs are present: fuel hydrocarbons or chlorinated solvents. Enhanced bioremediation for fuel hydrocarbon sites typically includes addition of amendments that act as electron acceptors in the biodegradation process. Enhanced bioremediation for sites with chlorinated solvents typically includes addition of amendments that act as electron donors in the biodegradation process. To be successful, biodegradation must degrade COCs and yield end products of insignificant toxicity.

Fuel hydrocarbons are the primary COCs to be addressed by enhanced bioremediation/MA at the following SWMUs and AOCs:

- **AOC-004** – This small site was affected by releases of gasoline, which likely included leaded gasoline, from a former UST. COCs at AOC-004 include TPH-G, benzene, toluene, ethylbenzene, and acetone in soil, and TPH-G, benzene, and lead in groundwater. Enhanced bioremediation, monitored attenuation, and institutional controls will be implemented as the cleanup action for AOC-004. Enhanced bioremediation and MA will address impacts to groundwater and saturated soils. Institutional controls will reduce exposure risks present prior to completion of the final remedy.

- **AOC-092** – This small AOC is located immediately east of Building 4-20 and was affected by a gasoline release from an unknown source. Cleanup activities for this area were conducted in August 2013 in support of a building expansion to support increased manufacturing production capacity. An excavation to a depth of approximately 6 feet bgs was completed to remove soils from the source area, and approximately 500 pounds of PermeOx® Plus was mixed into the backfill in select areas. Residual TPH was left in place along the northern extent of the excavation in soils that could not be excavated due to the presence of a footing for seismic braces for Building 4-20. A report documenting soil excavation and implementation of enhanced bioremediation at AOC-092 is attached as Appendix C. Institutional controls will reduce exposure risks due to COCs that remain present prior to completion of the cleanup remedy and from impacted soil that cannot be excavated due to site constraints.

Chlorinated solvents are the primary COCs to be addressed by enhanced bioremediation/MA at the following SWMUs and AOCs:

- **SWMU-172/174** - SWMU-172 and SWMU-174 are located on leased property at the Renton Municipal Airport. The COCs for this site include methylene chloride, PCE, TCE, and their degradation products. In addition to enhanced bioremediation, the cleanup action for this site also includes SVE, as described in Section 7.
- **Building 4-78/79 SWMU/AOC Group** – The Building 4-78/79 SWMU/AOC Group is located to the east of the Cedar River Trail Park, in the west-central portion of the main portion of the Facility on Boeing property. The COCs for this SWMU/AOC group include PCE, TCE, and degradation products to be addressed by bioremediation, as discussed in this section, and by SVE, as discussed in Section 7. Gasoline and benzene are also present at this site; these fuel hydrocarbons will be remediated by MNA, as discussed in Section 5.
- **AOC-001/002** – These AOCs are located about 350 feet south of Lake Washington, in the northern portion of the main Boeing property east of the Cedar River Waterway. The COCs for this area include TCE, chloroform, and degradation products. Enhanced bioremediation/MA was implemented at this site in 2005 following source area excavation. The cleanup action specified in the CAP includes continued bioremediation and MA.
- **AOC-003** – This AOC represents the site of a 500-gallon UST that was removed in 1986. The COCs for this site include PCE, TCE, and their degradation products.
- **AOC-060 –** This AOC consists of a former vapor degreaser. The plume for this site extends beyond the Boeing property boundary onto the Cedar River Trail Park. COCs for the site are present only in groundwater and consist of TCE and its degradation products. An injection of electron donor was done at this site in 2013 to initiate enhanced bioremediation.
- **AOC-090** – This AOC is the location of a historic release from an unknown source; the groundwater plume extends beyond Boeing property onto the Cedar River Trail Park. An interim cleanup action was implemented in 2004, with removal of approximately 250 cubic yards of solvent-affected soil and 1,240 cubic yards of TPH-affected soil. Electron-donor injection wells were subsequently installed, and enhanced bioremediation/MA has been implemented at this site since 2004. COCs for this site include carbon tetrachloride, methylene chloride, PCE, TCE, and degradation products.

A general description of the above SWMUs/AOCs is presented in Section 2.3.

6.2 ENHANCED BIOREMEDIATION/MONITORED ATTENUATION FOR SITES WITH FUEL-RELATED COCS

Fuel-related COCs are most likely to be present in shallow groundwater or near-surface soils. Because the fuels are generally less dense than water, any residual soil contamination is likely to be present within the seasonal range of the water table. Monitoring is performed following enhanced bioremediation treatment to track geochemical conditions, assess biodegradation, and determine if additional bioremediation amendment is required.

6.2.1 Enhanced Bioremediation

Enhanced bioremediation is the cleanup remedy specified to address fuel-related COCs at AOC-004 and AOC-092. Enhanced bioremediation to address fuel-range hydrocarbon compounds is accomplished by delivering a terminal electron acceptor (TEA), such as an oxygen-releasing compound (ORC) or nitrate, to the zone targeted for active bioremediation. Several different ORC materials are available commercially that slowly release oxygen to groundwater over a period of time up to almost a year. Indigenous microorganisms then use the hydrocarbons as a substrate and the injected amendment as an electron acceptor to support microbial activity and breakdown of hydrocarbons. Inorganic nutrients are sometimes added if inadequate nutrient concentrations are present in affected groundwater to support microbial growth. Repeat injections of TEA may be required to achieve cleanup goals.

The TEA amendment will be delivered to the subsurface at AOC-004 using new injection wells; TEA amendment was added to the base of the excavation where contaminated soils were removed from AOC-092 in August 2013. Details on injection of bioremediation amendment for TEA are presented in Table 4. CALIBRE's Standard Operating Procedures (SOPs) for bioremediation injection are presented in Appendix G.

6.2.1.1 AOC-004

The planned cleanup action at AOC-004 includes addition of TEA to enhance biodegradation of gasoline-related hydrocarbons and other COCs for this AOC. The TEA amendment will be introduced into the subsurface through two new injection wells to be installed in the source area. General locations of the new injection wells are shown on Drawing C-12 in Appendix A. Details on bioremediation injection and dosing are presented in Table 4.

The bioremediation target area focuses on the source area near PP190, PP191, and PP017. The work area is somewhat limited due to physical constraints, including shallow groundwater, an adjacent building (Building 4-21), and the seismic support structure. In addition, this AOC is located in a high traffic area.

A total of 75 pounds of an oxygen-donor compound, such as Oxygen-Release Compound-Advanced™ (ORC-A), PermeOx® Plus, or equivalent, will be mixed with water (details provided in Table 4). The resulting solution and flush water (310 gallons total) will be injected into the two new injection wells to promote degradation of petroleum compounds and VOCs (ORC-A and PermeOx® Plus product specifications are provided in Appendix F). Slow-release oxygen-donor compounds promote aerobic biodegradation of TPH-G and VOCs. Over the course of approximately 1 year, the slow-release oxygen donor will gradually release oxygen into the subsurface to support aerobic microbial respiration, thereby enhancing the natural process that degrades fuel hydrocarbons. Future TEA applications will be made as appropriate, based on results of groundwater monitoring, as discussed in Section 6.5.

The two bioremediation injection wells and one new shallow groundwater monitoring well (GW250S) will be installed in and around the source area in AOC-004 (Drawing C-12, Appendix A). The exact locations and screen depths of the injection wells may be revised based on conditions observed in the field to avoid underground utilities and to target the appropriate soil lithology. Structural support footings and a nearby doorway constrain the placement of the injection wells. Bioremediation injection well details for AOC-004 are provided on Drawing C-8 (Appendix A), and details of bioremediation well installation are provided in Section 6.4.

The well depth and placement of the screened interval for bioremediation wells in AOC-004 were selected based on evaluation of lithology reported in the RI Report (Weston, 2001) and lithology of nearby boreholes. Given that the injection of donor over a longer screen interval would favor higher permeability portions of the screened interval, the injection wells have been designed with limited screen length placed to target a specific depth interval for each site. Soils in the targeted injection zones consist primarily of a sand and gravel material or a mixture of sand, gravel, and silt. The total depth of the injection wells in AOC-004 is limited to 9 feet bgs so that the wells remain above a confining silt layer present in the source area. The length of the well screen is limited to 4 feet so as to avoid injection across soil types with different permeabilities. The two injection wells will be colocated and will be installed with staggered well screen depths to allow injection of oxygen donor compound into the vadose zone/capillary fringe, as well as the groundwater. Well B004-01 is designed to be screened from 5 to 9 feet bgs, while well B004-02 is designed to be screened from 3.5 to 7.5 feet bgs. Oxygen donor injected at B004-02 will be distributed by seasonal groundwater fluctuations resulting in conditions that should degrade the majority of the COCs present within the vadose zone in AOC-004 and limit downgradient migration of TPH.

6.2.1.2 AOC-092

The cleanup action specified in the CAP for AOC-092 included excavation of affected soil, placement of a bioremediation amendment, and groundwater monitoring to confirm the effectiveness of the removal action and bioremediation. Limited source area excavation followed by mixing 500 pounds of PermeOx® Plus into the base of the excavation to enhance bioremediation at AOC-92 was completed in August 2013. A work plan outlining the excavation and placement of the bioremediation amendment was sent to Ecology in June 2013 (AMEC, 2013b). A copy of this work plan is included in Appendix B.

The source area excavation was completed in August 2013, as illustrated on Drawing C-16 in Appendix A. Except for a small area of inaccessible soil located under a seismic structural support, soil affected by TPH-G was removed from AOC-092. Confirmation samples collected from the excavation confirmed that soil exceeding the cleanup level for TPH-G was removed, except for a localized area of the north wall of the excavation adjacent to the seismic brace. The location of the confirmation sample exceeding the TPH-G cleanup level is shown on Drawing C-16 in Appendix A. A sample collected on the north side of the seismic brace was below the cleanup level. A report documenting AOC-092 cleanup activities is included in Appendix C.

The final cleanup action being implemented at AOC-092 is shown on Drawing C-16 (Appendix A). The MA component of the cleanup action, where groundwater quality is monitored to assess the effectiveness of biodegradation, is ongoing and is described in Section 6.5.1.8. No future injections are expected for AOC-092, as nearly all affected soil was removed during source area excavation, as documented in Appendix C. As noted in Section 6.1, institutional controls will be implemented to address affected soil remaining at AOC-092 that exceeds soil cleanup levels for this area.

6.2.2 Monitored Attenuation

MA consists of monitoring COC concentrations and evaluating subsurface conditions to assess if geochemical conditions are conducive to biodegradation of fuel hydrocarbons and to assess the need for additional TEA or amendment injections to establish favorable conditions. MA will be initiated at AOC-004 following the initial injection of TEA. MA has commenced for AOC-092. For these areas, MA will include monitoring groundwater quality in the source area and at the CPOC. Groundwater quality, including geochemical parameters and COC concentrations, will be evaluated to assess effectiveness of biodegradation and evaluate if additional amendments or TEA is needed to maintain enhanced bioremediation. TEA injections and geochemical parameter monitoring will not be required at AOC-092, unless groundwater concentrations are found to exceed cleanup levels.

Trend charts of COC concentrations, methane concentrations, dissolved oxygen, oxidation/reduction potential (ORP), and pH will be used to track conditions and determine if subsurface conditions favor biodegradation of fuel hydrocarbons. The need for additional TEA injection will depend on how the site responds to the excavation and application of a slow-release oxygen release compound and observed progress in degrading COCs. Construction details for new groundwater monitoring wells are provided on Drawing C-17 (Appendix A). Details of groundwater monitoring well installation are provided in Section 5.3.

The MA monitoring program is summarized in Section 6.5 and documented in the Compliance Monitoring Plan in Appendix D. The MA monitoring parameters for sites with fuel-related COCs will comprise the groundwater COCs for each site as defined in the CAP, as well as the primary geochemical indicators listed in Table 3. The secondary geochemical indicators listed in Table 3 for fuel-related hydrocarbon COCs will be analyzed on a less frequent basis, as described in Section 6.5.

6.3 ENHANCED BIOREMEDIATION/MONITORED ATTENUATION FOR SITES WITH CHLORINATED SOLVENT COCS

Enhanced in situ bioremediation (ISB) for chlorinated organic COCs will be a key cleanup action component for SWMU-172/174, the Building 4-78/79 SWMU/AOC Group, AOC-001/002, AOC-003, AOC-060, and AOC-090. A network of injection wells designed to deliver electron donor to the target zone will be used to enhance and accelerate anaerobic biological degradation of chlorinated VOCs that is already occurring at these sites. Compliance monitoring will be conducted following application of the electron donor to monitor concentrations of COCs, to assess whether geochemical conditions are favorable for further biodegradation of COCs, and to determine if maintenance injections of electron donor and/or amendment are needed to maintain enhanced bioremediation.

6.3.1 Enhanced Bioremediation for Chlorinated Organic COCs

Chlorinated organic COCs are generally more readily biodegraded under anaerobic, reducing conditions in the presence of an electron donor. These COCs generally occur in areas where historic releases of the parent COCs (typically PCE or TCE) have generated mixed dissolved-phase plumes consisting of *cis*-1,2-DCE and/or VC, in addition to the parent compounds. The addition of readily degradable electron donor substrates, such as vegetable oil, lactate, molasses, or sugars, helps microorganisms that use the substrate to establish and maintain reducing conditions in the targeted groundwater and to support reductive dechlorination of the chlorinated VOCs.

New and or existing injection wells will be used to inject the electron donor substrate for the enhanced bioremediation areas. The target areas and the general layout of injection well galleries for each of the applicable sites are shown in Appendix A on the following drawings:

- Drawing C-2 for SWMU-172/174;
- Drawing C-4 and C-5 for the Building 4-78/79 SWMU/AOC Group;
- Drawing C-10 for AOC-001/002;
- Drawing C-11 for AOC-003;

- Drawing C-14 for AOC-060; and
- Drawing C-15 for AOC-090.

Table 4 shows the number of injection wells planned for injection of amendment for the chlorinated VOC bioremediation areas. The design injection well spacing is based on the injection well spacing that has been found to be effective for AOC-001/002 and AOC-090. Similar well spacing was used at the other sites, because aquifer soil types are similar among the SWMUs and AOCs designated for enhanced bioremediation.

Existing injection wells will be used to deliver maintenance doses of electron-donor at AOC-001/002, AOC-060, and AOC-090, if needed. New permanent injection wells will be installed at the other enhanced bioremediation sites to support injection to the target areas and to allow for future maintenance injection events that may be needed to achieve the cleanup objective. A total of 34 new injection wells (including conversion of an existing former extraction well at the Building 4-78/4-79 SWMU/AOC Group) will be installed at SWMU-172/174 (Drawing C-2), the Building 4-78/79 SWMU/AOC Group (Drawings C-4 and C-5), and AOC-003 (Drawing C-11). The number of injection wells for each site is shown in Table 4. Well construction specifications for the injection wells are presented on Drawing C-8 (Appendix A), and injection well construction procedures are described in Section 6.4.

Injection well depths and screened intervals for each chlorinated organic COC site were selected to target the aquifer unit and depth where groundwater COCs were detected and to avoid screening across substantially different soil types with varying permeabilities. Where appropriate, the total well depth was limited to avoid penetration of a confining layer. Projected well and screen depths shown on Drawing C-8 were based on site lithology presented in the RI Report and on results from groundwater investigations conducted during and subsequent to the RI. Final well and screen depths and lengths will be determined by a licensed geologist during well installation and based on conditions observed in the field. The field geologist may change screen placement to place the screen in the correct target zone; well locations may be changed as appropriate to avoid underground utilities or other obstacles, but wells will be placed as close as practicable to the planned location.

After injection wells have been constructed at SWMU-172/174, the Building 4-78/79 SWMU/AOC Group, and AOC-003, an electron donor will be injected into each of the injection wells for these sites. Two substrates, sugar and a mixture of emulsified vegetable oil (EVO) and lactate, were selected as the primary electron donor materials to be used for enhanced bioremediation. Sugar was chosen as a substrate because it dissolves easily, is readily biodegradable, and will quickly induce anaerobic conditions. The EVO/lactate mixture is beneficial due to the slow-release properties of EVO and the quick reaction time for lactate. Specifications for an example substrate, such as LactOil, are included in Appendix F.

A mixture of EVO and lactate may provide some benefits over sugar and other similar substrates. First, the vegetable oil typically continues to serve as an electron donor over a longer time period than soluble electron-donor substrates such as sugars, thereby allowing a longer period of time during which organic carbon is released, resulting in fewer injections. Second, a single injection of rapidly acting electron donor, such as sugar, may result in a drop in pH in the subsurface target zones; excessively low pH (i.e., below 6.0) may reduce the degradation rate for microbiologically mediated processes for degrading chlorinated VOCs. The two substrates will be used as appropriate to achieve the cleanup objective at the MA sites. Sugar may be used if data analysis indicates a soluble, rapidly reacting electron donor is appropriate, while the EVO/lactate amendment will be used if slower reactions over a longer period are determined to be appropriate. Electron donor injections will be done as described in CALIBRE's SOPs for bioremediation (Appendix G).

Enhanced bioremediation and MA have already been implemented at AOC-001/002, AOC-060, and AOC-090. No new injection wells are planned for these areas. Maintenance injections will be made for these three areas as required, based on the evaluations discussed in Section 6.3.2. The quantities of amendment to be injected in future injection events will be determined from previous injections and evaluation of monitoring data. Electron donor amendments will be selected as described above for the newly implemented enhanced bioremediation programs.

Table 4 shows the estimated quantities of substrate to be injected initially at SWMU-172/174, the Building 4-78/79 SWMU/AOC Group, and AOC-003. Table 4 also shows estimated quantities of substrate to be injected if needed for bioremediation maintenance at AOC-001/002, AOC-060, and AOC-090. The quantities to be injected into individual injection wells are based on previous experience with injections at AOC-001/002 and AOC-090 that have had successful results. These quantities are based on the area covered by the actual dose. The coverage achieved by the initial injections will be evaluated from monitoring data; this information will be used to modify future injections as appropriate to achieve full coverage of the target area. Injections will be adjusted as needed to achieve a target substrate concentration in groundwater ranging from 50 to 500 milligrams per liter (mg/L) of total organic carbon (TOC) in the formation adjacent to each injection well, as recommended by the Air Force Center for Civil and Environmental Engineering (AFCEE, 2004). Injections will be performed on an as-needed basis by a specialty contractor with equipment needed to mix and inject the appropriate electron donor materials.

As noted in the 2013 bioremediation work plan for maintenance injections (CALIBRE, 2013), an injection flow rate around 3 gallons per minute (gpm) will be used initially and may be adjusted based on field conditions. The injection flow rate may vary, depending on the specific hydraulic conductivities in the injection zones and well characteristics. Injections will be done as described in CALIBRE's SOPs (Appendix G). The SOPs are consistent with the procedures used for the 2013 maintenance injections (CALIBRE, 2013).

The estimated initial substrate injection amounts presented for each area in Table 4 may be revised in the field, based on observations during the injection events. Although EVO, lactate, and sugar have been selected as the substrates for initial injection, other electron donor materials may be selected for future injections. A variety of electron donors have been used for enhanced reductive dechlorination of chlorinated solvents in groundwater (AFCEE, 2004); alternate electron donor materials listed in the AFCEE document may be considered for use at the Facility. Changes to the substrate type and injection amounts will be based on MA data for each SWMU or AOC. Any proposed changes regarding electron-donor material and injection schedule will be proposed to Ecology in the regular progress reports prepared in accordance with the Order, prior to performing the injection.

6.3.2 Monitored Attenuation

MA will be initiated at each chlorinated solvent bioremediation area after initial substrate injections have been completed. The MA monitoring parameters for sites with chlorinated COCs will include the groundwater COCs for each SWMU or AOC, as defined in the CAP, as well as the primary and secondary geochemical indicators listed in Table 3. The primary geochemical indicators characterize the general geochemical conditions present in groundwater. These conditions are then evaluated to assess the suitability of the groundwater environment for supporting biodegradation of the COCs and determine if amendments, such as nutrients or electron donor, need to be injected. The primary geochemical indicators will be monitored during each sampling event. Secondary geochemical indicators will be monitored less frequently.

The MA monitoring data will be evaluated on a quarterly basis using trend charts for the concentration of COCs and geochemical parameters. Reporting is described in Section 8. Trends in dissolved oxygen, ORP, pH, methane, TOC, and ethene will be examined to assess the effectiveness of the MA program and to evaluate the need for additional electron donor substrate or nutrients. The two most likely conditions that would indicate additional treatment is needed are described below:

1. If methane concentrations and TOC content are decreasing and chlorinated COC concentrations are increasing, then additional substrate may be required.
2. If ORP is increasing and pH is decreasing, but TOC is not decreasing, then additional nutrients or pH buffering additives may be necessary.

Future dosing amounts and type of substrate will be determined by evaluating monitoring results, results of prior injections, and following recommendations presented in the AFCEE guidance (AFCEE, 2004). As noted previously, details of any changes will be provided to Ecology in the quarterly progress reports prior to the injection event.

Monitoring for MA will be conducted as part of the compliance monitoring program described in Section 6.5. Details concerning sampling and analytical protocols are presented in the Compliance Monitoring Plan in Appendix D.

6.4 BIOREMEDIATION INJECTION WELL INSTALLATION

Direct-push drilling methodologies will be used to install new bioremediation injection wells at SWMU-172/174, the Building 4-78/79 SWMU/AOC Group, AOC-003, and AOC-004. Direct-push well installation is preferable to the more traditional HSA drilling methods, because the fine-grained silty sands present at the Facility are susceptible to sand heave that occurs when using HSA to install injection wells. All direct-push injection wells will be installed by a Washington State licensed well driller using a direct-push drill rig under the supervision of a Washington State licensed geologist. The bioremediation injection wells will be installed as shown in Drawing C-8 in Appendix A. The screen intervals and planned screen lengths selected for each well are based on lithologic logs from push probes or groundwater monitoring wells in the vicinity of the injection wells.

Most of the new bioremediation injection wells will be installed without lithologic logging because sufficient lithologic information is already available in most of these areas. Lithology will be logged for only the following wells:

- B172-4 and B172-11 at SMWU-172/SWMU-174; and
- B78-02, B78-10, and B78-11 at the Building 4-78/79 SWMU/AOC Group.

For these wells, the lithology will be logged in the field, and will include a description of soil or rock types, soil color, weathering, texture, structure, and fractures (see Attachment 1 in Appendix D for details concerning lithologic logging).

A detailed construction record or log of all new bioremediation injection wells will be prepared. The construction logs and descriptions will include the following information:

1. Date and time of construction;
2. Drilling method and drilling fluid, if any, used;
3. Well location (surveyed to within 0.5 foot);
4. Borehole diameter and well casing diameter;
5. Well depth (to within 0.1 foot);

6. Lithologic logs (for selected wells only, as described above);
7. Casing materials;
8. Screen material and design, including screen length and slot size;
9. Well casing and screen joint type;
10. Sand pack material, including grain size, placement method, and approximate volume;
11. Composition and approximate volume of sealant material and method of placement;
12. Surface seal design and construction;
13. Ground surface elevation (to within 0.01 foot);
14. Top-of-casing elevation (to within 0.01 foot); and
15. Detailed drawing of well, including dimensions.

Locations and elevations of the new injection wells will be surveyed by a licensed surveyor after the wells have been installed.

Bioremediation injection well design details are provided on Drawing C-8 in Appendix A. All of the direct-push wells will be constructed of 2-inch-diameter Schedule 40 flush-thread PVC casing. The PVC vee-wire screen will have 0.030-inch slots and will be installed with a sand prepack. All of the wells will be constructed using pre-packed well screens, where the sand pack medium is held in place by a mesh-screen secured to the outside of the well casing. After the boring has been logged, a “macro-core” 3.5-inch-diameter core casing will be driven back through the narrower direct-push boring to the total well depth. A plug at the end of the core barrel will be removed, and the pre-pack well screen and well casing will then be assembled and lowered into the core barrel. Loose filter pack sand will be added slowly into the annulus as the core barrel is retracted. The filter pack sand is used to stabilize the well screen and casing as the core is removed. Once the loose filter pack is approximately 2 feet above the top of the prepack well screen, medium-sized bentonite chips will be used to seal the boring. The bentonite chips will be hydrated after placement. The flush-mounted well monument will then be cemented around the well to protect it. The surface monument and concrete will be sloped to drain surface water away from the monument cap.

As described in Attachment 1 of Appendix D, the soil cuttings from well installation and decontamination/purge water from well development will be managed by Boeing. Soil will be characterized and disposed off site in accordance with applicable state and federal regulations. Any personal protective equipment and other non-contaminated refuse from well installation will be double-bagged and disposed in waste containers provided by Boeing for management with general Facility refuse.

6.5 COMPLIANCE MONITORING

Compliance monitoring will be conducted at each SWMU and AOC to assess attainment of the cleanup standard, to assess effectiveness of the cleanup action, and to evaluate if geochemical conditions are conducive to biodegradation of COCs. This section presents a summary and overview of the monitoring approach and protocol for MA. A summary of the compliance monitoring plan for the SWMUs and AOCs addressed in this EDR is presented in the Compliance Monitoring Plan (Appendix D).

The compliance monitoring program presented in this EDR is consistent with the conceptual MA program described in the CAP and is based on general requirements followed for monitored natural attenuation, as described in the Ecology MNA guidance for petroleum sites (Ecology, 2005). The MNA guidance applies directly to MA for the SWMUs and AOCs with fuel hydrocarbon COCs that are addressed by enhanced bioremediation (Section 6.2). To the extent appropriate, the monitoring concepts in Ecology’s guidance for MNA at petroleum sites have also been applied to MA monitoring for the SWMUs and AOCs with chlorinated solvents or other non-petroleum-related COCs (Section 6.3).

Boeing will periodically evaluate the monitoring frequency for each site and may propose changes (well network monitoring frequency or wells included in the monitoring network) to Ecology for approval. No changes to the monitoring program outlined below will be made without Ecology approval.

The compliance monitoring network for each of the MA sites is described briefly in Section 6.5.1 and shown in detail on each of the applicable design drawings in Appendix A. The data analysis and reporting procedures for MA sites are described in Section 6.5.2. The monitoring network and reporting procedures are documented in the Compliance Monitoring Plan in Appendix D.

6.5.1 MA Monitoring Network and Sampling and Analysis Schedule

This section presents the groundwater monitoring network and sampling and analysis schedule for each SWMU and AOC to be addressed by MA. The layout of the groundwater monitoring network for these areas is shown on the appropriate engineering design drawing in Appendix A.

6.5.1.1 SWMU-172/174

Drawing C-2 shows the layout of the groundwater monitoring network for SWMU-172/174. Three new shallow groundwater monitoring wells (GW232S, GW234S, and GW236S) and two new intermediate monitoring wells (GW233I and GW235I) will be installed east of the primary source area; these wells will be installed following the well design shown on Drawing C-17 and the methods described in Section 5.3. The MA well network at SWMU-172/174 will consist of the following wells:

- ***Source Area Wells*** – GW152S and GW153S;
- ***Downgradient Plume Wells*** – GW081S, GW172S, GW173S, and GW226S; and
- ***CPOC Wells –*** GW232S, GW233I, GW234S, GW235I, and GW236S.

The monitoring network wells at SWMU-172/174 will be monitored quarterly, and will be analyzed for the COCs and the primary geochemical indicators listed in Table 3. The secondary geochemical indicators for chlorinated solvents listed in Table 3 will be analyzed once annually during the second quarterly sampling event.

Field and laboratory results from quarterly groundwater sampling at SWMU-172/SWMU-174 will be evaluated as described in Section 6.5.2 to assess attainment of the cleanup standard described in Section 3 and to evaluate geochemical conditions for potential effects on biodegradation of COCs. Results of this evaluation will be provided to Ecology in the groundwater monitoring reports as described in Section 8. The compliance monitoring program for SWMU-172/SWMU-174 is fully documented in the Compliance Monitoring Plan (Appendix D).

6.5.1.2 Building 4-78/79 SWMU/AOC Group

The cleanup action for the Building 4-78/79 SWMU/AOC Group includes institutional controls and bioremediation/MA for chlorinated COCs and MNA for gasoline and benzene. Drawing C-4 (Appendix A) shows the location of the existing and proposed new monitoring wells for this area. The combined monitoring program is presented in this section for both MA and MNA.

Three new shallow groundwater monitoring wells (GW237S, GW241S, and GW244S), four new intermediate groundwater monitoring wells (GW238I, GW239I, GW242I, and GW243I), and one new deep groundwater monitoring well (GW240D) will be installed west of the primary source area following the procedures described in Section 5.3. Well installation design details are presented in Drawing C-17 (Appendix A). The monitoring well network will also include several existing wells. The monitoring well network for the Building 4-78/79 SWMU/AOC Group will consist of the following wells:

- ***Source Area Wells –*** GW031S, GW033S, GW034S, GW039S, GW243I, and GW244S;

- ***Downgradient Plume Wells –*** GW038S, GW209S, and GW210S; and
- **CPOC Wells –** GW143S, GW237S, GW238I, GW239I, GW240D, GW241S, and GW242I.

The monitoring well network for the Building 4-78/79 SWMU/AOC Group will be monitored quarterly for the site COCs and the primary geochemical indicators listed in Table 3. The secondary geochemical indicators for chlorinated solvents listed in Table 3 will be analyzed once annually during the second quarterly sampling event.

Field and laboratory results from quarterly groundwater sampling at the Building 4-78/79 SWMU/AOC Group will be evaluated as described in Section 6.5.2 to assess attainment of the cleanup standard described in Section 3 and to evaluate geochemical conditions for potential effects on biodegradation of COCs. Results of this evaluation will be provided to Ecology in groundwater monitoring reports as described in Section 8. The compliance monitoring program for the Building 4-78/79 SWMU/AOC Group is documented in the Compliance Monitoring Plan (Appendix D).

6.5.1.3 AOC-001/002

Drawing C-10 (Appendix A) shows the layout of the monitoring well network for AOC-001/002. One new shallow groundwater monitoring well (GW246S) will be installed northwest of the primary source area following the well design shown on Drawing C-17 and the procedures outlined in Section 5.3. The MA monitoring well network for AOC-001/002 will consist of the following wells:

- ***Source Area Well –*** GW193S, located within the backfill of the former source area excavation;
- ***Downgradient Plume Wells –*** GW190S, GW191D, GW192S, and new monitoring well GW246S; and
- ***CPOC Wells –*** GW185S, GW194S, GW195S, GW196D, and GW197S.

The wells at AOC-001/AOC-002 will be monitored quarterly, as is presently being done for this site. Groundwater samples from these wells will be analyzed for the COCs defined in the CAP and the primary geochemical indicator parameters listed in Table 3. The secondary geochemical indicators listed in Table 3 for chlorinated solvent sites will be analyzed once annually during the second quarterly sampling event.

Field and laboratory results will be evaluated following each monitoring event, as described in Section 6.5.2, to assess the effectiveness of bioremediation/MA in achieving the cleanup standard described in Section 3 and to evaluate geochemical conditions for potential effects on biodegradation of COCs. Results of this evaluation will be reported to Ecology quarterly, as described in Section 8.

The compliance monitoring program for AOC-001/002 is documented in the Compliance Monitoring Plan (Appendix D).

6.5.1.4 AOC-003

Drawing C-11 (Appendix A) shows the layout of the monitoring well network for AOC-003. Two new shallow monitoring wells (GW247S and GW249S) and one new intermediate monitoring well (GW248I) will be installed at this site following the well design shown on Drawing C-17 and the procedures described in Section 5.3. The monitoring network will consist of the following wells:

- ***Source Area Well –*** GW249S, to be installed adjacent to the former UST;
- ***Downgradient Plume Well*** – GW188S; and
- ***CPOC Wells –*** GW247S and GW248I, to be installed approximately 150 feet north northwest of the source area.

The wells at AOC-003 will be monitored quarterly. Groundwater samples from these wells will be analyzed for AOC-003 COCs and the primary geochemical indicator parameters listed in Table 3. The secondary geochemical indicators listed in Table 3 for chlorinated solvent sites will be analyzed annually during the third quarterly sampling event each year.

Field and laboratory results from quarterly groundwater sampling at AOC-003 will be evaluated as described in Section 6.5.2 to assess attainment of the cleanup standard described in Section 3 and to evaluate geochemical conditions for potential effects on biodegradation of COCs at AOC-003. Results for field and laboratory measurements and data evaluation will be reported to Ecology quarterly, as described in Section 8. The compliance monitoring program for AOC-003 is documented in the Compliance Monitoring Plan (Appendix D).

6.5.1.5 AOC-004 MA Monitoring Program

Figure 23 in the Cleanup Action Plan showed the conceptual monitoring design anticipated for AOC-004. During site reconnaissance performed to support the design presented in the EDR, it was noted that the proposed shallow groundwater wells north of GW174S were located next to structural supports (seismic bracing) for Building 4-21; the support foundation extends well below the vertical limit of contamination and the planned depths for the monitoring wells. Even if these wells could be installed adjacent to the support, the support foundation would affect groundwater flow and prevent accurate monitoring of downgradient water quality. Therefore, the CPOC was moved to GW-174S, which is significantly closer to the source area. Due to the proximity of GW 174S to the source area, only one CPOC well is proposed to monitor groundwater quality for this AOC.

Drawing C-12 (Appendix A) shows the layout of the groundwater monitoring well network at AOC-004. One new shallow groundwater monitoring well (GW250S) will be installed in the source area at this AOC following the well design shown on Drawing C-17 (Appendix A) and the methods described in Section 5.3. The monitoring network at AOC-004 will consist of the following wells:

- ***Source Area Well –*** GW250S, to be installed in the vicinity of the source area; and
- ***CPOC Well –*** GW174S.

The wells at AOC-004 will be monitored quarterly. Groundwater samples from the well network will be analyzed for the COCs for AOC-004 and the primary geochemical indicator parameters listed in Table 3. The secondary geochemical indicators listed in Table 3 for fuel hydrocarbon sites will be analyzed once annually during the third quarter sampling event.

Field and laboratory results from quarterly groundwater sampling at AOC-004 will be evaluated as described in Section 6.5.2 to assess attainment of the cleanup standard described in Section 3 and to evaluate geochemical conditions for potential effects on biodegradation of the AOC-004 COCs. Results for field and laboratory measurements and data evaluation will be reported to Ecology quarterly, as described in Section 8. The compliance monitoring program for AOC-004 is documented in the Compliance Monitoring Plan (Appendix D).

6.5.1.6 AOC-060 MA Monitoring Program

Drawing C-14 (Appendix A) shows the layout of the monitoring well network for AOC-060. Two new shallow groundwater monitoring wells (GW252S and GW254S) and one new intermediate groundwater monitoring well (GW253I) will be installed in the City of Renton's Cedar River Trail Park for monitoring at AOC-060. Wells will be installed in accordance with the well design shown on Drawing C-17 (Appendix A) and the procedures described in Section 5.3. In addition, two existing bioremediation injection wells will be used as monitoring wells. Following installation of the new wells, the groundwater monitoring network for AOC-060 will consist of the following wells:

- ***Source Area Well –*** GW009S;
- ***Cross-Gradient Wells*** – GW012S and GW014S;
- ***Downgradient Well***: GW147S;
- ***CPOC Wells –*** GW149S, GW150S, GW252S, GW253I, and GW254S; and
- ***Water Level Monitoring Wells –*** GW010S and GW011D.

AOC-060 has been sampled semiannually since 2004; therefore, the existing monitoring wells will continue to be sampled semiannually; the new wells (GW252S, GW253I, and GW254S) will be sampled semiannually until clear COC trends have been established for these wells. Groundwater samples and water levels will continue to be collected from GW012S and GW147S despite their use as injection wells. Monitoring wells GW010S and GW011D will be monitored for groundwater elevation only; no groundwater samples will be collected from GW010S and GW011D. Semiannual groundwater samples from the MA wells will be analyzed for TCE, *cis*-1,2-DCE, VC, and the primary geochemical indicator parameters listed in Table 3. Once annually, during the second semiannual sampling event, samples from selected upgradient and/or downgradient wells will also be analyzed for the secondary geochemical indicators listed in Table 3 for chlorinated solvent sites.

Field and laboratory results from semiannual groundwater sampling at AOC-060 will be evaluated to assess attainment of the cleanup standard described in Section 3 and to evaluate geochemical conditions for potential effects on biodegradation of COCs at AOC-060. Results for field and laboratory measurements and data evaluation will be reported to Ecology in monitoring reports, as described in Section 8. The compliance monitoring program for AOC-060 is documented in the Compliance Monitoring Plan (Appendix D).

6.5.1.7 AOC-090

Drawing C-15 (Appendix A) shows the layout of the monitoring well network for AOC-090. The monitoring well network will consist of the following existing wells:

- ***Source Area Well*** – GW189S located at the location of the southern sidewall of the former excavation;
- ***Downgradient Wells*** – GW176S and GW175I;
- ***CPOC Wells (shallow)*** – GW178S and GW208S (to the south) and GW180S and GW207S (to the north); and
- ***CPOC Wells (intermediate)*** – GW163I, GW165I, and GW177I (to the south), and GW179I (to the north).

Groundwater monitoring has been conducted at AOC-090 since the interim removal action was completed; the current monitoring schedule for this site will continue. As is done presently, GW189S will be monitored quarterly; quarterly samples from this well will be analyzed for the AOC-090 COCs and the primary geochemical indicators listed in Table 3. The other monitoring network wells at AOC-090 will be monitored semiannually and analyzed for the AOC-090 COCs and the primary geochemical indicator parameters listed in Table 3. Monitoring for GW189S will be done in conjunction with semiannual monitoring of the other monitoring network wells. The secondary geochemical indicators listed in Table 3 for chlorinated solvents will be analyzed once annually during the third-quarter sampling event.

Field and laboratory results from periodic groundwater sampling at AOC-090 will be evaluated as described in Section 6.5.2 to assess attainment of the cleanup standard described in Section 3 and to evaluate geochemical conditions for potential effects on biodegradation of the AOC-090 COCs. Results for field and laboratory measurements and data evaluation will be reported to Ecology quarterly, as described in Section 8. The compliance monitoring program for AOC-090 is documented in the Compliance Monitoring Plan (Appendix D).

6.5.1.8 AOC-092

The MA well network for this AOC consists of one existing monitoring well (GW227S) located on the CPOC, as shown in Drawing C-16.

The source area at AOC-092 was removed by excavation, as demonstrated by confirmation samples. Documentation of the excavation and the results for confirmation sampling are presented in Appendix C. A small amount of soil affected by TPH-G remains under the Building 4-20 seismic footing south of GW 227S, as shown on Drawing C-16 in Appendix A. This soil could not be removed without potentially causing damage to the structure. Drawing C-16 in Appendix A shows the location of the confirmation sample exceeding the TPH-G cleanup level. As noted in the excavation report (Appendix C), soil contamination did not extend to the north side of the seismic footing.

GW227S will be monitored quarterly in conjunction with the well network for AOC-001/AOC-002. Groundwater samples from GW227S will be analyzed for the AOC-092 COCs and the primary geochemical indicator parameters listed in Table 3. The secondary geochemical indicators listed in Table 3 for fuel-related hydrocarbons will be analyzed once annually during the third-quarter sampling event.

Field and laboratory results from quarterly groundwater sampling at AOC-092 will be evaluated as described in Section 6.5.2 to assess attainment of the cleanup standard described in Section 3 and to evaluate geochemical conditions for potential effects on biodegradation of the AOC-092 COCs. Results for field and laboratory measurements and data evaluation will be reported to Ecology quarterly, as described in Section 8. The compliance monitoring program for AOC-092 is documented in the Compliance Monitoring Plan (Appendix D).

6.5.2 Data Evaluation and Reporting

Field and laboratory analytical results from periodic groundwater monitoring at each of the MA sites will be evaluated to assess attainment of the cleanup standards described in Section 3 and to evaluate geochemical conditions for potential effects on biodegradation of COCs at each location. MA will be evaluated by tracking trends in COC concentrations and by evaluating geochemical conditions as indicated by the primary and secondary geochemical parameters. Trends in COC concentrations and geochemical parameters will be assessed graphically and, if needed, using statistical methods as outlined by Ecology guidance for MNA (Ecology, 2005).

Trend plots for the geochemical indicators will be reviewed to identify long-term, seasonal, and/or short-term trends or changes. Short-term trends will be carefully reviewed, as short-term changes may indicate that conditions adverse to biodegradation of COCs may be occurring. Results and conclusions from this evaluation will be presented in quarterly monitoring reports, as described in Section 8 of this EDR.

Analytical results for groundwater samples collected from CPOC wells at each of the MA sites will be compared to the site-specific CULs presented in Section 3 after each monitoring event. The results of the comparison will be presented in quarterly monitoring reports (Section 8).

If the concentration of COCs in all samples collected from all CPOC monitoring wells at a given site are below the site-specific CULs for a period of eight consecutive quarters, Boeing may consider the cleanup standard to have been attained and may submit a written request to Ecology to confirm attainment of the cleanup standard and to approve cessation of compliance monitoring at that site. Monitoring will continue at each site as described in Section 6.5 until Ecology approves demonstration that the cleanup standard has been achieved for the site.

6.6 REGULATORY COMPLIANCE

Implementation of ISB injection is exempted from procedural and permitting requirements of Washington State underground injection control regulations (WAC 173-218), which regulate the injection of fluids that could endanger groundwater. However, the substantive requirements of WAC 173-218-060(5)b will be met by registering the injection wells. Boeing will work closely with Ecology for compliance with underground injection well requirements, including construction and decommissioning regulations, meeting the non-endangerment standard, and meeting requirements for evaluation of downgradient effects. Construction and decommissioning requirements will be met by conforming to WAC 173-160. Injections will consist only of nontoxic amendments.

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7.0 SOIL VAPOR EXTRACTION PLAN FOR SWMU-172/174 AND BUILDING 4-78/79 SWMU/AOC GROUP

This section describes implementation of SVE at SWMU-172/174 and the Building 4-78/79 SWMU/AOC Group. SVE is a component of the final cleanup action specified in the CAP for these two areas; other components of the final cleanup action for these areas are described in other sections of this EDR. Sections 7.1 and 7.2 provide an overview of the final remedy for SWMU-172/174 and the Building 4-78/79 SWMU/AOC Group, respectively. Section 7.3 outlines the design and specifications for the SVE system for the two sites. The construction plans for installing the SVE systems are outlined in Section 7.4. Operation of the SVE systems is discussed in Section 7.5. Criteria for shutting down the SVE systems are described in Section 7.6.

7.1 OVERVIEW OF SWMU-172/174 REMEDIATION

The COCs for this area include several VOCs in both soil and groundwater (see Table 1). Chlorinated solvents, including PCE, TCE, and methylene chloride, as well as their breakdown products, are the primary COCs that will be addressed by the remedies specified in the CAP for SWMU-172/174. These remedies include institutional controls, enhanced bioremediation/monitored attenuation, and SVE. Institutional controls and enhanced bioremediation/monitored attenuation were described in Sections 4 and 6, respectively.

The SVE system will include a trailer-mounted SVE blower, vapor treatment units, and a network of vapor-recovery wells (Drawing C-2, Appendix A). The SVE system for SWMU-172/174 will be installed and operated in the vicinity of the two former USTs. Based on these SVE well locations, the expected radius of influence (ROI) will provide coverage for the affected area, including the areas near push probes PP061 and PP062 (Drawing C-2, Appendix A). SVE is compatible with the current site use and will be effective at addressing affected soil in the target area. The SVE system will be operated until vapor monitoring data indicate that the SVE system is no longer effective in removing site COCs, as described in Section 7.6. Following shutdown of the SVE system, soil confirmation sampling will be performed to assess residual COC concentrations in unsaturated zone soil as described in the Compliance Monitoring Plan (Appendix D). The COC concentrations in soil confirmation samples will be compared to the soil cleanup levels in Table 2. Institutional controls will be implemented as appropriate for affected soil, if any, that exceeds soil cleanup levels.

7.2 OVERVIEW OF BUILDING 4-78/79 SWMU/AOC GROUP REMEDIATION

COCs for this area include PCE, TCE, and their biodegradation products as well as TPH-G and benzene (see Table 1). Institutional controls, MNA, enhanced bioremediation/MA, and SVE were selected in the CAP as the final cleanup action for the Building 4-78/79 SWMU/AOC Group.

Institutional controls, MNA, and enhanced bioremediation/MA were described in Sections 4, 5, and 6, respectively.

SVE will be used to address the VOCs present in affected vadose-zone soils within the target area (Drawings C-4 and C-5, Appendix A). It is expected that recovered VOCs will include chlorinated solvents, solvent degradation products, benzene, and volatile gasoline constituents. The SVE system will include a trailer-mounted SVE blower and a network of vapor recovery wells (Drawing C-5, Appendix A).

The Building 4-78/79 SWMU/AOC Group is in an area with a high water table, resulting in a thin vadose zone. In order to ensure adequate treatment of the SVE target area in this area with a shallow water table, the SVE system has been designed using horizontal rather than vertical wells and is designed to accommodate two different modes of operation, as described in more detail in Section 7.3.1.2. For standard mode SVE operations, the SVE wells will be under vacuum only, drawing soil vapors from the target area directly into the SVE blower. For vent mode SVE operations, some SVE wells will be opened to the atmosphere to allow air to enter the vent wells and flow to the vacuum wells. The SVE system will be operated until vapor monitoring data indicate it is no longer effective in removing site COCs, as described below in Section 7.6. Following shutdown of the SVE system, soil confirmation sampling will be performed to assess residual COC concentrations in unsaturated zone soil, as described in the Compliance Monitoring Plan (Appendix D). The COC concentrations in soil confirmation samples will be compared to the soil cleanup levels in Table 2. Institutional controls will be implemented as appropriate for affected soil, if any, that exceeds soil cleanup levels.

7.3 SVE SYSTEM DESIGN AND SPECIFICATIONS

The two SVE systems will be installed and implemented to address releases of volatile COCs that have impacted soils in both SWMU-172/174 and the Building 4-78/79 SWMU/AOC Group. SVE will permanently remove volatile COCs present in recovered soil gas in these areas. Details on the soil vapor extraction well network and soil vapor extraction systems are provided for each area in this section.

7.3.1 Soil Vapor Extraction Well Network

The SVE extraction well networks for the two areas include soil vapor recovery wells, collection piping, and the vapor collection manifolds. The extraction well networks are designed to collect soil vapor from the vadose zone within the target areas, direct the recovered vapors to the SVE treatment system, and enable operator control of soil vapor extraction rates. The design also allows some wells to be operated as vent wells while other wells are operated simultaneously as extraction wells; this mode of operation allows air to be introduced to the subsurface through the vent wells, which would increase the flow of air from the vent well to the extraction well, thereby increasing the air exchanges through the SVE target volume. Check valves will be installed on the air inlet lines to prevent potential vapor migration from the subsurface to ambient air in the event of system shutdown or system malfunction during vent mode operations.

The SVE wells have been distributed to cover the SVE target areas as described in the CAP, with collection piping running from the SVE wells to manifolds and then from the manifolds to the SVE blowers. The manifolds will be used to control flow from individual vapor extraction wells. The networks have been designed for limited impact on existing buildings, underground utilities, and site operations. Details on design of the SVE wells, piping, and trenching are provided below. For both systems, SVE equipment (blower, controls, etc.) will be housed in a trailer.

7.3.1.1 SWMU-172/174

The design for the SVE system for SWMU-172/174 is illustrated on Drawings C-2, C-3, and P-1 in Appendix A. The SVE target area for SWMU-172/174 was described in the CAP as the area near the two former USTs and push probes PP061 and PP062 (Drawing C-2, Appendix A). The SVE well locations specified in this EDR have been selected to minimize impact on utilities and to provide adequate coverage of the SVE target area. Soils in the SVE target area are a mixture of sand with gravel, and the surface is covered entirely by concrete or asphalt pavement of low permeability. The highest recorded water level in this area was measured at approximately 7.5 feet bgs. The water table drops to a seasonally low level of approximately 9.5 feet bgs during the dry season.

SVE well design and layout are based on soil types, soil and groundwater characterization data, and water level data from the RI report (Weston, 2001), FS report (Geomatrix, 2008), CAP, and quarterly monitoring reports. Based on the depth to groundwater, conventional vertical wells will be installed for soil vapor recovery at SWMU-172/174. Three SVE wells will be installed at this site, extending to depths of about 7 feet bgs; the vapor recovery wells will terminate about 0.5 foot above the highest recorded water level in this area. The wells will be constructed of schedule 40 PVC casing and a 3.5-foot-long PVC well screen with 0.030-inch slots (Drawing C-3, Appendix A). The screen depth for the SVE wells was selected to reduce the potential for flooding the screens by upwelling of groundwater and to allow a reasonable vacuum to be established without recovering excessive amounts of groundwater. The well surface completions will be below-grade vaults rated for heavy vehicular traffic (Drawing C-3, Appendix A). Underground piping (schedule 40 PVC) will be connected to the SVE well head and will run to Building 5-08, where the piping will surface and run above grade to the manifold and SVE unit (Drawings C-2 and C-3, Appendix A).

The three recovery wells are expected to enable soil gas to be recovered from the entire SVE target area. Based on prior experience with design and operation of SVE systems, a design ROI of 40 feet was used for SWMU-172/174. This design ROI is considered to be a conservative estimate given that ROIs of 50-75 feet have been measured at other SVE installations. Based on the design ROI, the well layout shown on Drawing C-2 (Appendix A) was established to cover the SVE target area. The SVE system was designed to allow the extraction rate to be increased if necessary, which would increase the ROI for the recovery wells. The ROI for the recovery wells will be confirmed prior to startup of the system. During pre-startup testing, vacuum will be pulled at only SVE-02, and valves to SVE-01 and SVE-03 will remain closed. Measurements will be taken at SVE-01 and SVE-03 to confirm that vacuum meets or exceeds ROI design estimates.

The SVE target area for SWMU-172/174 encompasses approximately 14,000 square feet. The vadose zone varies from the surface to 7.5–9.5 feet bgs, depending on the seasonal fluctuation in depth to groundwater. This depth translates to a target volume of 20,000 to 26,000 cubic feet of soil gas, assuming an effective soil porosity of 20 percent, which is the value recommended by the U.S. Army Corps of Engineers (USACE) for soils of this type (USACE, 2002). A total SVE flow rate of approximately 10 standard cubic feet per minute (SCFM) for each recovery well (30 SCFM total) provides sufficient air exchanges in approximately 0.5-2 years (1,000-1,500 total soil gas exchanges), as recommended by the USACE in their 2002 guidance document. Calculations for system soil gas exchanges are summarized on Table 5. The design flow rate of 10 SCFM per well and ROI of 40 feet provide an average pore gas velocity of 30 feet per day, which is at the upper end of the USACE recommended range of 3 to 30 feet per day (Table 5).

Potential emissions rates of VOCs (Table 6) from the SVE system were estimated based on the total estimated mass of VOCs in the soil and groundwater in the SVE target area. The estimated emissions rates are based on a conservative assumption that the entire mass of VOCs present in soil and groundwater within the SVE target area would be removed in a single calendar year. Soil data from the CAP and groundwater monitoring data from the late 1990s through 2013 were used to estimate the VOC mass in the SVE target area. Actual emissions will be monitored after SVE system startup and during operations. As noted above, pre-startup testing will be done to assess the ROI; pre-startup testing will include checking system components for confirm proper operation prior to startup. Emissions startup testing will be performed as described in Appendix J after initial startup of the complete system.

As shown on Drawing C-2 (Appendix A), piping will run underground from the soil vapor recovery well to the nearest building, where the piping will be routed to the surface. Above-grade piping will then be run to the SVE manifold by securing the piping to the exterior walls of Building 5-08 and Building 5-09 using uni-strut fasteners (Drawing C-3, Appendix A). The SVE manifold includes the following instruments and valves for each well: rotameters to measure flow, vacuum gauges, gate valves for control of air flow rate, and sampling ports. The above-grade piping will be schedule 40 PVC and will be sloped to drain any condensate either back to the SVE well or to the SVE trailer. The piping will run from the manifold to the SVE trailer, which will house the blower unit and controls. Vacuum and flow measurements will be taken at the manifold. Additional vacuum measurement points will also be installed for each well, as shown in Drawing P-1 (Appendix A). Soil gas entering the trailer will flow through a knock-out tank to remove condensed water and then to the blower. The blower effluent will flow through the vapor treatment units and discharge to the atmosphere from the stack mounted on the corner of Building 5-08. SVE well, trenching, piping, and vault details are provided in Drawing C-3 (Appendix A).

Joints in newly installed concrete and asphalt will be sealed by application of hot-applied sealant (ASTM D6690 – 12 or equivalent method). Sealant will also be applied to cracks and seams in the existing surface pavement within the SVE target area shown by the ROI on Drawing C-2 (Appendix A).

7.3.1.2 Building 4-78/79 SWMU/AOC Group

The design for the SVE system for the Building 4-78/79 SWMU/AOC Group is illustrated on Drawings C-4, C-5, C-6, C-7, and P-2 in Appendix A. SVE well design for the Building 4-78/79 SWMU/AOC Group was based on information on soil types, analytical data, and water level data from the CAP, the RI Report (Weston, 2001), and quarterly monitoring reports. The water table at this site is shallow, varying from about 2.5 feet bgs in the wet season to approximately 4.5 feet bgs during the dry season. The shallow groundwater leads to a very thin vadose zone for SVE treatment, especially during the wet season. Given the shallow water table, horizontal SVE wells were chosen for this area to limit the amount of groundwater upwelling during SVE operations and to improve the radius of influence for the SVE wells. The SVE treatment area for the Building 4-78/79 SWMU/AOC Group is shown on Drawing C-4, and the layout for the SVE wells is shown on Drawing C-5 (Appendix A).

The SVE target area for the Building 4-78/79 SWMU/AOC Group is based on the area identified in the CAP and available soil quality data. The horizontal well layout will enable the recovery of soil gas within the target area by operating the system under standard and vent modes. The locations of the SVE wells and piping were selected to be compatible with existing underground utilities, based on available drawings for this area. Final locations for SVE wells and piping will be cleared for underground utilities and other obstacles prior to installation of the system.

The SVE target area shown in Drawing C-4 encompasses both a chlorinated solvent source area and a TPH source area. As noted in the CAP, the primary source of chlorinated VOCs at this site is located around the northern end of Building 4-78 (near PP185 and PP188) and the loading dock area (near PP178). The primary TPH/benzene source area is in the vicinity of the former USTs and dispenser island. The planned SVE well locations (Drawing C-5, Appendix A) were altered slightly from the locations shown in the CAP to minimize potential impacts on utilities and to adequately address the SVE target area (Drawing C-4, Appendix A). The ROIs shown on Drawing C-5 show a conservative projection of the area influenced by each extraction well when operated in standard mode. The areas within the target treatment area outside the ROIs on Drawing C-5 will be addressed by operating the SVE system in vent mode.

The 15 horizontal SVE wells were designed to achieve vapor recovery for the target area but limit the extent of trenching, as the Building 4-78/79 SWMU/AOC Group is in a high traffic area. Horizontal wells will be installed in two sizes: one 5 feet long with 2-inch screens, and the other 10 feet long with 1-inch screens. Both sizes will have 0.030-inch machine slots in SDR 11 high-density polyethylene (HDPE) pipe (Drawing C-6, Appendix A). To reduce the potential for short-circuiting of the SVE well to the bedding material beneath the pavement, an impermeable HDPE geomembrane liner has been included to cover the top of the trench over the well screen (Drawing C-6, Appendix A). To limit short-circuiting to the pipe bedding/trench backfill, low-permeability cement bentonite plugs have also been included in the design near the end of the well screen (Drawings C-6 and C-7, Appendix A).

To prevent pipe damage from high surface loads and the limited bedding depth of underground piping (less than 2 feet of bedding), SDR 11 HDPE pipe will be needed for the horizontal well screens and subsurface conveyance piping. The SVE piping will be placed in trenches over most of the area; however, wherever possible, the need for trenching will be eliminated by mounting SVE piping on the walls of existing buildings (Drawings C-5 and C-7, Appendix A). Above-grade conveyance piping will be schedule 40 PVC. Conveyance piping will be sloped to drain any condensate back to the SVE wells or to the SVE manifolds for collection. The SVE collection piping runs to three separate manifolds, each mounted on the side of an existing building (Drawing C-5, Appendix A). The manifolds serve as collection points for several SVE wells and enable flow/vent control for the SVE wells. Schedule 80 PVC will be used for piping manifolds and valves (Drawing P-2, Appendix A). Controls for each well include a rotameter to measure flow rate and a vacuum gauge to measure well vacuum. The vapors from the SVE system will be discharged from a stack mounted on the corner of Building 4-79 (Detail 1, Drawing C-5).

Due to the very thin vadose zone at this site, soil vapor flow modeling was performed to estimate the ROI and to assess water table upwelling under the vacuum to be applied at the soil vapor recovery wells (Appendix H). Modeling indicated that a flow rate of 25 SCFM per well would likely yield an ROI in excess of 20 feet for each well, but that even with lower flows (at approximately 10 SCFM), significant upwelling would be likely to occur in less than a day, resulting in flooded wells during the wet season. Results of the soil vapor flow analysis are presented in Appendix H. To minimize upwelling, lower flow rates (1.5 to 6.0 SCFM per well) were selected based on modeling results. However, the system will be capable of an average flow rate of 10 SCFM per well. Modeling results indicate that the ROI for these flow rates would range from 20 to more than 90 feet under seasonally variable groundwater levels. Lower flow rates would be used during periods of high groundwater level. The system was also designed to allow operation of any SVE well as a vent well, as described below.

The ROI for the recovery wells will be confirmed during startup of the system. During pre-startup testing, vacuum will be pulled at only SVE-02, SVE-06, SVE-07, SVE-10, and SVE-13. The remaining wells will be closed, and vacuum measurements will be taken to confirm that measured vacuum meets or exceeds ROI design estimates.

Two different modes of SVE operation were developed for the SVE system at the Building 4-78/79 SWMU/AOC Group:

- Mode 1—Standard Operation: all wells operating under vacuum with low vapor extraction rates (1.5 SCFM per well, 23 SCFM total);
- Mode 2—Vent Operation: 10 wells operating under vacuum; five wells used as vent wells (open to the atmosphere), with higher vapor extraction rates for the wells under vacuum (up to 6 SCFM per well, 60 SCFM total).

The effective treatment area under standard operation mode is approximately 19,000 square feet (i.e., the area within the ROIs shown on Drawing C-5, Appendix A). Under vent mode operation, the effective treatment area will encompass up to 22,000 square feet (i.e., the entire SVE target area shown on Drawing C-4, Appendix A). The targeted remediation volume varies from approximately 8,000 to 17,000 cubic feet, based on the seasonal fluctuation in the water table. A total system flow rate of 23 SCFM (1.5 SCFM average for each of the 15 SVE wells) provides sufficient air exchange to effectively remove VOCs from the target area in approximately 1–2 years (i.e., 1,000 to 1,500 total air exchanges recommended by USACE [2002], see Table 5). Under standard operations, the flow rate of 1.5 SCFM per well will yield an ROI of about 20 feet and provide an average pore gas velocity of 17–29 feet per day, which is at the upper end of the range of 3 to 30 feet per day recommended by the USACE (2002) (Table 5).

Under vent mode operation, it is expected that the flow rate could be as high as 6 SCFM per well, with the SVE drawing soil gas from a distance extending more than 90 feet from the well. The total system flow rate under vent mode would be approximately 60 SCFM (five vent wells, with an average flow of 6 SCFM for the remaining 10 SVE wells). This flow rate would provide sufficient air exchanges to effectively remove VOCs from the entire SVE target area in less than 1 year (Table 5). Under vent mode operations, the average pore gas velocity in this area would be in the range of 17-31 feet per day, which is at the upper end of the USACE recommended range (3 to 30 feet per day, Table 5).

Potential emissions rates of VOCs were estimated (Table 7) based on the total estimated mass of VOCs present in the soil and groundwater in the SVE target area. It was conservatively assumed that the entire VOC mass in the SVE target area would be removed in a single calendar year. Soil data from the CAP and groundwater monitoring data from the late 1990s through 2013 were used to estimate total VOC mass in the SVE target area. Actual emissions will be monitored after SVE system startup and during operations. As noted above, pre-startup testing will be done to assess extraction well ROI; this testing will include system checks to confirm proper operation of system components prior to startup. Emissions startup testing will be performed as described in Appendix J after initial startup of the complete SVE system.

The three SVE manifolds include the following for each well: rotameters to measure flow, vacuum gauges, gate valves for control of air flow, and sampling ports. In order to support the two modes of operation, the SVE manifolds include gate valves for each SVE well. These gate valves enable the line to the blower to be closed and a line to the atmosphere to be opened, allowing air to flow into the well (Drawing P-2, Appendix A).

To reduce the potential for short-circuiting of the SVE wells to the bedding beneath the pavement and, potentially, to the atmosphere, joints and cracks in new pavement above trenching and within existing concrete and asphalt paving above the SVE target area will be sealed by application of hot applied sealant (ASTM D6690 – 12 or equivalent method).

7.3.2 Soil Vapor Extraction and Treatment Units

The SVE units for both systems will be installed within trailers; this equipment will include a knockout tank, blower, and controls. The vapor treatment units and stacks will be located outside and adjacent to the trailers. Boeing currently owns two SVE trailers that will be available for use at these two sites and plans to re-use the existing equipment to the extent appropriate for conducting SVE at SWMU-172/174 and the Building 4-78/79 SWMU/AOC Group. Modifications will be made to existing equipment so that the units to be installed for these sites meet design and performance requirements.

7.3.2.1 SWMU-172/174

One of Boeing's existing SVE trailers is equipped appropriately for implementing SVE at SWMU-172/174, with the modifications described below. The existing system is a self-contained SVE unit designed to operate automatically, and is expected to require operator inspection on a weekly or biweekly basis. As experience is gained regarding the rate of water accumulation in the knockout tank and actual COC concentrations in soil gas are measured, the inspection frequency may be modified. A process and instrumentation diagram (P&ID) for this system is shown in Drawing P-1 (Appendix A). The unit will be located as shown on Drawing C-2 (Appendix A). The trailer is equipped with an electrical panel that will require a minimum service of 240 volt, single-phase power rated for 50 amps.

Power will be provided by Boeing from Building 5-09. Alarms will be displayed locally on the motor and controls or programmable logic controller (PLC) panel.

A knockout tank is included in the system to separate entrained liquids from the soil gas before the gas enters the blower. The knockout tank has a visual level indicator and a transfer pump controlled by high- and low-level float switches. The transfer pump will automatically pump condensate from the knockout tank to a storage tank located next to the SVE trailer. The condensate storage tank will be used for temporary storage of liquids collected by the knockout tank. The liquids in the condensate storage tank will be containerized and characterized for disposal on an as-needed basis. Characterized waste may be disposed of off site or treated with industrial wastewater produced by Facility operations. The condensate storage tank includes a high-level float switch that will be connected to the system controls to trigger an automatic shutdown of the transfer pump and blower in the event either the storage tank or knockout tank becomes full. The automatic shutdown will protect the blower and prevent overflow of the condensate storage tank.

The blower in Boeing's existing SVE trailer is a 7.5-horsepower (HP) Kaeser Omega positive displacement blower (Model BB23) capable of 160 SCFM at 175 inches water column vacuum. This capacity is in excess of the design flow of 30 SCFM. The blower head will be replaced with a Kaeser Omega positive displacement blower (Model 21P) capable of 104 SCFM at 150 inches water column vacuum. The used Model BB23 blower head will be used for the Building 4-78/79 SWMU/AOC Group SVE system, as described below. The blower will be configured with a variable-frequency drive (VFD) and different sized pulleys to provide from 31 to 104 SCFM. For minor adjustments in flow, the VFD will be manually adjusted at the control panel. For large adjustments to flow, the pulley will be switched out with a different size based on the direction of flow adjustment.

Blower flow control will be used to achieve the design total soil gas extraction rate of 30 SCFM and the flow rate required for proper operation of the emission control units. The variable flow will allow the SVE extraction rate to be adjusted to modify the ROI achieved by the three SVE recovery wells and thereby provide adequate coverage in the target zone. Instrumentation includes temperature, flow, and pressure indicators (Drawing P-1, Appendix A). The control panel includes logging of blower run time via a run-time meter. A vacuum relief valve is included to prevent deadheading of the blower. Automatic shutdown of the blower will occur if the knockout tank or condensate storage tanks fills or in the event of blower motor failure (overheating, high amperage draw, etc).

The blower will discharge vapors to a series of two vapor treatment units run in a lead-lag configuration. Each vapor treatment unit will include a minimum of 200 pounds each of granular activated carbon (GAC) and zeolite impregnated with potassium permanganate (KMN 2000). For each vapor treatment unit, the GAC and KMN 2000 may be in two separate vessels or combined within a single vessel; the complete vapor treatment train will consist of two to four adsorber vessels so that two, redundant, vapor treatment units will be in use. The treatment media are most effective at flow velocities of 40 to 60 feet per minute (fpm), but 20 to 80 fpm is the typical operating range recommended by the vendor, Evoqua. In order to reach a minimum of 20 fpm, a total flow rate of 60 SCFM is required. The extraction flow rate of 30 SCFM will be supplemented with dilution air to provide a minimum flow of 60 SCFM to the treatment media units. The air dilution valve is located prior to the blower, as shown on Drawing P-1, Appendix A. The number, media type, and sizing of treatment units may be adjusted if necessary based on initial soil vapor measurements during system installation or startup. If modifications to the vapor treatment system are necessary, Boeing will notify Ecology of the changes and the reason for the changes and will implement the changes after Ecology approval.

7.3.2.2 Building 4-78/79 SWMU/AOC Group

A second Boeing-owned SVE trailer will be used to implement SVE for the Building 4-78/79 SWMU/AOC Group. This trailer is fully equipped with a blower, knockout tank, instruments, and controls. Modifications, as described below, will be made to adapt the existing equipment to meet the design requirements for this site. The existing SVE system is a self-contained unit designed to operate automatically, with operator inspection on a weekly or biweekly basis. As experience accrues regarding the rate of water accumulation in the knockout tank, and as actual COC concentrations in the soil gas are measured, the inspection frequency may be modified. The P&ID illustrating general specifications for piping and instrumentation is included in Drawing P-2 (Appendix A). The trailer will require a minimum electrical service of 240 volt, three-phase power rated for 50 amps. Power for the SVE trailer will be provided by Boeing from Building 4-79, which is adjacent to the trailer location (Drawing C-5, Appendix A).

A knockout tank is included in the system to separate entrained liquids from the soil gas before the gas enters the blower. The knockout tank has a visual level indicator and a transfer pump controlled by high- and low-level float switches. The transfer pump will automatically pump condensate to a storage tank next to the SVE trailer. The condensate storage tank will accumulate liquids for temporary storage. Liquids collected in the tank will be characterized and disposed in accordance with applicable regulations on an as-needed basis. The condensate storage tank includes a high-level float switch that will be connected to system controls to trigger an automatic shutdown of the condensate transfer pump and SVE blower to protect the blower and to prevent overflow of the condensate tank. The P&ID is shown on Drawing P-2 (Appendix A).

The existing 7.5 HP Kaeser Omega blower in the trailer will be retrofitted with the blower head removed from the blower unit in the SVE trailer that will be installed for SWMU-172/174 (Model BB23). With this replacement blower head, the unit will be capable of 159 SCFM at 150 inches water column vacuum. The blower will also be configured with a VFD and different sized pulleys to provide a range of flows from 31 to 159 SCFM. For minor adjustments in flow, the VFD can be manually adjusted. For large adjustments to flow, the pulley will be replaced with a different size.

Dilution air will be used as required to control soil vapor extraction rates and wellhead vacuum for the SVE wells. Dilution air will ensure proper air flow through the blower. The air dilution valve is located prior to the blower, as shown on Drawing P-2 (Appendix A). The unit will be able to provide the design soil gas extraction flow rates ranging from 23 to 60 SCFM with the addition of dilution air, based on the capacity of the blower. System instrumentation includes temperature, flow, and pressure indicators (Drawing P-2, Appendix A). A run-time meter will be used to log blower run time. A vacuum relief valve on the knockout tank is included to prevent deadheading of the blower. Automatic shutdown of the blower will occur if the knockout tank fills, the condensate storage tank fills, or if the blower motor fails (overheating, high amperage draw, etc).

The blower will discharge vapors to a series of two vapor treatment units run in a lead-lag configuration. Each vapor treatment unit will include a minimum of 200 pounds each of GAC and KMN 2000. For each vapor treatment unit, the GAC and KMN 2000 may be in two separate vessels or combined within a single vessel, as described above for SWMU-172/174. The extracted soil gas will be diluted with air to provide a minimum flow of 60 SCFM to the treatment media units; dilution air is needed to achieve the target velocity through the adsorber units. The adsorber units were sized to achieve a reasonable run time between media change-out. The air dilution valve is located prior to the blower, as shown on Drawing P-2. The number, media type, and sizing of treatment units may be modified as appropriate based on soil vapor analyses during system startup. If modifications to the vapor treatment system are necessary, Boeing will notify Ecology of the changes and the reason for the changes and will implement the changes after Ecology approval.

7.4 CONSTRUCTION PLAN

The scope of construction addressed by this plan includes installation of the SVE systems at SWMU-172/174 and the Building 4-78/79 SWMU/AOC Group. This work will include installation of soil vapor extraction wells, collection piping, manifolds, treatment units, and SVE trailers. Construction operations for other components of the remedies for these two sites is limited to drilling of monitoring wells and bioremediation injection wells, as discussed in Sections 5.3 and 6.4, respectively.

7.4.1 Permitting and Stormwater Management

Less than 1 acre will be disturbed during construction, so a construction stormwater permit will not be required. The Facility currently holds a National Pollutant Discharge Elimination System (NPDES) permit, which covers stormwater discharges. Stormwater erosion and sediment controls will be applied during construction activities in accordance with the existing NPDES permit and local regulatory agency requirements.

The Facility holds an operating permit with the Puget Sound Clean Air Agency (PSCAA) (Appendix I). Installation and operation of the two SVE units will be done in accordance with the Facility operating permit. No well construction notifications (start cards) are required for installation of the SVE wells at either SWMU-172/174 or the Building 4-78/79 SWMU/AOC Group. In accordance with WAC 173-162-050, a licensed well driller will install the vertical SVE wells at SWMU-172/174, and installation of the horizontal SVE wells at the Building 4-78/79 SWMU/AOC Group will be done under the supervision of a registered professional engineer licensed in Washington. Well reports for all SVE wells will be filed with Ecology, and a well tag will be installed on each SVE well. The well installation will be documented in accordance with WAC 173-160 using Ecology’s required format. This documentation will be provided to Ecology within 30 days of well installation.

7.4.2 Preconstruction Activities

The cleanup action will include the following preconstruction activities:

- **Design and Construction Planning** – The individual components of the cleanup action and design criteria are described in this EDR. The specific design details and construction drawings are included in Appendix A. O&M requirements for the SVE systems are summarized in Section 7.5. The health and safety plan for the project is provided as Appendix E.

- **Construction Management and Administration** – Construction management and administrative activities required to plan and execute the cleanup action include project management and field supervision (including construction quality assurance), administration and office support, scheduling and coordination with Facility operations, contracting and procurement, site security and emergency services, procuring and maintaining health and safety supplies, establishing temporary construction facilities (field office, equipment, supplies, etc.), and procuring temporary utilities. Boeing will conduct the bidding process and manage contractors. AMEC and/or CALIBRE will be the Engineer for the construction work, responsible for reviewing completed work for compliance with the plans and specifications and approving contractor submittals as requested by Boeing.

- **Preconstruction Conference and Coordination Meetings** – Coordination meetings among Boeing, AMEC, CALIBRE, and subcontractors will occur as required for preconstruction and construction planning during the preconstruction period and during construction. These meetings will address health and safety issues, ongoing construction activities, schedules, field modifications of design or construction requirements, and contractor quality assurance and control activities. Ecology will be provided construction updates in the bimonthly status reports.

7.4.3 Construction Activities

Construction for the SVE cleanup action at both SWMU-172/174 and the Building 4-78/79 SWMU/AOC Group will be performed as a single construction project; multiple specialty contractors may be used for the different construction tasks or a single general contract may be issued, at the discretion of Boeing. This work will be carried out as a series of discrete activities. Construction work performed at these two areas must be coordinated with Facility operations carried on routinely at the plant to avoid adversely affecting plant activities and to maintain the safety of plant and construction workers. Boeing will schedule and manage cleanup action construction activities to achieve these objectives. Construction related to the SVE systems must also be coordinated with installation of wells for groundwater monitoring and for bioremediation.

The following major construction activities are planned for SWMU-172/174 and the Building 4-78/79 SWMU/AOC Group:

- Mobilization and site preparation
- Demolition of existing structures (as necessary)
- Saw cutting of asphalt and concrete
- Trenching and installation of below-grade SVE pipe, horizontal SVE wells, and well vaults
- Vertical SVE well installation
- Restoration/capping
- Sealing of cracks/joints in asphalt and concrete in SVE target areas
- Above-grade SVE pipe and manifold installation
- Installation of electrical service (to be done by Boeing)
- SVE trailer modifications and installation
- SVE vapor treatment unit setup
- Waste handling, transportation, and disposal
- Demobilization

The SVE system components will be installed in active areas of the Facility. Whenever possible, work will be performed during Facility production downtime or during periods of low production activity; work must be scheduled to minimize adverse effects on Facility production activities.

7.4.3.1 Mobilization and Site Preparation

After selecting the remediation contractor(s) and receiving approval from Boeing Facility staff to proceed, the personnel, materials, and equipment needed for construction will be mobilized to the construction sites. No construction work will begin until all applicable permits and agency approvals have been received. Appropriate areas will be designated for contractor staging for each construction area. All equipment and material that cannot be left within the work area will be staged or stored in the designated staging area.

Boeing will clear all work areas and ensure access is available for construction related to the cleanup actions. A defined work schedule will be established to ensure the work can be performed while Facility operations are maintained. Work that must be performed in high-traffic areas will be identified ahead of time, and a traffic control and coordination plan will be developed to allow for safe completion of work with minimal disturbances to Facility traffic. Prior to initiating any work that disturbs existing walls or roofing of buildings (such as placement of piping on existing buildings), the affected wall or roof areas will be evaluated for the presence of lead and asbestos. If lead paint or asbestos is identified, the affected material will be managed as detailed in Section 7.4.3.7.

All locations for trenching or well installation will be located using a hand-held global positioning system (GPS) unit or by measurement from existing structures and then marked in the field. Trenching setup will include, as appropriate, establishing temporary facilities, setting up temporary fencing, and installing temporary erosion and sediment control (TE&SC) measures.

Subsurface utilities will be identified prior to the start of excavation and drilling. The utilities underground location center (1-800-424-5555) will be contacted, and a private utility locate will be conducted within the work areas and extending at least 20 feet beyond the areas designated for excavation or drilling, where possible. The location and depth to any utilities identified or suspected within areas to be excavated or drilled will be confirmed by hand-excavation at appropriate locations. Based on the location, size, and nature of the utilities found, the remediation subcontractor will determine whether to work around the line or temporarily reroute the utility line. In areas where pavement markings (such as parking space designations or roadway markings) may be disturbed by cleanup action construction activities (e.g., trenching, sealing, or other activities that disturb the surface cover), the markings will be photographed and measured. The pavement markings will be replaced to their original configuration after construction is complete.

7.4.3.2 Demolition

Demolition needed for system installation at the Building 4-78/79 SWMU/AOC Group will occur prior to installation of the SVE system. The groundwater treatment system remaining from the interim measure that was implemented at the Building 4-78/79 SWMU/AOC Group is located near the southwest corner of Building 4-79. This groundwater treatment system includes controls, an air stripper and blower, a below-grade lift station, a concrete secondary containment pad, a storage area for treatment chemicals and other materials, and roofing. The existing groundwater treatment system in this area will be removed to allow installation of the SVE system at this location; the SVE trailer and vapor treatment units will be placed in the same location that was used for the groundwater treatment unit. Demolition of the water treatment system will be accomplished in the following steps:

1. Boeing will disconnect power to the existing electrical panel that powers the air stripper and lift station.
2. All chemicals presently in the storage area will be characterized for disposal in an off-site disposal facility.
3. The building walls and awnings will be checked for lead paint and asbestos. If lead paint or asbestos is found, the lead paint and/or asbestos will be removed prior to commencing demolition and the work will be completed in accordance with applicable state and federal regulations.
4. The air stripper, blower, pumps, lift station, and any associated electrical equipment not needed for the SVE system will be removed and transported to a recycling or disposal facility or will be retained by Boeing for other remediation projects.
5. Piping entering the lift station will be cut and capped.
6. Metal covers on the lift station will be removed, and pumps/exposed piping in the lift station will be removed.
7. The lift station will be filled to grade with concrete, or the station will be removed entirely and the excavation backfilled with clean fill, as determined by Boeing facilities engineering.
8. The concrete containment area will either be removed or filled and extended to create a pad for the SVE trailer.
9. The awning and any existing bollards affecting placement of the SVE trailer at this location will be removed for disposal.

7.4.3.3 Saw Cutting

Saw cutting of surface pavement within the areas cleared for underground utilities will be performed prior to trenching and SVE well vault installation. Saw cutting will be performed with water spray to minimize dust generation. Controls will be put in place to prevent saw cutting water from reaching stormwater drains.

7.4.3.4 Below-Grade SVE Pipe Installation

Trenching and underground pipe installation will be done after saw cutting has been completed. The saw-cut pavement will be removed prior to trench excavation; removed pavement will be transported to a recycling or disposal facility. Trenching and pipe installation have the greatest potential to adversely affect Facility production operations. Therefore, this portion of the work must be carefully coordinated with Boeing facilities staff so that Facility production work can be maintained during construction activities. It is expected that work in high traffic areas will be scheduled to occur during periods of reduced Facility activities in the remediation construction areas. It is also expected that provisions to facilitate normal traffic, such as using traffic plates to allow vehicles to cross trenches, will be incorporated into the work plan.

The trenches and vault areas will be excavated to an approximate depth of 2 feet bgs (unless noted otherwise). Trenching and piping layouts and details are provided on Drawings C-2 through C-7, Appendix A. The excavated soil will be placed along the trench on plastic sheeting and then covered with plastic sheeting. Excavated soils will be sampled and analyzed for the soil COCs listed in Table 2 applicable to the work area; sampling and analysis will be performed in accordance with the Compliance Monitoring Plan (Appendix D). Excavated soils will be disposed as described in Section 7.4.3.10. Soil sampling in advance of trench excavation work may be completed to avoid stockpiling of soil near excavation trenches.

For SWMU-172/174, the piping, trenches, and wellhead vaults will be installed prior to installation of the vertical SVE wells. The subgrade piping for this area will be 1-inch-diameter, Schedule 40 PVC, placed so that it slopes back to the well head (Drawing C-3, Appendix A). Imported granular fill will be used as pipe bedding (Drawing C-3, Appendix A), with clean excavated soils or clean backfill used to fill the trench. Backfill will be placed in lifts no more than 6 inches thick. The backfill will be compacted to a moderate density using a vibrating plate. The interior of the vertical SVE wellhead vaults will measure approximately 2 feet by 2 feet and extend to a depth of 2 feet. SVE piping will be installed at an approximate depth of 1.5 feet bgs (refer to Drawing C-3 in Appendix A for buried piping installation details).

Prior to backfill, the piping will be pressure tested to verify that leaks are not present. Pressure testing will require that the piping maintains a pressure of 5 pounds per square inch (psi) for a period of 1 hour with no more than 5 percent decrease in pressure. After Boeing approves pressure testing results, the pipes can be covered and the trenches backfilled. Trace wires will be laid on top of the pipe bedding to facilitate location of buried piping in the future. The trench will then be backfilled with 5/8-inch minus crushed rock from 12 to 6 inches bgs and compacted to a firm density by vibrating plate in 6-inch lifts. The remaining 6 inches to grade will be covered with a combination of base course and asphalt or concrete pavement, to match existing surfaces.

For the Building 4-78/79 SWMU/AOC Group, the buried piping will be 1- to 3-inch-diameter, SDR 11 HDPE pipe placed such that it slopes back to the horizontal well or to the base of the SVE manifold (Drawing C-7, Appendix A). Piping is sloped so that condensate in the piping will flow either back to the wells where the water would return to the subsurface or toward the manifolds where accumulated water can be manually pumped out. Imported granular fill will be used as pipe bedding. The backfill will be placed in lifts no more than 6 inches thick and then compacted to a moderate density using a vibrating plate compactor. SVE piping will be installed at an approximate depth of 1.5 feet bgs (refer to Drawings C-5 through C-7 in Appendix A).

Prior to placing any backfill, the piping will be pressure tested (as described above for SWMU-172/174) to verify that leaks are not present. After Boeing approves pressure testing results, the trenches will be backfilled. Trace wires will be laid directly above the pipe to facilitate location of buried piping in the future. The trench will then be backfilled with 5/8-inch minus crushed rock from 12 to 6 inches bgs and compacted to a firm density using a vibrating plate compactor. The remaining 6 inches to grade will be paved with a combination of base course and asphalt or concrete, to match the existing surface.

The SVE piping crosses a high-traffic road in one location at the Building 4-78/79 SWMU/AOC Group (near PP188; Drawing C-5, Appendix A). A traffic control plan will be completed per Boeing requirements for this road crossing prior to the start of trenching in this area. This work will be carefully coordinated with Boeing Facility personnel to minimize adverse impacts on Facility operations.

7.4.3.5 SVE Well Installation

The vertical SVE wells at SWMU-172/174 will be installed by a driller licensed in Washington State and working under the direct supervision of a Washington licensed geologist to verify correct screen placement and construction standards, and to document constructed features of the wells. SVE well specifications for SWMU-172/174 are presented on Drawing C-3 (Appendix A). The piping trenches and wellhead vaults for SWMU-172/174 will be installed prior to drilling and installation of the vertical SVE wells. To expedite vertical SVE well installations, borehole lithology will not be logged. The installation includes three 4-inch-diameter SVE wells at SWMU-172/174 (Drawing C-2). The 4-inch-diameter PVC SVE wells will be installed using a hollow-stem auger drill rig. To install the SVE wells, approximately 16-inch-diameter holes will be bored through the bottom of the previously installed concrete vault. The boreholes will be drilled through these holes, and the wells will be installed in accordance with Drawing C-3 (Appendix A). A heavy-traffic-rated vault will be installed to match existing grade for each SVE well.

A licensed driller will not be necessary for horizontal SVE well installation at the Building 4-78/79 SWMU/AOC Group, as these wells will be installed under the supervision of a Washington State licensed professional engineer, as allowed under WAC-340-162-050. Horizontal SVE wells will be laid in trenching in a manner similar to laying collection piping and completed in accordance with the specifications presented in Drawings C-6 and C-7 in Appendix A. Trace wires will be placed immediately above the horizontal wells, as shown on Drawing C-6 (Appendix A). Backfill and surface restoration will be done following the general procedures described in Section 7.4.3.4 for piping and in Section 7.4.3.6, and following the detailed specifications illustrated on Drawings C-6 and C-7 (Appendix A).

Drill cuttings and soils generated during drilling and trenching for the SVE wells will be containerized or stockpiled on bermed pads covered with plastic. Should any stormwater come in contact with drill cuttings or excavated trench soils, it will be collected and containerized for treatment prior to discharge to the King County publicly owned treatment works.

7.4.3.6 Site Restoration and Surface Cover

All disturbed areas will be restored to the original grade and final surface cover to match the existing finish (asphalt or concrete pavement plus all surface marking restored to pre-construction condition). Pavement and bedding placed over trenching will be placed in accordance with Drawings C-3, C-6, and C-7. Joints in the existing concrete/pavement will be sealed with asphalt sealant in accordance with ASTM D6690 – 12 or equivalent. Cracks within the SVE target area (Drawings C-2 and C-4, Appendix A) will also be sealed in accordance with this standard. Concrete placed over trenches will be rated for high strength and will match the existing thickness.

Work in each area, including placement of final surface cover, will be completed prior to removing any temporary fencing and erosion control measures and returning the area to Boeing for normal operations. Pavement marking will be restored to match previously existing conditions.

7.4.3.7 Above-Grade SVE Pipe Installation

Above-grade SVE piping will be Schedule 40 or Schedule 80 PVC and will be mounted on buildings using uni-strut fasteners (or equivalent, as approved by Boeing). The locations on building walls and roofs where piping or other equipment will be mounted will be surveyed for the presence of asbestos and lead paint prior to disturbing the surfaces. If lead paint or asbestos is found, Boeing will remove the lead paint and/or asbestos in accordance with WAC 296-155-176 and/or WAC 296-65 prior to pipe installation. Wastes generated as a result of asbestos or lead removal will be characterized and disposed of in accordance with applicable state and federal regulations. Piping will be supported every 4 feet per manufacturer’s specifications so that no sagging or low spots are present in pipe runs (Drawings C-3 and C-7, Appendix A). Piping will be sloped to drain condensate back to the SVE wells or manifolds, as shown on Drawings C-3 and C-7 (Appendix A). Above-grade piping segments will be glued together.

All SVE manifolds will be constructed of glued Schedule 80 PVC. SVE piping will be constructed of Schedule 40 PVC, Schedule 80 PVC, and SDR 11 HDPE, as noted on the drawings. Given the relatively limited time frame expected for SVE operation, aboveground PVC piping will not be painted for UV protection. The SVE stacks will be placed in close proximity to the SVE trailers and mounted to the building and roof (Building 5-09 and Building 4-79), as appropriate. The SVE stacks will extend a minimum of 2 feet above the edge of the roof.

7.4.3.8 SVE Blower and Housing Installation

SVE blowers for both SWMU-172/174 and the Building 4-78/79 SWMU/AOC Group will be mounted inside weatherproof trailers dedicated to each site. A single electrical connection is required for the blower and associated pumps and controls. Boeing will provide power and connection to the trailers.

Air dilution valves and blower intakes may require noise reduction measures if excessive noise is produced after startup, as determined by Boeing. Mufflers or housings will be installed as necessary to mitigate any excess noise created by the SVE system.

7.4.3.9 SVE Vapor Treatment Units

For both SVE sites, the vapor treatment units will be placed next to the trailer to allow easy connection to the SVE stack. The SVE stack will be placed within 5 feet of the emission control vessels and mounted to the building and roof (Building 4-79 and Building 5-09), as appropriate. The stack will extend a minimum of 2 feet above the edge of the roof.

7.4.3.10 Waste Handling, Transportation, and Disposal

Wastes generated during and after SVE system installation will be characterized, stored, transported, and disposed at an off-site, permitted facility in accordance with established Boeing waste management procedures. The wastes will be managed in accordance with the requirements of applicable state and/or federal laws and regulations.

It is anticipated that the cleanup action will generate the following wastes:

- Miscellaneous wastes associated with temporary construction;
- Demolition wastes:
  - Used electrical equipment,
  - Used treatment equipment,
  - Excess treatment chemicals,
  - Structure demolition wastes:

        - Concrete,
        - Asphalt,
        - Scrap metals;
    - Excavation spoils:
        - Contaminated material from trenching for belowground piping installation,
        - Excess soils from trenching for belowground piping installation,
        - Soil cuttings from borings for the well installations;
- Groundwater from dewatering and/or well development activities, potentially contaminated stormwater, and decontamination fluids;
- Used personal protective equipment; and
- Used oils, lubricants, hydraulic fluids, and coolants from heavy equipment operations and maintenance, including residuals from cleanup of any spilled materials.

Wastes generated during construction will be placed within appropriate containers and will be labeled and stored in designated temporary storage areas prior to off-site disposal. Soil and/or groundwater from the construction work that will be disposed will be characterized in accordance with applicable regulations prior to disposal. Excavated soil will not be reused and will be managed in accordance with Washington State Dangerous Waste requirements. Boeing may request a contained-in determination from Ecology for chlorinated solvent-containing soil excavated at SWMU-172/174 or at the Building 4-78/79 SWMU/AOC Group.

7.4.3.11 Demobilization and Site Restoration

Personnel, equipment, unused materials and supplies, and temporary construction facilities will be removed upon completion of construction activities. After construction activities are completed at each area, construction stormwater best management practices and temporary fencing/barricades will be removed and the work area cleaned and returned to Boeing for use. Final decontamination of excavation and/or drilling equipment will be performed before the equipment leaves the Facility.

7.4.4 Construction Quality Assurance and Quality Control

Construction quality assurance (QA) and quality control (QC) for the different components of the cleanup action will be carried out so that SVE construction is completed in accordance with the plans and specifications presented in this document and accompanying appendices. This section specifies the protocols to be followed for QA/QC during construction of the SVE systems.

7.4.4.1 Roles and Responsibilities

The roles and responsibilities for each party completing construction are described below.

> **Contractor.** The contractors retained by Boeing for completing this work are responsible for completing their scope of work safely, in full accordance with the plans and specifications presented in the EDR, and in accordance with Boeing's standard requirements for contractors working within their plant sites. The contractors will be required to provide complete written submittals for equipment and materials purchased for installation and to obtain approval by Boeing prior to placement or installation of any equipment or materials. The contractors are responsible for correcting any deficiencies noted by Boeing so that the finished work meets the plans and specifications included in this EDR. The contractors are responsible for the health and safety of their workers, for ensuring that workers excavating within these areas are trained in accordance with hazardous waste operations and emergency response (HAZWOPER) requirements (29 CFR 1910), for preparing a site-specific Health and Safety Plan covering their work and their workers, and for conforming to applicable regulations issued by the Washington Department of Labor and Industries and the federal Occupational Safety and Health Administration.
>
> **Construction Manager.** Boeing will be the Construction Manager for construction of the cleanup action remedies described in this EDR. Boeing will be responsible for completing the work in accordance with the EDR, for scheduling the work so that it can be done safely and with minimal impact on Boeing Facility operations, for providing safe access to work areas, and for providing direct oversight of contractor work. Boeing will be responsible for providing final approval of all contractor submittals and for final acceptance of contractor work. Boeing will ensure that QA/QC testing described in this EDR is completed by the contractor and that results meet plans and specifications. Boeing will also be responsible for providing electrical power as required for cleanup action equipment and for proper disposal of wastes generated from the work.
>
> **The Engineer.** AMEC will be the Engineer for the cleanup action construction work and will provide services to Boeing as requested. Licensed geologists and/or professional engineers required for oversight of well installation and/or for review of specific construction elements, as requested by Boeing, will be provided by AMEC or CALIBRE. The Engineer will review results from QA/QC testing specified in the EDR. The Engineer will be responsible for addressing any questions that arise regarding the plans and specifications. The Engineer will also participate in the commissioning of the two SVE systems and in preparing the Completion Report after construction has been completed.

SVE system construction installation will be performed under the supervision of the Boeing Construction Manager. Daily field inspection reports will be prepared by the Construction Manager or his designee. The Construction Manager may request the Engineer to provide oversight of specific activities, such as pressure testing of piping or observation of soil compaction. Weekly progress conference calls or on-site meetings will be conducted among the Construction Manager, Contractor, and Engineer to review the project and schedule status, resolve any issues, and discuss any design changes or corrective action that may be needed.

The Construction Manager, his designee, or the Engineer will field verify depths of trenching and subsurface installations with a tape measure. Once the trenching is completed, the target depth of trenches will be checked by the Contractor to ensure target grades and slopes are achieved. The method used to check grades and slopes will be reviewed and accepted by the Engineer. The Contractor will complete piping installation, pipe bedding, grading, and surface finishes to the satisfaction of the Construction Manager. A final record survey of the site will be conducted by a professional land surveyor licensed in the State of Washington.

7.4.4.2 Quality Assurance and Quality Controls during Construction

Activities for SVE system installation will be checked daily for quality assurance by the Construction Manager. All aspects of construction will be inspected and documented daily in field logs and photographed as needed. Material and installations will be inspected to verify that construction meets the minimum design requirements as noted on the project plans and specifications. The elements to be checked will include, but are not limited to, the materials or equipment used and the depth and/or elevation of installations. Pipe bedding compaction techniques will be checked against the specifications (maximum 6-inch lifts compacted by vibrating plate) as bedding is occurring. The piping, fittings, elbows, and instrumentation will be inspected to verify compliance with design specifications. In particular, SVE manifolds must be placed to allow for easy access to all sections of piping for future operations and maintenance requirements. The inspections will include evaluations to document that installations have been completed in accordance with manufacturers’ recommendations.

The Contractor shall perform a pressure test on the newly installed SVE piping to ensure the integrity of the system piping and joints. Testing shall be performed as described in Chapter VI, Section 345.7 (Initial Service Leak Test) of the ASME Pressure Piping Code B31.3, unless modified below. Pipe runs shall be sealed with blind flanges at the terminus of each individual piping segment. Air shall be used to test the pipes. Pressure shall be increased to 5 pounds per square inch gauge (psig) for the SVE piping and shall be maintained for a minimum of 60 minutes with less than 5 percent decrease in pressure to indicate no leaks. The Contractor may use alternative pressure test methods with the prior approval of the Engineer.

The Contractor shall immediately repair any leakage identified in the newly installed system piping by pressure testing. The Contractor shall repeat the test procedure and repair any leakage until pressure test results achieve the acceptance criterion (5 psig held for 60 minutes with less than 5 percent decrease).

7.4.4.3 System Commissioning

After construction is complete, each SVE system will be commissioned to verify that it functions as designed. The systems will not be accepted as complete until commissioning has been approved by the Construction Manager. Mechanical and electrical components will be checked to verify correct installation and operation. SVE equipment, instruments, pumps, sensors, controls, and valves will be checked for proper operation. The electrical components and field instrumentation will be tested to verify that all components are functioning within design flow and vacuum/pressure ranges. System flow rates will be checked to verify that the design SVE flows are achieved for each well. The system also will be checked to ensure the proper flow conditions are achieved for the vapor treatment units. Inspections and the results of system commissioning will be documented in the Completion Report. Operations will commence after commissioning of the systems is complete.

7.5 OPERATIONS AND MAINTENANCE PLAN

This section provides a general outline for operations and maintenance of the SVE systems. The systems will be operated by CALIBRE; the trailers were built and operated by CALIBRE at the previous installations for Boeing. CALIBRE has a complete O&M Plan (Appendix J) for these systems that has been used for the two trailer units during previous operations at Boeing sites. The existing O&M Plans will be updated as appropriate to incorporate the changes described above. CALIBRE’s Forms for recording O&M data for SVE operations are presented in Appendix J.

7.5.1 SVE O&M Overview

The SVE systems for SWMU-172/174 and the Building 4-78/79 SWMU/AOC Group are designed to operate continuously and unattended with periodic on-site system checks. CALIBRE will have overall responsibility for operation of the SVE systems. During system startup, the baseline operating conditions will be determined and compared against the design, and SVE emissions will be measured and evaluated to verify that they comply with the Facility air permit. Once system startup is complete, periodic flow adjustment, inspection, monitoring, and maintenance will be required.

7.5.2 SVE O&M Procedures

CALIBRE will operate the SVE systems in accordance with equipment manufacturers’ recommendations and CALIBRE’s existing O&M Plan (Appendix J). The O&M Plan will be updated as appropriate as operating experience is accrued at the two Renton sites.

Monitoring of the soil vapor extraction wells will be performed to establish proper soil vapor extraction rates needed to achieve cleanup objectives. The emission control system will also be monitored to assess the effectiveness of soil vapor treatment prior to discharge to the atmosphere. The planned monitoring program for the vapor treatment systems is described in the O&M Plan (Appendix J). Monitoring will include weekly sampling of untreated soil vapor entering the lead GAC/KMN 2000 vessel and treated soil vapor at the outlet from the lag GAC/KMN 2000 vessel for the first month of full operation; the untreated and treated samples will be analyzed in a laboratory, as described in the O&M Plan (Appendix J). Routine monitoring will also be performed using field instruments to track total VOCs recovered by the treatment system and to assess breakthrough of COCs in the vapor treatment system. Monitoring results will be reported to Ecology in regularly prepared progress and/or quarterly reports.

Piping will be checked weekly during the first month of operation for any vacuum loss along the pipes or water accumulation at the designed water collection points. Flows from each well will be adjusted to optimize soil vapor extraction rates without excessive water recovery. The SVE wells with the highest VOC concentrations will be targeted for operation at higher flow rates than SVE wells with lower VOC concentrations, with the overall objective of increasing overall recovery of COCs for each of the two targeted treatment areas.

Piping, valves, instruments, and equipment will be regularly inspected for proper operation and for damage. The SVE system will be inspected by an operator at least bimonthly. Inspection and maintenance activities for individual pieces of equipment will be completed at the frequency recommended by the manufacturer of the specific equipment; more frequent inspections may be made if Boeing determines that it is appropriate, based on accrued operating experience. Inspections and maintenance will be recorded in a log book dedicated to each system and on the SVE system inspection form (Appendix J). The operations log books will be initialed by the operator whenever the system is checked for operations, inspections, or maintenance, or in response to alarms. Maintenance work will include repairs to any equipment, replacement of any parts, preventative maintenance recommended by the equipment manufacturer, cleaning of treatment equipment, draining/disposal of condensate, replacement/servicing of GAC or KMN 2000 units, calibration of instruments, and other non-routine work on the SVE system. In addition, non-routine operations or changes to operating conditions will be recorded in the log book along with the responsible person’s name, the date, and the time of the change.

Process information (including flow rates, vacuums, pressures, etc.) will be collected as part of routine operations and reviewed on a regular basis to monitor system performance and assist in optimizing VOC capture and vapor treatment. The cause of each system shutdown will be recorded to assist in troubleshooting and optimizing the system.

Standard performance monitoring will include flow measurements, pressure/vacuum measurements, hours of operation, vapor sampling, and COC mass removed from the subsurface. Total air exchanges will be calculated and compared to typical air exchanges to assess SVE performance.

Vapor samples will be taken at the inlet to the lead vapor treatment unit and at the outlet from the lag vapor treatment unit (at a minimum) monthly. These samples will be submitted to an independent laboratory for analysis of the volatile COCs identified in Attachment E to the O&M Plan (Appendix J). Analytical results will be used to supplement field measurements and to track concentrations of volatile COCs in the extracted vapors, assess effectiveness of vapor treatment, and monitor compliance with the air permit.

PID readings for recovered soil gas will be taken simultaneously with collecting samples for laboratory analysis. In addition, PID readings will be taken more frequently than analytical samples are collected. The PID readings will be taken at individual SVE wells for adjustment of SVE system flow rates and vacuums at individual wells. PID readings will also be taken between the lead and lag vapor treatment units. As monitoring results become available, they will be used to adjust flows from individual wells, as well as the system as a whole. Vacuum may also be applied to individual wells on a periodic basis to assess rebound if results indicate asymptotic behavior for removal of VOCs.

The SVE system at SWMU-172/174 will be operated as a conventional SVE system, with all wells that are in service under vacuum. Due to its unique conditions (shallow water table, horizontal wells), two different modes of SVE operation were developed for the SVE system at the Building 4-78/79 SWMU/AOC Group:

- Mode 1—Standard Operations: all wells under vacuum with low vapor extraction rates (1.5 SCFM per well, 23 SCFM total);
- Mode 2–Vent Operations: Some wells under vacuum and some wells used as vent wells (open to the atmosphere) with higher vapor extraction rates for the wells under vacuum (up to 6 SCFM per well, 60 SCFM total).

During standard operation, all SVE wells that are in service will be opened to the vacuum side of the SVE blower. During vent operations, some SVE wells will be isolated from the blower suction and used as vent wells by opening them to the atmosphere. For vent mode operation, the vent well manifold valves to the blower will be closed, and the gate valves to the atmosphere will be opened to allow ambient air into the well (Drawing P-2, Appendix A). For example, to treat the areas between SVE-15, SVE-14, and SVE-13 beyond the ROI for standard operating mode, SVE-15 would be set as a vent well so that SVE-14 and SVE-13 would pull ambient air from SVE-15 through the subsurface to SVE-14 and SVE-13 (Drawings C-4 and C-5, Appendix A). Different arrangements of vent and vacuum wells under vent mode operation can be used to treat the entire SVE target area at the Building 4-78/79 SWMU/AOC Group.

It is expected that the SVE system will operate for 0.5 to 2 years for SWMU-172/174 and for 1 to 2 years for the Building 4-78/79 SWMU/AOC Group. The flow rates presented in this document are values that have been estimated for startup and design purposes. Actual flow rates will be determined in the field based on site conditions and operating performance after the SVE systems become operational.

7.6 SVE COMPLETION CRITERIA

The SVE systems at SWMU-172/174 and the Building 4-78/79 SWMU/AOC Group will be operated until monitoring results indicate that the systems have achieved the completion criteria described in this section. It has been found that SVE systems ultimately reach low, asymptotic rates of VOC removal in recovered soil gas at the end of their useful life. It is also typical to assess the potential for rebound in soil gas VOCs by temporary shutdown of the SVE system to allow soil gas to re-equilibrate with affected soil.

If monitoring results for total VOCs in recovered soil gas at either SVE system decline and approach asymptotic levels as discussed in the USACE guidance document (USACE, 2002), the SVE system will be temporarily shut down, and VOC concentrations will be evaluated to assess if rebound is occurring in the concentrations of VOCs in soil vapor. Rebound occurs as additional VOCs accumulate in soil gas during shutdown. Should rebound occur, VOC recovery rates for the SVE system would increase substantially upon restart. Assessment of whether rebound is occurring would be conducted by restarting the SVE system after a suitable shutdown period (30-90 days) and then monitoring VOC concentrations in untreated soil gas using a PID. Should the rate of mass removal following system restart after a period of rebound remain a very low percentage (less than 5 percent) of the peak mass removal rate achieved and soil sampling confirms attainment of soil cleanup levels, then Boeing may propose that the SVE system be permanently shut down.

Rebound operation will be determined based on two criteria: (1) the cumulative total VOC mass removal approaches an asymptotic level, and (2) trends in VOC concentration in extracted soil vapor approach an asymptotic level. Permanent SVE system shutdown will only occur if soil confirmation samples show that VOCs are below soil cleanup levels. SVE systems will be shut down only if approved by Ecology.

7.6.1 Rebound Operation Criteria

The SVE system will be temporarily shut down and rebound operations will be initiated if the following two conditions occur:

- The rate of VOC removal from either SVE system continues at less than 5 percent of the peak mass removal rate; and

- Trends in soil gas VOC concentrations measured over a period of at least 30 days approach an asymptotic slope, as described in USACE guidance manual (USACE, 2002).

Under rebound operations, the SVE system will be temporarily shut down for 30-90 days to allow VOC concentrations the opportunity to rebound. The SVE system will then be restarted and operated for at least 30 days. Vapor monitoring (PID readings) will be performed during rebound operations at system restart, after about 15 days, and after 30 days of rebound operation. VOC measurements will be considered to indicate a *significant rebound* in mass removal if the mass removal rate is greater than 5 percent of the peak mass removal rate measured during operations prior to the temporary shutdown (i.e., the highest influent soil gas VOC concentration measured, typically observed at initial startup). If *significant rebound* is observed, then system operation will continue until the mass removal rate drops to less than 5 percent of the peak mass removal rate. Once the mass removal rate drops to less than 5 percent of the peak mass removal rate, the system would then be shut down once again for 90 days, and rebound operations repeated. The rebound operations cycle will be repeated until the permanent shutdown criteria described in the next section are met.

7.6.2 Permanent Shutdown Criteria

The SVE systems will be shut down for soil confirmation sampling if the untreated soil gas monitoring data collected for at least 60 days after completing rebound operations indicate the following criteria have been achieved:

- A mass removal rate less than 5 percent of the peak mass removal rate for total VOCs; and
- A mass removal rate less than 5 percent of the peak mass removal rate for VC (if VC is present in the soil gas).

Following system shutdown, soil confirmation sampling will be performed in accordance with this EDR and the Compliance Monitoring Plan (Appendix D). The results for confirmation samples will be used to assess attainment of the soil cleanup levels for volatile soil COCs. After receiving the results from soil confirmation sampling, Boeing will prepare a technical memorandum documenting the results of soil sampling and attainment of the soil cleanup levels. The technical memorandum will be submitted to Ecology with a request for permanent shutdown and decommissioning of the SVE system.

7.6.3 Decommissioning Plan

Each SVE system will be decommissioned and removed from the Facility after Ecology approves the shutdown and decommissioning request for the SVE system. After receiving decommissioning approval, the SVE wells will be abandoned in accordance with WAC 173-160, and the aboveground SVE conveyance piping and manifolds will be removed. Belowground SVE conveyance piping may be abandoned in place (ends of piping will be cut below ground, capped, and covered with concrete) or removed, at Boeing's discretion. SVE controls and equipment will be disconnected from power and removed from the Facility.

7.7 AREA WEST OF BUILDING 4-70

Groundwater contaminated with chlorinated solvents and degradation products were recently detected in sampling conducted to support Facility construction activities. These results were reported to Ecology in the Duct Bank West and Southwest Marshalling Yard Additional Investigation Results (AMEC, 2014). A copy of this report is included as Appendix K. A planned bioremediation and monitoring program is included in Appendix K. The bioremediation and monitoring program included in Appendix K will be implemented in conjunction with the other remediation activities described in this EDR.

8.0 SCHEDULE AND REPORTING

The projected implementation schedule and reporting requirements for implementation of the CAP are described in this section. The implementation schedule is based on the estimated duration of work items, with work commencing when the EDR has been formally approved by Ecology. The reporting program presented below has been designed to comply with requirements of the Order and MTCA regulations for implementing cleanup actions (WAC 173-340-400).

8.1 PROJECTED IMPLEMENTATION SCHEDULE

Implementation of the CAP requires installation of two SVE systems, drilling bioremediation injection wells, and drilling groundwater monitoring wells. Nearly all of this work must be completed within active portions of the Facility. Therefore, it will be necessary to carefully coordinate the execution of CAP construction work so that it can be completed safely and without excessive impact to Facility operations. This coordination may require deviation from the schedule presented below.

The projected CAP implementation schedule is shown in Table 8. The projected schedule commences when the EDR is approved by Ecology. The estimated duration of the work items listed in the table is shown in the second column of the table; the estimated total elapsed time for completion of each work item since approval of the EDR is shown in the third column. Finalizing permits and contractor bidding are the first tasks to be completed. It has been assumed that two contracts will be issued: one contract will cover well drilling (vertical SVE wells, bioremediation wells, and monitoring wells), and the second contract will cover installation of piping, horizontal SVE wells, and equipment needed for the two SVE systems. The two contractors will be working at the Facility concurrently and must coordinate work schedules to avoid conflicts. The SVE wells will be drilled after placement of the vertical well vaults at SWMU-172/174. The drilling contractor will then proceed to drill bioremediation injection wells and the new groundwater monitoring wells described in the EDR.

As shown on Table 8, bioremediation injections should be completed prior to completing installation of the SVE systems. It is projected that commissioning and startup of the SVE systems will be completed within 1 year after Ecology approval of the EDR.

8.2 REPORTING

Reports will be prepared and issued to Ecology to document work performed for compliance with the Order and to meet MTCA regulatory requirements for the cleanup action. Reports to be prepared to document implementation of the cleanup action specified in the CAP and reports prepared on a routine basis to address reporting requirements specified in the Order are described below. Routine reporting will include progress reporting and reporting results from monitoring the cleanup actions for the SWMUs and AOCs addressed by this EDR. Additional reports not addressed in the EDR may be prepared on an as-needed basis if requested by Ecology or deemed appropriate by Boeing.

8.2.1 Completion Report

After installation of the SVE systems, bioremediation wells, and groundwater monitoring wells has been completed, a Completion Report will be prepared to meet the requirements of WAC 173-340-400(6)(b). This report will document construction of the remedy components described in this EDR. Record drawings will be included showing actual locations and installation notes for underground lines and providing specifications for equipment and piping. Well logs will be included for all wells installed for the Site remedy. Survey reports will be appended to the Completion Report. Deviations from design drawings and/or specifications will be described in the Completion Report; the rationale for deviations will also be documented. The report will describe construction techniques as appropriate and will include results of relevant tests and measurements made during remedy construction.

The Completion Report will be prepared under oversight of a Professional Engineer licensed in Washington State. The report will include an opinion by the Professional Engineer as to whether the cleanup action has been constructed in substantial compliance with the plans and specifications and related documents included in this EDR. The Professional Engineer’s opinion will be based upon observations, testing, and inspections.

8.2.2 Progress Reports

Progress reports will be prepared on a bimonthly basis, in accordance with the requirements of the Order, and submitted to Ecology via email no later than the 30th day following each two-month reporting period. The progress reports will document work completed and planned for implementing the cleanup action, and will also include all other information specified in Section VII.B of the Order. Copies of raw data received during the reporting period, including laboratory analysis reports, field logs, and chain-of-custody forms, will be included with the progress reports.

It is proposed that bimonthly progress reports be prepared and submitted to Ecology until the remedy components addressed by this EDR have been constructed and the Completion Report has been approved or accepted by Ecology. Once the Completion Report has been finalized, the work will consist primarily of maintaining the enhanced attenuation program, operating and maintaining the SVE system, and monitoring groundwater quality. At that time, it is proposed that the progress reports be combined with the quarterly Monitoring Reports described below. This approach is proposed to streamline the reporting program and to provide progress report information in the context of discussions of data and performance of the remedy components under implementation. Under this revised reporting schedule to be implemented only after the Completion Report has been finalized, progress reporting would occur four times per year rather than six times per year. Approval will be requested from Ecology prior to modifying the schedule for reporting.

8.2.3 Monitoring Reports

Monitoring reports will be prepared on a quarterly basis; each report will be submitted to Ecology no later than 45 days after the end of each calendar quarter. These reports will document results from groundwater monitoring, operation of the SVE systems, and maintenance of bioremediation systems. These reports will present groundwater quality data and discuss historical water quality trends, as appropriate. The quarterly monitoring reports will also assess attainment of the cleanup standard for each SWMU and AOC, assess the effectiveness of MNA or MA as appropriate, and assess operations and maintenance issues for the two SVE systems. Raw data and data validation reports will be appended to the quarterly monitoring reports.

As noted above, it is proposed that progress reporting be combined with quarterly monitoring reports after Ecology has approved or accepted the Completion Report. If this revised reporting schedule is approved by Ecology, the quarterly monitoring reports would be expanded to include the information currently submitted with the progress reports.

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TABLES

TABLE 1

SUMMARY OF CLEANUP ACTIONS

Boeing Renton Facility
Renton, Washington

SWMU/ AOC	Constituents of Concern		Cleanup Action
	Soil	Groundwater	
SWMU-168	Methylene chloride	Vinyl chloride	MNA and institutional controls
SWMU-172/174	Chlorinated solvents & degradation products, benzene, and three metals	Chlorinated solvents & degradation products, *bis*(2-ethylhexyl) phthalate, and four metals	SVE, enhanced bioremediation, MA, and institutional controls
Building 4-78/79 SWMU/AOC Group	PCE, TCE, and degradation products; carbon disulfide; benzene; and gasoline	TCE & degradation products, benzene, and gasoline	SVE, enhanced bioremediation, MA, MNA, and institutional controls
Former Fuel Farm	Benzene, 2-methyl-naphthalene, diesel fuel, jet fuel	Jet fuel and diesel fuel	MNA and institutional controls
AOC-001 and AOC-002	TCE & degradation products, gasoline	Benzene, chloroform, TCE & degradation products, and naphthalene	Enhanced bioremediation, MA, and institutional controls
AOC-003	TCE	PCE, TCE, & degradation compounds	Enhanced bioremediation, MA, and institutional controls
AOC-004	Acetone, benzene, ethylbenzene, toluene, and gasoline	Benzene, gasoline, and lead	Enhanced bioremediation, MA, and institutional controls
AOC-034/035	TCE degradation products	TCE degradation products	MNA and institutional controls
AOC-060	none	TCE & degradation products	Enhanced bioremediation, MA, and institutional controls
AOC-090	Chlorinated & nonchlorinated VOCs, metals, SVOCs, gasoline, diesel fuel, and motor oil	Chlorinated & nonchlorinated VOCs, gasoline, diesel fuel, and motor oil	Enhanced bioremediation, MA, and institutional controls
AOC-092	Gasoline and benzene	Gasoline and benzene	Source area excavation, enhanced bioremediation, MA, and institutional controls
AOC-093	Gasoline	Gasoline	MNA and institutional controls

Abbreviations

AOC = area of concern
MA = monitored attenuation
MNA = monitored natural attenuation
PCE = Tetrachloroethene
SVE = soil vapor extraction
SVOCs = semivolatile organic compounds
SWMU = Solid Waste Management Unit
TCE = Trichloroethene
VOCs = volatile organic compounds

TABLE 2

SOIL AND GROUNDWATER CONSTITUENTS OF CONCERN AND CLEANUP LEVELS

Boeing Renton Facility
Renton, Washington

Constituent	Soil Cleanup Level[1,2] (mg/kg)	Groundwater Cleanup Level[1,2] (µg/L)
SWMU-168		
Methylene Chloride	0.024	NA
Vinyl chloride	NA	0.11
SWMU-172/174		
Benzene	0.009	0.80
1,1-Dichloroethene	0.001	0.057
cis -1,2-Dichloroethene	0.003	0.03
Chloromethane	NA	0.5
Methylene chloride	0.024	4.6
Tetrachloroethene	0.01	0.02
Trichloroethene	0.006	0.02
Vinyl chloride	0.004	0.11
Bis(2-ethylhexyl) phthalate	NA	1.2
Arsenic	NA	1.0
Chromium, total, as Cr(III)	NA	57
Chromium, total, as Cr(VI)	NA	10
Copper	36	3.5
Lead	NA	1.0
Thallium	0.34	NA
Zinc	39.8	NA
Building 4-78/79 SWMU/AOC Group		
Benzene	19	0.80
cis -1,2-Dichloroethene	0.2	0.70
Tetrachloroethene	0.16	NA
Trichloroethene	0.1	0.23
Vinyl chloride	0.1	0.20
Carbon disulfide	11	NA
TPH-Gasoline w/benzene	30	800
Former Fuel Farm SWMU/AOC Group		
Benzene	0.012	NA
2-Methylnaphthalene	45.8	NA
TPH-Jet fuel	2,000	500
TPH-diesel	2,000	500
AOC-001/002		
Benzene	NA	0.80
1,1-Dichloroethene	NA	0.057
cis -1,2-Dichloroethene	0.01	0.02
trans -1,2-Dichloroethene	NA	24
Chloroform	NA	5.7
Trichloroethene	0.02	0.02
Vinyl chloride	0.02	0.05
Naphthalene	NA	119
TPH-Gasoline w/benzene	30	NA

TABLE 2

SOIL AND GROUNDWATER CONSTITUENTS OF CONCERN AND CLEANUP LEVELS
Boeing Renton Facility
Renton, Washington

Constituent	Soil Cleanup Level[1,2] (mg/kg)	Groundwater Cleanup Level[1,2] (µg/L)
AOC-003		
cis -1,2-Dichloroethene	NA	0.78
Tetrachloroethene	NA	0.02
Trichloroethene	0.09	0.16
Vinyl chloride	NA	0.24
AOC-004		
Acetone	3.3	NA
Benzene	9.5	5.0
Ethylbenzene	21.5	NA
Toluene	19	NA
TPH-Gasoline w/benzene	30	800
Lead	NA	1.0
AOC-034/035		
cis -1,2-Dichloroethene	0.05	0.7
Vinyl chloride	0.04	0.29
AOC-060		
cis- 1,2-Dichloroethene	NA	0.08
Trichloroethene	NA	0.02
Vinyl chloride	NA	0.26
AOC-090		
Acetone	NA	300
Benzene	0.7	0.8
Toluene	19	75
1,1-Dichloroethene	0.001	0.057
cis -1,2-Dichloroethene	0.006	2.4
trans -1,2-Dichloroethene	NA	53.9
Carbon tetrachloride	0.008	0.23
Chloroform	0.079	2.0
1,1,2-Trichloroethane	0.01	0.20
1,1,2,2-Tetrachloroethane	NA	0.17
Methylene chloride	0.027	2.0
Tetrachloroethene	0.03	0.05
Trichloroethene	0.01	0.08
Vinyl chloride	0.006	0.13
2-Methylnaphthalene	45.8	NA
Isophorone	0.1	NA
Phenanthrene	0.009	NA
TPH-Gasoline w/benzene	30	800
TPH-Diesel	2,000	500
TPH-Motor oil	2,000	500
Antimony	5.06	NA
Arsenic	7	NA
Cadmium	1	NA
Chromium(III)	1,140	NA
Chromium(VI)	3.84	NA

TABLE 2

SOIL AND GROUNDWATER CONSTITUENTS OF CONCERN AND CLEANUP LEVELS

Boeing Renton Facility
Renton, Washington

Constituent	Soil Cleanup Level^{1,2} (mg/kg)	Groundwater Cleanup Level^{1,2} (µg/L)
AOC-090 (continued)		
Copper	36	NA
Mercury	0.013	NA
Selenium	0.52	NA
Silver	13.6	NA
AOC-092		
Benzene	0.15	5.0
TPH-Gasoline w/benzene	30	800
AOC-093		
TPH-Gasoline w/o benzene	100	1,000

Notes

1. Cleanup level specified in the final CAP (AMEC, 2012).
2. An entry of NA indicates that the CAP did not specify a cleanup level for that constituent in that medium and that constituent is not a COC for that medium. For example, an entry of NA for selenium under groundwater indicates that selenium is not a COC in groundwater.

Abbreviations

µg/L = micrograms per liter
AOC = area of concern
CAP = cleanup action plan
COC = constituent of concern
mg/kg = milligrams per kilogram
SWMU = solid waste management unit
TPH = total petroleum hydrocarbons

TABLE 3

GEOCHEMICAL INDICATORS FOR MAJOR CLASSES OF CONSTITUENTS OF CONCERN

Boeing Renton Facility
Renton, Washington

Type of SWMU/AOC	Typical COCs	Primary Geochemical Indicators [1]	Secondary Geochemical Indicators [2]
Fuel-Related Hydrocarbon Sites	TPH-G, TPH-D, TPH-Jet Fuel, benzene, toluene, ethylbenzene, and xylenes	Dissolved oxygen, oxidation/reduction potential, pH, specific conductance, temperature and TOC	Sulfate, nitrate, ferrous soluble iron, soluble manganese, methane, and total alkalinity
Chlorinated Solvent-Related Sites	PCE, TCE, *cis* -1,2-DCE, VC		Sulfate, nitrate, ferrous soluble iron, soluble manganese, methane, ethane, ethene, and total alkalinity

Notes

1. All primary geochemical indicators except TOC are monitored in the field during sampling. TOC is analyzed in the laboratory following methods specified in AMEC, 2012, *Quality Assurance Project Plan* , Boeing Renton Facility, Renton, Washington: Prepared for the Boeing Company, February 2012.
   The Primary Geochemical indicators differ slightly depending on whether the site is a fuel-related site or a solvent-related site.
   At a fuel related site, TOC is not necessary; at a solvent-related site, TOC is a measure of how much electron donor remains present.
2. All secondary geochemical indicators except ferrous iron are measured in the laboratory following methods specified in AMEC, 2012, *Quality Assurance Project Plan* , Boeing Renton Facility, Renton, Washington: Prepared for the Boeing Company, February 2012. Ferrous iron is monitored in the field during sampling.
   The Secondary Geochemical indcators differ slightly depending on whether the site is a fuel-related site or a solvent-related site.
   At a fuel related site, ethene, ethane, and TOC are not necessary; at a solvent-related site, ethene, ethane, and TOC are needed.
   Ethene and ethane are by-products of anaerobic biodegradation, and TOC is a measure of how much electron donor remains present.
   Secondary geochemical indicators will be evaluated at selected monitoring wells at each location where analysis is deemed necessary. Secondary geochemical parameters will not typically be analyzed in wells were COCs are not detected.

Abbreviations

AOC = Area of Concern
COC = constituent of concern
cis -1,2-DCE = *cis* -1,2 dichloroethene
PCE = tetrachloroethene
QAPP = Quality Assurance Project Plan.
SWMU = Solid Waste Management Unit
TCE = trichloroethene
TOC = total organic carbon
TPH = total petroleum hydrocarbons
VC = vinyl chloride

TABLE 4

BIOREMEDIATION INJECTION DETAILS
Boeing Renton Facility
Renton, Washington

Area	Bioremediation Injection Wells		Amendment[1,2]	Amount per Well	Total Dose [3]	Projected Injection Schedule[4]
	New	Existing				
Electron Donor Sites						
SWMU-172 & 174	14	--	LactOil	1,000 gallons	14,000 gallons	Four injection events over a 2-year period
Building 4-78/79	16	--	LactOil	1,500 gallons	24,000 gallons	Four injection events over a 2-year period
AOC-001 & 002	--	5	LactOil	1,500 gallons	7,500 gallons	As needed, based on monitoring[5]
AOC-003	4	--	LactOil	1,500 gallons	6,000 gallons	Three events, over a 3-year period
AOC-060	--	2	LactOil	1,500 gallons	3,000 gallons	Future injection events will be based on monitoring results.
AOC-090[5]	--	10	LactOil	200 gallons	2,000 gallons	As needed, based on monitoring[5]
	--	3	Sugar	750 gallons	2,250 gallons	As needed, based on monitoring[5]
Terminal Electron Acceptor Sites						
AOC-004 [6]	2	--	ORC-A, PermeOx Plus, or Equivalent	37.5 lb Amendment + water (30 gal. solution)	75 lb Amendment + water (60 gal. solution)	As needed, based on monitoring results.
				125 gallons flush water	250 gallons flush water	
AOC-092	Mixed in excavation backfill		PermeOx Plus	N/A	500 pounds	Remediation complete
Total Number of Wells	**36**	**20**				

Notes

1. Electron donor amendments may include equivalent or alternate electron donor materials, such as emulsified vegetable oil (EVO), sodium lactate, or sugar mixtures. The dose for alternate or equivalent amendments will be modified from the tabulated values as appropriate for the amendment used. In addition, nutrients (such as nitrogen, phosphorous, yeast extracts, Vitamin B12) or water conditioning additives (pH buffers such as sodium bicarbonate, etc) may be added to enhance biodegradation depending on initial injection results.
2. For amendments for electron donor sites, LactOil is added as a mixture of 4 parts water to 1 part LactOil. Sugar is added as a 15% sugar solution by weight.
3. The dose is consistent with dosing proposed in the Work Plan for Continued Interim Actions at Boeing Renton Facility, Substrate Injections to Promote Enhanced Reductive Dechlorination (CALIBRE, 2013).
4. Future injections will be based on monitored attenuation results. Actual injection schedules may be different and may extend over a longer period.
5. Per the CALIBRE Work Plan (CALIBRE, 2013) with the addition of eight additional potential injection well locations. Total dose for lactate amount may be applied to two wells as discussed in Work Plan or to any number of the existing injection wells to meet the total dose.
6. A total mass of 75 pounds of ORC-A or equivalent will be diluted in water to a 15% solution by weight, for a total amendment solution volume of about 60 gallons. Half of this solution (30 gallons) will be pumped into each injection well and then each well will be flushed with approximately 125 gallons of water, for a total injection volume of approximately 310 gallons. The dose is consistent with dosing proposed in the AOC-092 Source Area Excavation Work Plan (AMEC 2013b).

TABLE 5

SVE PORE VELOCITY AND AIR EXCHANGE ESTIMATES

Boeing Renton Facility
Renton, Washington

Well Description (Type of operation)	Estimated ROI[1] (Standard) / Estimated Distance (Modified) (feet)	Effective Soil Porosity (%)	Minimum Vadose Zone (feet bgs)	Minimum Target Cross Sectional Area per well (square feet)	Minimum Well Flow Rate (SCFM)	Minimum Vadose Zone Pore Gas Velocity[2] (feet per day)	USACE Recommended Pore Gas Velocity[3] (feet per day)
High Water Table Conditions (winter)							
SWMU-172/174 SVE well (Standard)	40	20	7	452	10	32	3-30
Building 4-78/79 area well (Standard)	20	20	2	75	1.5	29	3-30
Building 4-78/79 area well (Vent Mode)	90	20	2	277	6	31	3-30
Low Water Table Condition (summer)							
SWMU-172/174 SVE well (Standard)	40	20	9	553	10	26	3-30
Building 4-78/79 area well (Standard)	20	20	4	126	1.5	17	3-30
Building 4-78/79 area well (Vent Mode)	90	20	4	503	6	17	3-30

Site	Expected Minimum Operation (years)	Expected Maximum Operation (years)	Total Target Area (square feet)	Target Volume (cubic feet)	Minimum System Flow Rate (SCFM)	Estimated Number of Soil Gas Exchanges[4]		USACE Recommended Soil Gas Exchanges
						Expected Minimum Operation Time	Expected Maximum Operation Time	
High Water Table Conditions (winter)								
SWMU-172/174 System	1	2	14,400	20,200	30	700	1,400	1,000-1,500
Building 4-78/79 area system (Standard)	1	2	18,840	7,500	23	1,400	2,800	1,000-1,500
Building 4-78/79 area system (Vent Mode)	0.25	0.5	21,700	8,700	60	800	1,600	1,000-1,500
Low Water Table Condition (summer)								
SWMU-172/174 System	1	2	14,400	25,900	30	500	1,100	1,000-1,500
Building 4-78/79 area system (Standard)	1	2	18,840	15,100	23	700	1,400	1,000-1,500
Building 4-78/79 area system (Vent Mode)	0.5	1	21,700	17,360	60	800	1,600	1,000-1,500

Notes

1. Estimated ROI for SWMU-172/174 is an expected minimum based on operations of SVE systems under similar subsurface conditions and flow rates.
   Estimated ROI for Building 4-78/79 area well (Standard) is based on standard horizontal well operations at a maximum of 5 SCFM per well, which will prevent excessive upwelling, based on modelling presented in **Appendix H.**
   Estimated ROI for Building 4-78/79 area well (Modified) is based on using five horizontal wells as vent wells, assuming very low pavement permeability (1%), and allowing for higher flow rates for this mode of operation.
2. Pore gas velocity calculation assumes that the pavement is 90% impermeable.
3. From USACE, 2002.
4. Air exchange calculation assumes a 90% operating factor.

Abbreviations

bgs = below ground surface
ROI = Radius of Influence
SCFM = standard cubic feet per minute
SVE = soil vapor extraction
SWMU = Solid Waste Management Unit
USACE = U.S. Army Corps of Engineers.

Table 6

ESTIMATED SVE SYSTEM VOC EMISSIONS FOR SWMU-172/174

Boeing Renton Facility
Renton, Washington

Constituent	Annual SVE Recovery and Emissions (pounds/year)[1]	Constituent	Annual SVE Recovery and Emissions (pounds/year)[1]
Hazardous Air Pollutants[2]		**Nonhazardous Air Pollutants**	
Benzene	0.781	Acetone	0.376
Carbon disulfide	0.023	Bis(2-ethylhexyl) phthalate	3.275
Chloroform	0.009	1,2-Dichloroethene (total)	1.605
1,1-Dichloroethane	0.011	Methyl ethyl ketone	0.071
1,1-Dichloroethene	0.025	Trimethylbenzene	1.446
Ethylbenzene	0.482	Butylbenzene	0.062
Methyl chloride	0.0003	Propylbenzene	0.289
Methylene chloride	0.252	sec-Butylbenzene	0.038
Styrene	0.0095	4-Isopropyltoluene	0.075
Tetrachloroethene	32.314	Isopropylbenzene	0.182
Toluene	2.056	1,1,2-Trichloro-1,2,2-trifluorethane	0.011
1,1,1-Trichloroethane	0.028	**TOTAL**	**7.4**
Trichloroethene	4.386		
Vinyl chloride	0.042	**Total Emissions**	
Xylenes	2.134	Total, HAPs	42.6
		Total, Non-HAPs	7.4
TOTAL	**42.6**	**TOTAL**	**50.0**

Notes

1. Estimated SVW recovery assumes 100% recovery of total mass of each constituent present in soil and/or groundwater. Each tabulated constituent was detected in at least one soil of groundwater sampl.
2. Hazardous air polluntants (HAPs) are as defined in 40 CFR 63 Subpart GGGGG.

Table 7

ESTIMATED SVE SYSTEM VOC EMISSIONS FOR BUILDING 4-78/79 SWMU/AOC GROUP

Boeing Renton Facility
Renton, Washington

Constituent	Annual SVE Recovery and Emissions (pounds/year)[1]	Constituent	Annual SVE Recovery and Emissions (pounds/year)[1]
Hazardous Air Pollutants[2]		**Nonhazardous Air Pollutants**	
Benzene	0.2	Acetone	0.3
Carbon disulfide	0.046	Octane	14.8
Chlorobenzene	0.009	Pentane	3.8
1,1-Dichloroethane	0.1	1,2-Dichloroethene (total)	2.3
1,1-Dichloroethene	0.002	Methyl ethyl ketone	0.1
Ethylbenzene	3.9	Trimethylbenzene	49.0
Methyl chloride	0.003	Butylbenzene	3.0
Methylene chloride	0.003	Decane	13.3
Naphthalene	16.2	Dodecane	30.0
Acetonitrile	0.002	Propylbenzene	2.4
Hexane	3.9	sec-Butylbenzene	0.0069
Vinyl acetate	0.02	4-Isopropyltoluene	0.0078
Styrene	0.01	Isopropylbenzene	0.92
Tetrachloroethene	0.1	1,1,2-Trichloro-1,2,2-trifluorethane	0.054
Toluene	0.5	**TOTAL**	**120.0**
1,1,1-Trichloroethane	0.1		
1,1,2-Trichloroethane	0.001		
Trichloroethene	7.8	**Total Emissions**	
Vinyl chloride	0.6	Total, HAPs	46.9
Xylenes	13.3	Total, Non-HAPs	120.0
TOTAL	**46.9**	**TOTAL**	**166.9**

Notes

1. Estimated SVW recovery assumes 100% recovery of total mass of each constituent present in soil and/or groundwater. Each tabulated constituent was detected in at least one soil of groundwater sampl.
2. Hazardous air pollutants (HAPs) are as defined in 40 CFR 63 Subpart GGGGG.

TABLE 8

FINAL REMEDY IMPLEMENTATION SCHEDULE

Boeing Renton Facility
Renton, Washington

Work Item[1]	Duration (weeks)	Elapsed Time[2] (weeks)
1. Ecology approval of Final EDR	0	0
2. Finalize permits, prepare bid packages, & receive contractor bids	16	16
3. Award contracts	4	20
4. Construct SVE systems, SWMU-172/174 & Bldg. 4-78/79		
4a. SVE well drilling	4	24
4b. Construct/Install SVE trailers, piping, & manifolds	20	44
5. Commission & commence SVE operations	4	48
6. Install bioremediation wells		
6a. AOC-001/002	4	28
6b. AOC-003	0.5	28.5
6c. AOC-004	0.5	29
6d. Building 4-78/79 SWMU/AOC Group	5	34
6e. SWMU-172/174	1	35
7. Initial bioremediation injections	6	41
8. Install new monitoring wells	6	41
9. Commence groundwater monitoring & bioremediation maintenance	0	41
10. Prepare draft Completion Report for submittal to Ecology	8	56

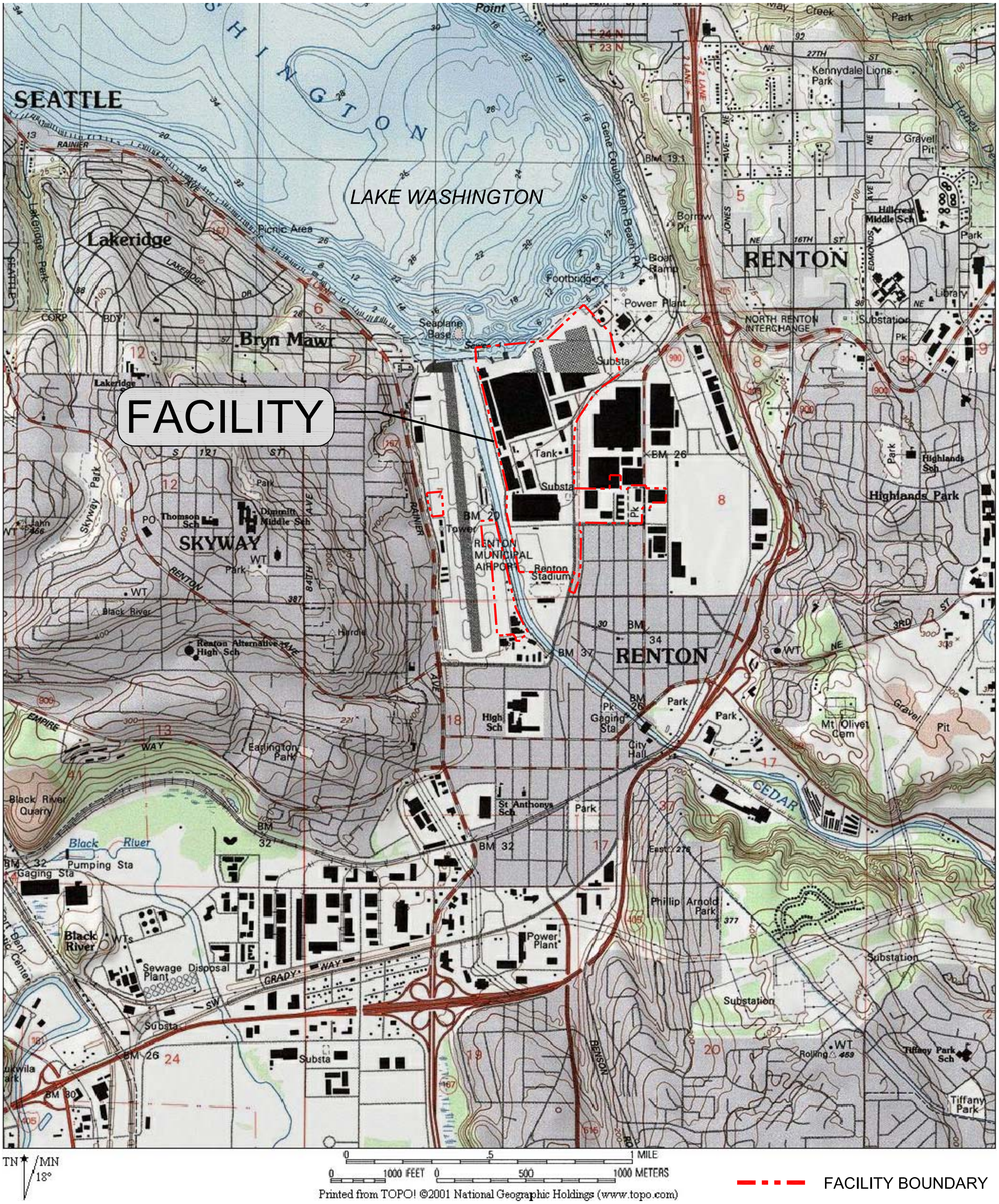
Notes

1. Work Items 4b and Items 6, 7, 8, & 9 will be performed concurrently.
2. Elapsed time is the total time from EDR approval to completion of the work item.

Abbreviations

AOC = area of concern
EDR = engineering design report
SVE = soil vapor extraction
SWMU = solid waste management unit

FIGURES



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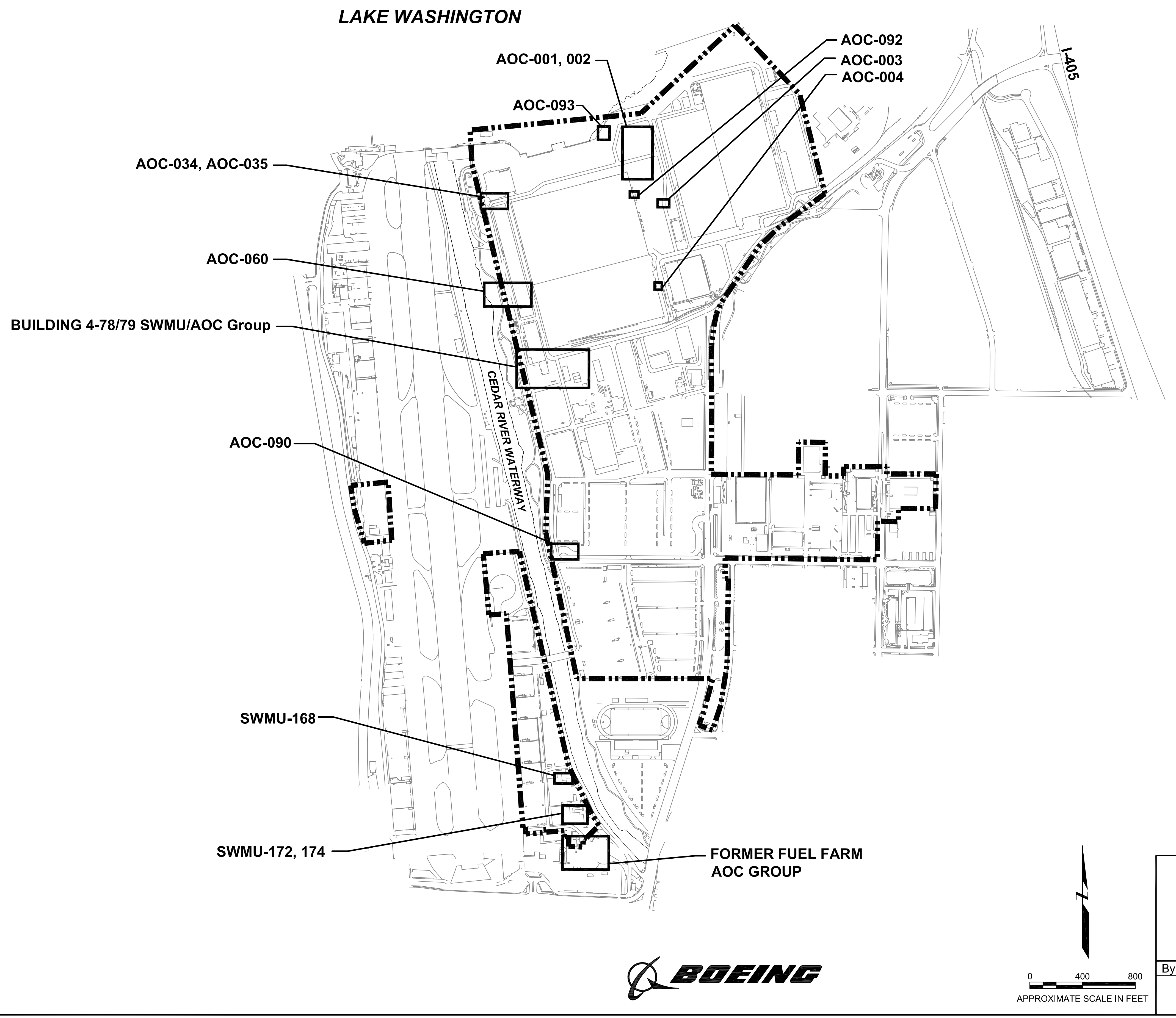
BOEING FACILITY LOCATION

Boeing Renton Facility
Renton, Washington

BOEING

By: APS	Date: 10/08/13	Project No. 8888
amec		Figure 1

Plot Date: 10/08/13 - 6:09pm, Plotted by: adam.stenberg
Drawing Path: S:\8888_2006\069_EDR\, Drawing Name: BoeingRentonSiteMap_090413.dwg



LEGEND

▭ GENERAL LOCATION OF SWMUs AND AOCs

━ · · ━ FACILITY BOUNDARY

NOTES

1. BASEMAP COMPILED BY DUANE HARTMAN & ASSOCIATES INC., DECEMBER, 1994

SWMU AND AOC LOCATION MAP
Boeing Renton Facility
Renton, Washington

By: APS
Date: 10/08/13
Project No. 8888
amec
Figure 2

Plot Date: 10/08/13 - 6:11pm, Plotted by: adam.stenberg
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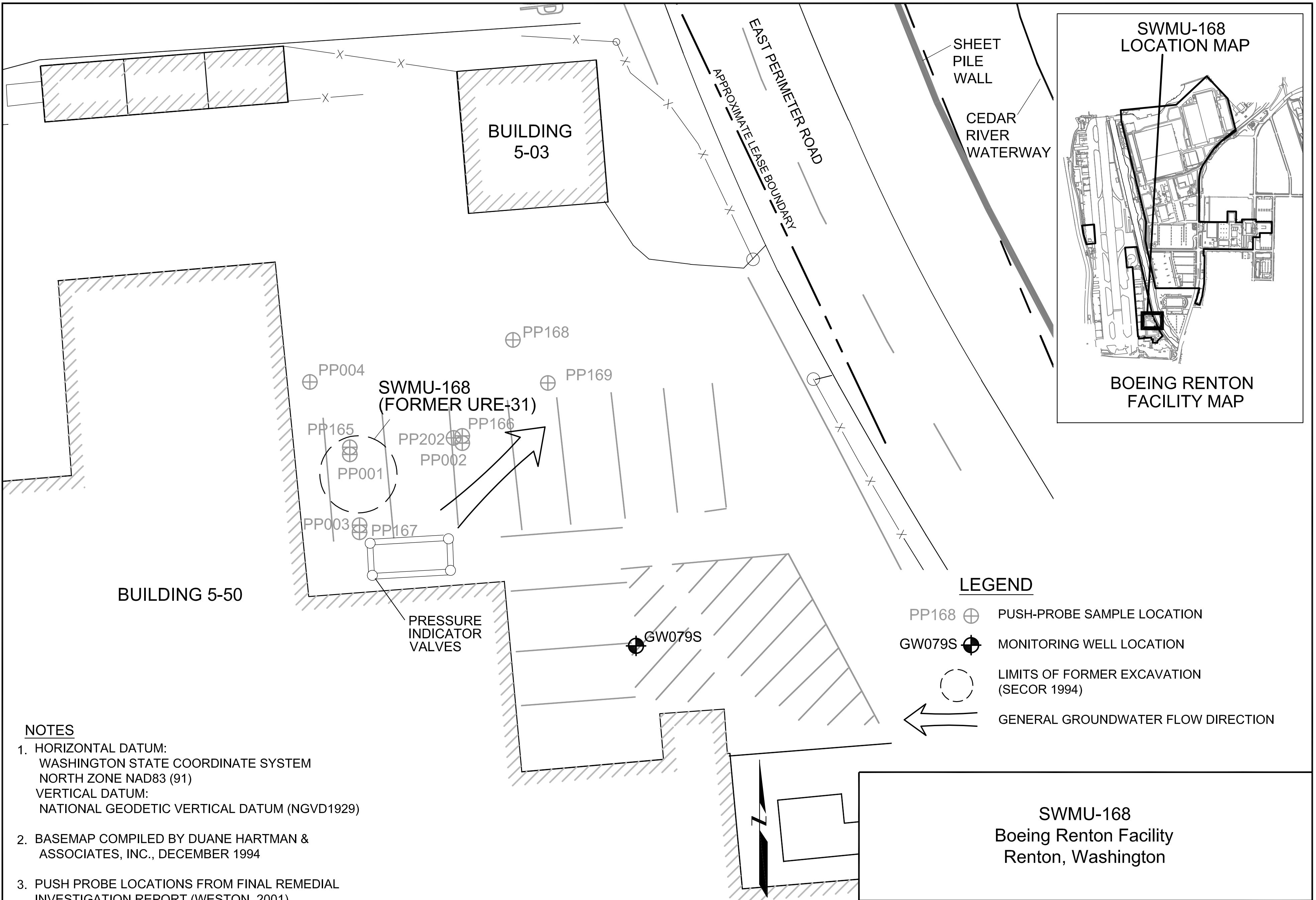


LEGEND

PP168 ⊕	PUSH-PROBE SAMPLE LOCATION
GW079S ⊕	MONITORING WELL LOCATION
◌	LIMITS OF FORMER EXCAVATION (SECOR 1994)
⇐	GENERAL GROUNDWATER FLOW DIRECTION

NOTES

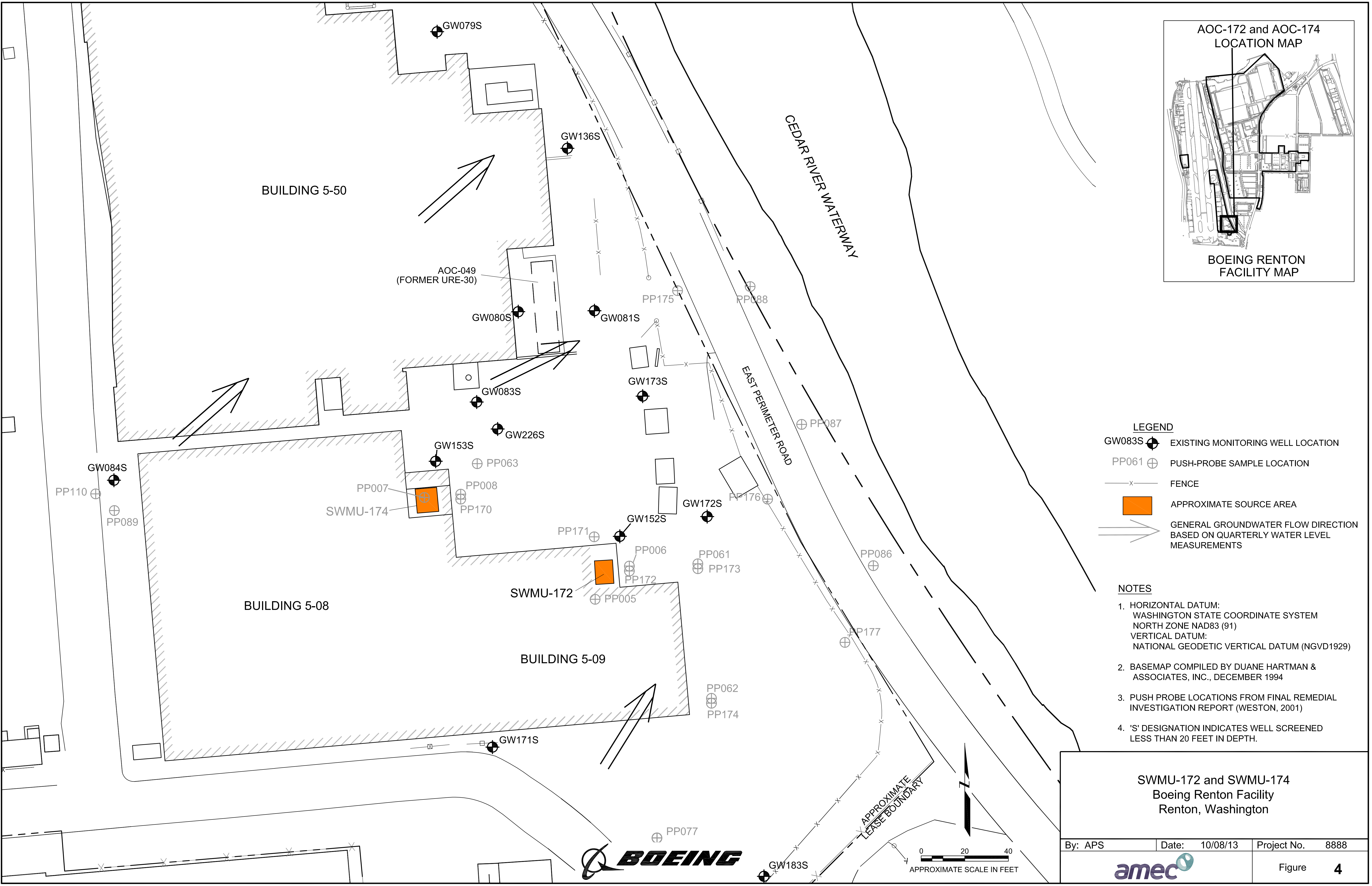
1. HORIZONTAL DATUM:
   WASHINGTON STATE COORDINATE SYSTEM
   NORTH ZONE NAD83 (91)
   VERTICAL DATUM:
   NATIONAL GEODETIC VERTICAL DATUM (NGVD1929)
2. BASEMAP COMPILED BY DUANE HARTMAN & ASSOCIATES, INC., DECEMBER 1994
3. PUSH PROBE LOCATIONS FROM FINAL REMEDIAL INVESTIGATION REPORT (WESTON, 2001)
4. 'S' DESIGNATION INDICATES WELL SCREENED LESS THAN 20 FEET IN DEPTH.

0 10 20
APPROXIMATE SCALE IN FEET

SWMU-168
Boeing Renton Facility
Renton, Washington

By: APS	Date: 10/10/13	Project No. 8888
amec		Figure 3

Plot Date: 10/10/13 - 3:59pm, Plotted by: adam.stenberg
Drawing Path: S:\8888_2006\069_EDR\, Drawing Name: SWMU-168_ProposedCleanupAction_092313.dwg



NOTES

1. HORIZONTAL DATUM:
   WASHINGTON STATE COORDINATE SYSTEM
   NORTH ZONE NAD83 (91)
   VERTICAL DATUM:
   NATIONAL GEODETIC VERTICAL DATUM (NGVD1929)
2. BASEMAP COMPILED BY DUANE HARTMAN & ASSOCIATES, INC., DECEMBER 1994
3. PUSH PROBE LOCATIONS FROM FINAL REMEDIAL INVESTIGATION REPORT (WESTON, 2001)
4. 'S' DESIGNATION INDICATES WELL SCREENED LESS THAN 20 FEET IN DEPTH.

SWMU-172 and SWMU-174
Boeing Renton Facility
Renton, Washington

By: APS | Date: 10/08/13 | Project No. 8888

amec

Figure 4

Plot Date: 10/08/13 - 5:15pm, Plotted by: adam.stenberg
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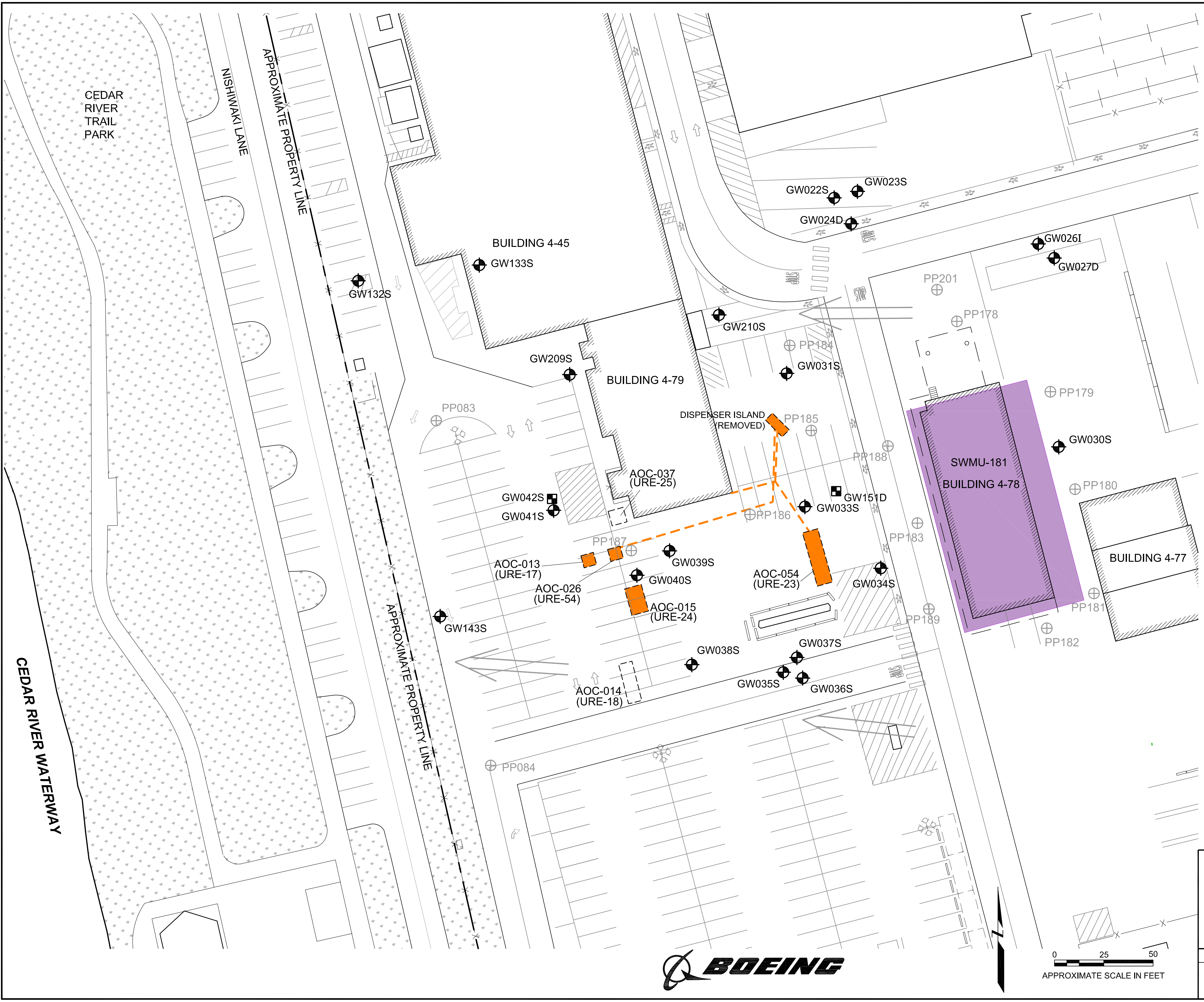
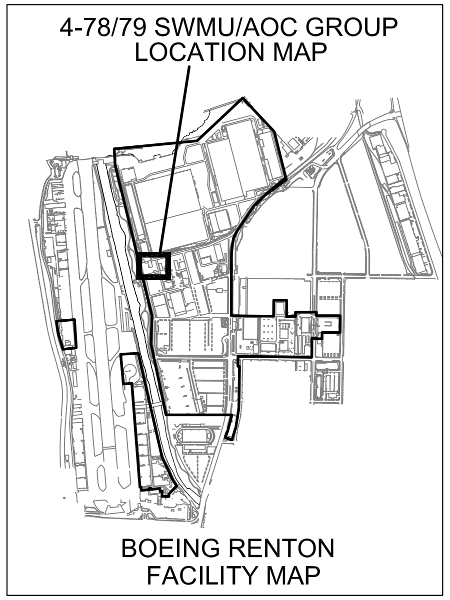




LEGEND

GW033S ⊕	EXISTING MONITORING WELL LOCATION
GW151S ▣	EXISTING EXTRACTION WELL LOCATION
PP083 ⊕	PUSH-PROBE SAMPLE LOCATION
– – –	APPROXIMATE FORMER PIPING NETWORK BASED ON HISTORICAL DISPENSER LOCATION
🟪	APPROXIMATE CHLORINATED VOC SOURCE AREA
🟧	APPROXIMATE FUEL AND NON-CHLORINATED VOC SOURCE AREAS
⬚	REMOVED UST (WESTON, 2001)
←	GENERAL GROUNDWATER FLOW DIRECTION BASED ON QUARTERLY WATER LEVEL MEASUREMENTS

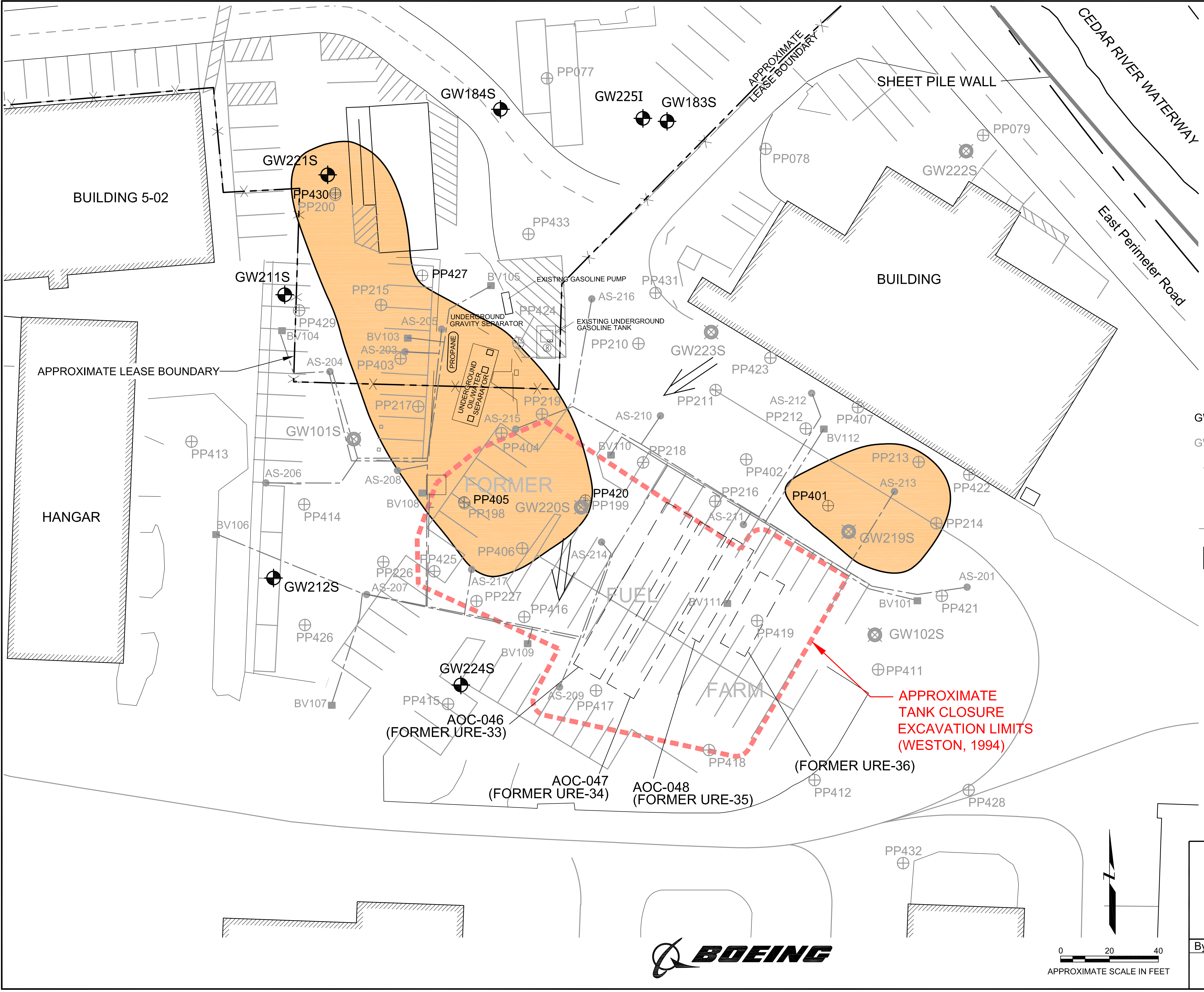
NOTES

1. BASEMAP COMPILED BY DUANE HARTMAN & ASSOCIATES, INC., DECEMBER 1994
2. UST LOCATIONS AND PRODUCT PIPING LOCATIONS FROM FINAL REMEDIAL INVESTIGATION (WESTON, 2001)
3. 'S' DESIGNATION INDICATES WELL SCREENED LESS THAN 25 FEET IN DEPTH. 'D' DESIGNATION INDICATES WELL SCREENED GREATER THAN 25 FEET IN DEPTH.

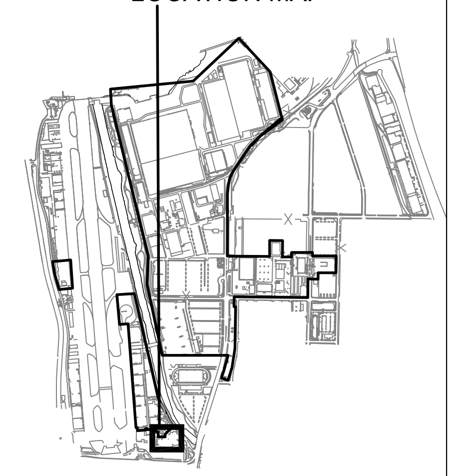
BUILDING 4-78/79 SWMU/AOC GROUP
Boeing Renton Facility
Renton, Washington

By: APS | Date: 10/08/13 | Project No. 8888
amec
Figure 5

Plot Date: 10/08/13 - 5:24pm, Plotted by: adam.stenberg
Drawing Path: S:\8888_2006\069_EDR\, Drawing Name: Building 4-78 and 79_WorkPlanDesign_092313.dwg



FORMER FUEL FARM AOC GROUP LOCATION MAP



BOEING RENTON FACILITY MAP

LEGEND

PP420 ⊕	PUSH-PROBE SAMPLE LOCATION
GW101S ⊕	EXISTING MONITORING WELL
GW223S ⊗	ABANDONED MONITORING WELL
AS-204 ●	ABANDONED AIR SPARGING WELL
BV112 ■	ABANDONED BIOVENTING WELL
— · — ·	ABANDONED LINES
——x——	FENCE
▨	TPH-JET SOIL AND GROUNDWATER SOURCE AREAS AS IDENTIFIED IN THE 1999 REMEDIAL INVESTIGATION. CONCENTRATIONS AND BOUNDARIES MAY NO LONGER BE REPRESENTATIVE OF CURRENT CONDITIONS.
⇐	APPROXIMATE GROUNDWATER FLOW DIRECTION POST AIR SPARGE/BIOVENT SHUTDOWN

NOTES

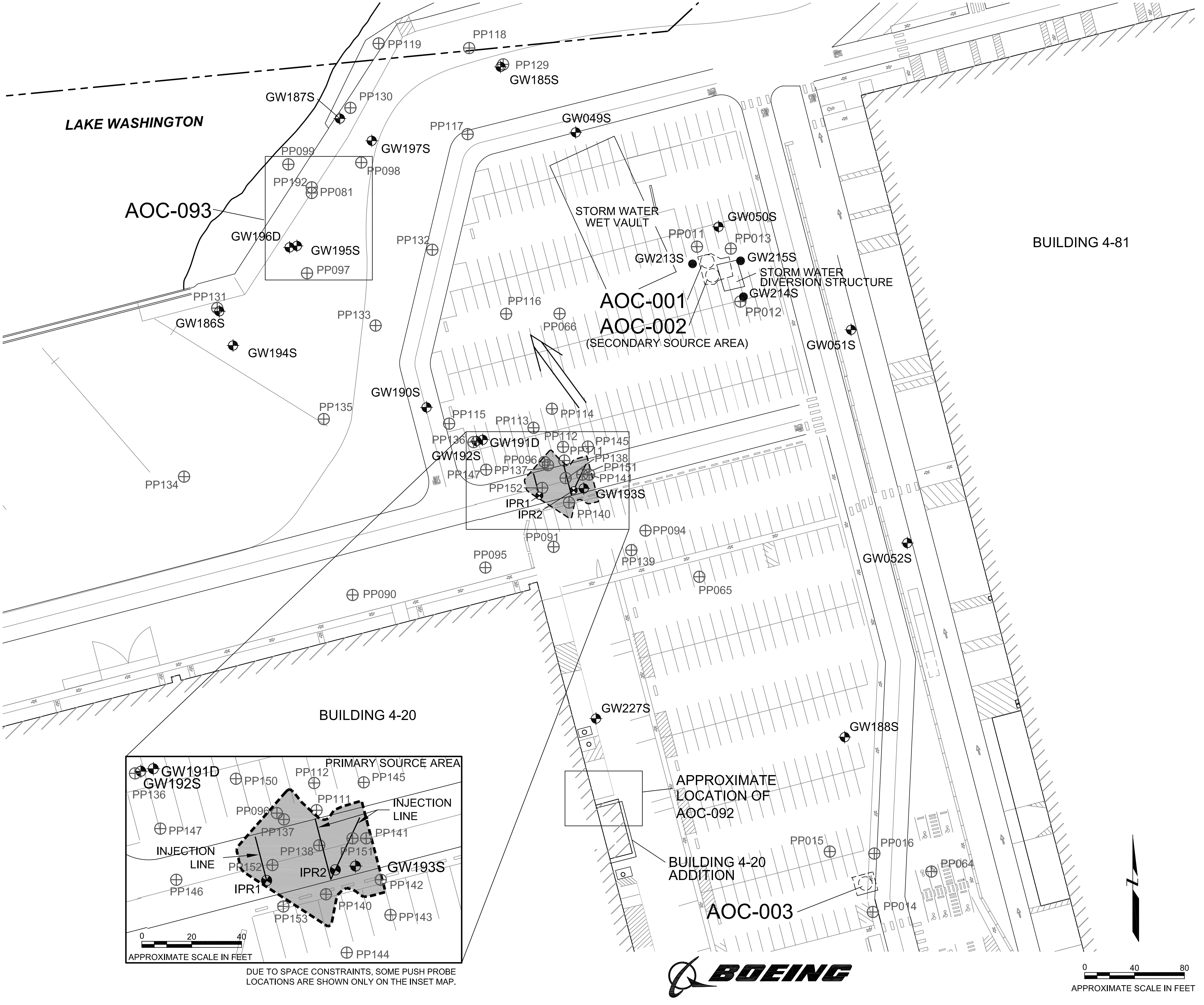
1. BASEMAP COMPILED BY DUANE HARTMAN & ASSOCIATES, INC., DECEMBER 1994.
2. PUSH-PROBE LOCATIONS FROM FINAL REMEDIAL INVESTIGATION REPORT (WESTON, 2001).
3. PIPING LOCATIONS APPROXIMATE.
4. 'S' DESIGNATION INDICATES WELL SCREENED LESS THAN 18 FEET IN DEPTH. 'I' DESIGNATION INDICATES WELL SCREENED GREATER THAN 20 FEET IN DEPTH.

BOEING

FORMER FUEL FARM
Boeing Renton Facility
Renton, Washington

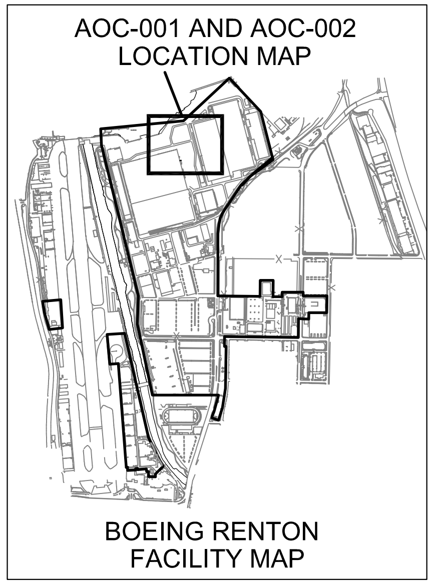
By: APS	Date: 10/08/13	Project No. 8888
amec		Figure 6

Plot Date: 10/08/13 - 5:39pm, Plotted by: adam.stenberg
Drawing Path: S:\8888_2006\069_EDR\, Drawing Name: FormerFuelFarm_ProposedCleanupAction_092313.dwg



DUE TO SPACE CONSTRAINTS, SOME PUSH PROBE LOCATIONS ARE SHOWN ONLY ON THE INSET MAP.

BOEING



LEGEND

GW050S ⊕	EXISTING MONITORING WELL
GW215S ●	EXISTING ELECTRON DONOR INJECTION WELL
IPR1 ⊗	EXISTING INJECTION PIPE RISER
PP011 ⊕	PUSH-PROBE SAMPLE LOCATION
— — —	APPROXIMATE PROPERTY LINE
▨	APPROXIMATE NOVEMBER 2005 EXCAVATION AREA, SHOWING EXISTING REMEDIATION PORTS AND LINES.
⇒	GENERAL GROUNDWATER FLOW DIRECTION FROM SECOND QUARTER 2013 GROUNDWATER MONITORING

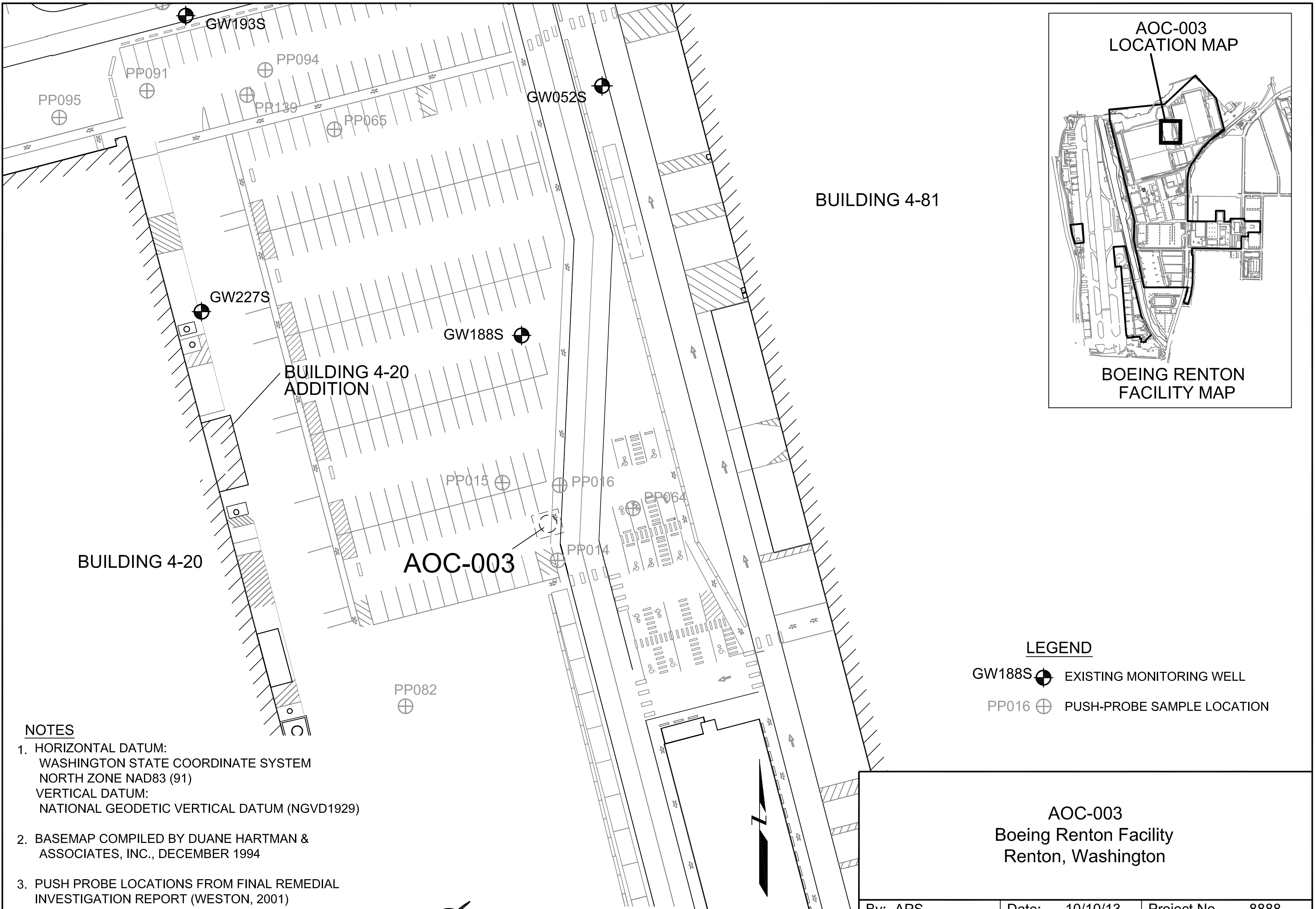
NOTES

1. HORIZONTAL DATUM:
   WASHINGTON STATE COORDINATE SYSTEM
   NORTH ZONE NAD83 (91)
   VERTICAL DATUM:
   NATIONAL GEODETIC VERTICAL DATUM (NGVD1929)
2. BASEMAP COMPILED BY DUANE HARTMAN & ASSOCIATES, INC., DECEMBER 1994
3. 'S' DESIGNATION INDICATES WELL SCREENED LESS THAN 24 FEET IN DEPTH.

AOC-001, AOC-002 and AOC-093
Boeing Renton Facility
Renton, Washington

By: APS	Date: 10/08/13	Project No. 8888
amec		Figure 7

Plot Date: 10/08/13 - 5:44pm, Plotted by: adam.stenberg
Drawing Path: S:\8888_2006\069_EDR\, Drawing Name: AOC-001-002_ProposedCleanupAction_092413.dwg



LEGEND

GW188S ● EXISTING MONITORING WELL

PP016 ⊕ PUSH-PROBE SAMPLE LOCATION

NOTES

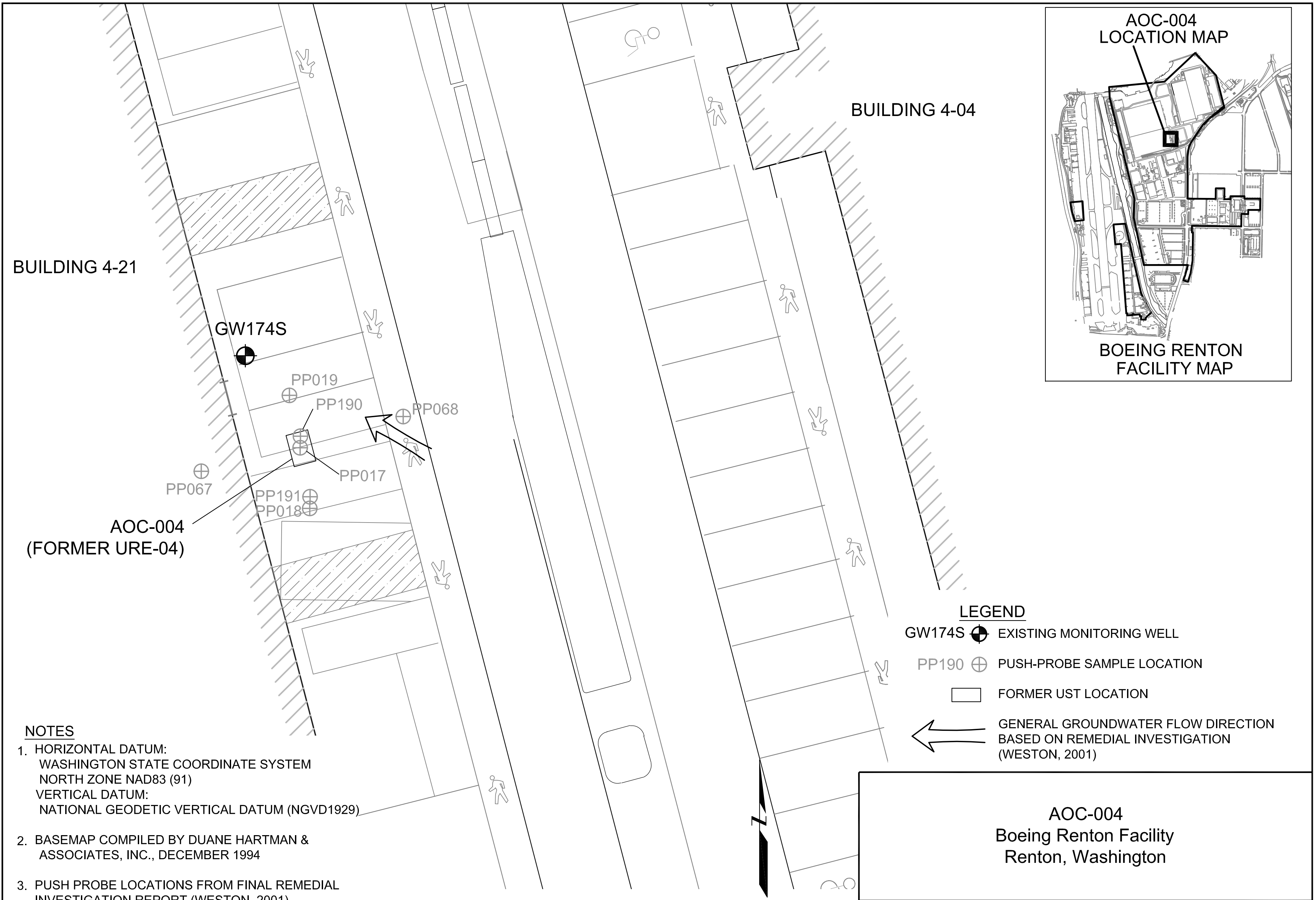
1. HORIZONTAL DATUM:
   WASHINGTON STATE COORDINATE SYSTEM
   NORTH ZONE NAD83 (91)
   VERTICAL DATUM:
   NATIONAL GEODETIC VERTICAL DATUM (NGVD1929)
2. BASEMAP COMPILED BY DUANE HARTMAN & ASSOCIATES, INC., DECEMBER 1994
3. PUSH PROBE LOCATIONS FROM FINAL REMEDIAL INVESTIGATION REPORT (WESTON, 2001)
4. 'S' DESIGNATION INDICATES WELL SCREENED LESS THAN 10 FEET IN DEPTH.

Plot Date: 10/10/13 - 4:35pm, Plotted by: adam.stenberg
Drawing Path: S:\8888_2006\069_EDR\, Drawing Name: AOC-003_WorkPlanDesign_092413.dwg

BOEING

AOC-003
Boeing Renton Facility
Renton, Washington

By: APS	Date: 10/10/13	Project No. 8888
amec		Figure 8



NOTES

1. HORIZONTAL DATUM:
   WASHINGTON STATE COORDINATE SYSTEM
   NORTH ZONE NAD83 (91)
   VERTICAL DATUM:
   NATIONAL GEODETIC VERTICAL DATUM (NGVD1929)
2. BASEMAP COMPILED BY DUANE HARTMAN & ASSOCIATES, INC., DECEMBER 1994
3. PUSH PROBE LOCATIONS FROM FINAL REMEDIAL INVESTIGATION REPORT (WESTON, 2001)
4. 'S' DESIGNATION INDICATES WELL SCREENED LESS THAN 10 FEET IN DEPTH.

BOEING

AOC-004
Boeing Renton Facility
Renton, Washington

By: APS	Date: 06/30/14	Project No. 8888
amec		Figure 9

Plot Date: 06/30/14 - 3:33pm, Plotted by: adam.stenberg
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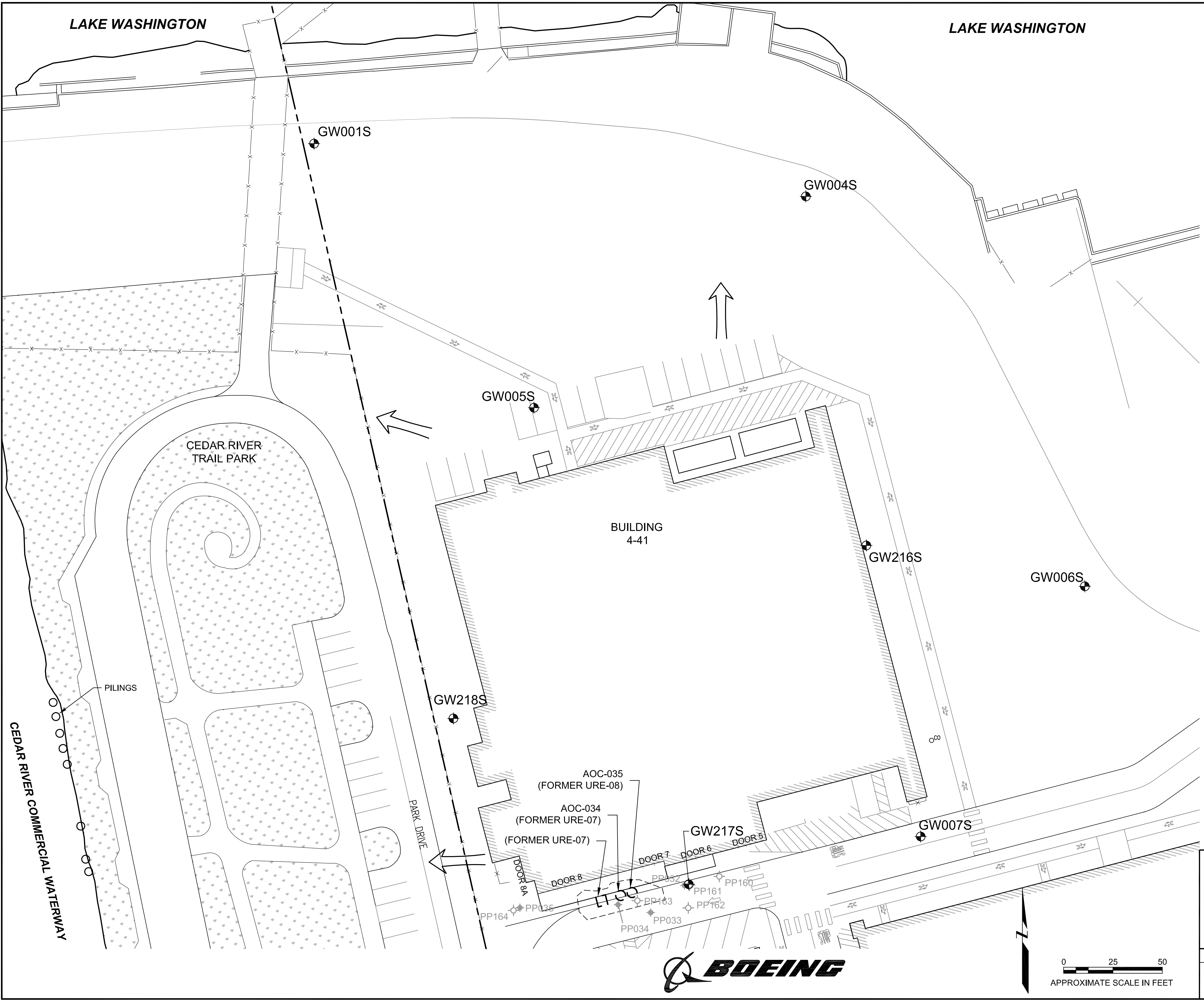
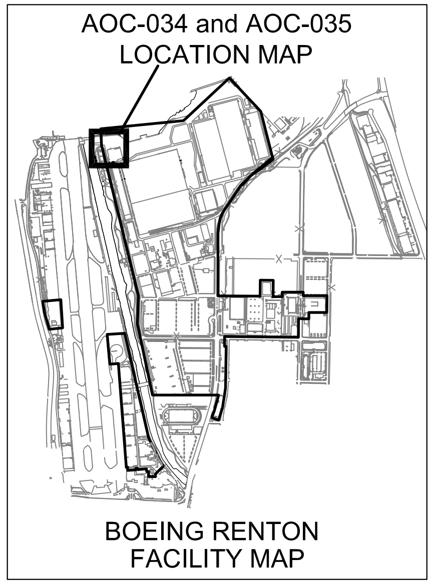



AOC-034 and AOC-035 LOCATION MAP

BOEING RENTON FACILITY MAP

LEGEND

GW218S ⊕	EXISTING MONITORING WELL LOCATION
PP162 ⌖	12/14/2006 PUSH-PROBE SOIL AND GROUNDWATER SAMPLE LOCATION
PP032 ✦	HISTORICAL PUSH-PROBE SAMPLE LOCATION
┆┄┄┄┆	LIMITS OF PREVIOUS EXCAVATION
⌐¬	FORMER UST LOCATION
—x—	FENCE
⇐	GENERAL GROUNDWATER FLOW DIRECTION

NOTES

1. HORIZONTAL DATUM:
   WASHINGTON STATE COORDINATE SYSTEM
   NORTH ZONE NAD83 (91)
   VERTICAL DATUM:
   NATIONAL GEODETIC VERTICAL DATUM (NGVD1929)
2. BASEMAP COMPILED BY DUANE HARTMAN & ASSOCIATES, INC., DECEMBER 1994
3. 'S' DESIGNATION INDICATES WELL SCREENED LESS THAN 24 FEET IN DEPTH.
   'D' DESIGNATION INDICATES WELL SCREENED GREATER THAN 24 FEET IN DEPTH.

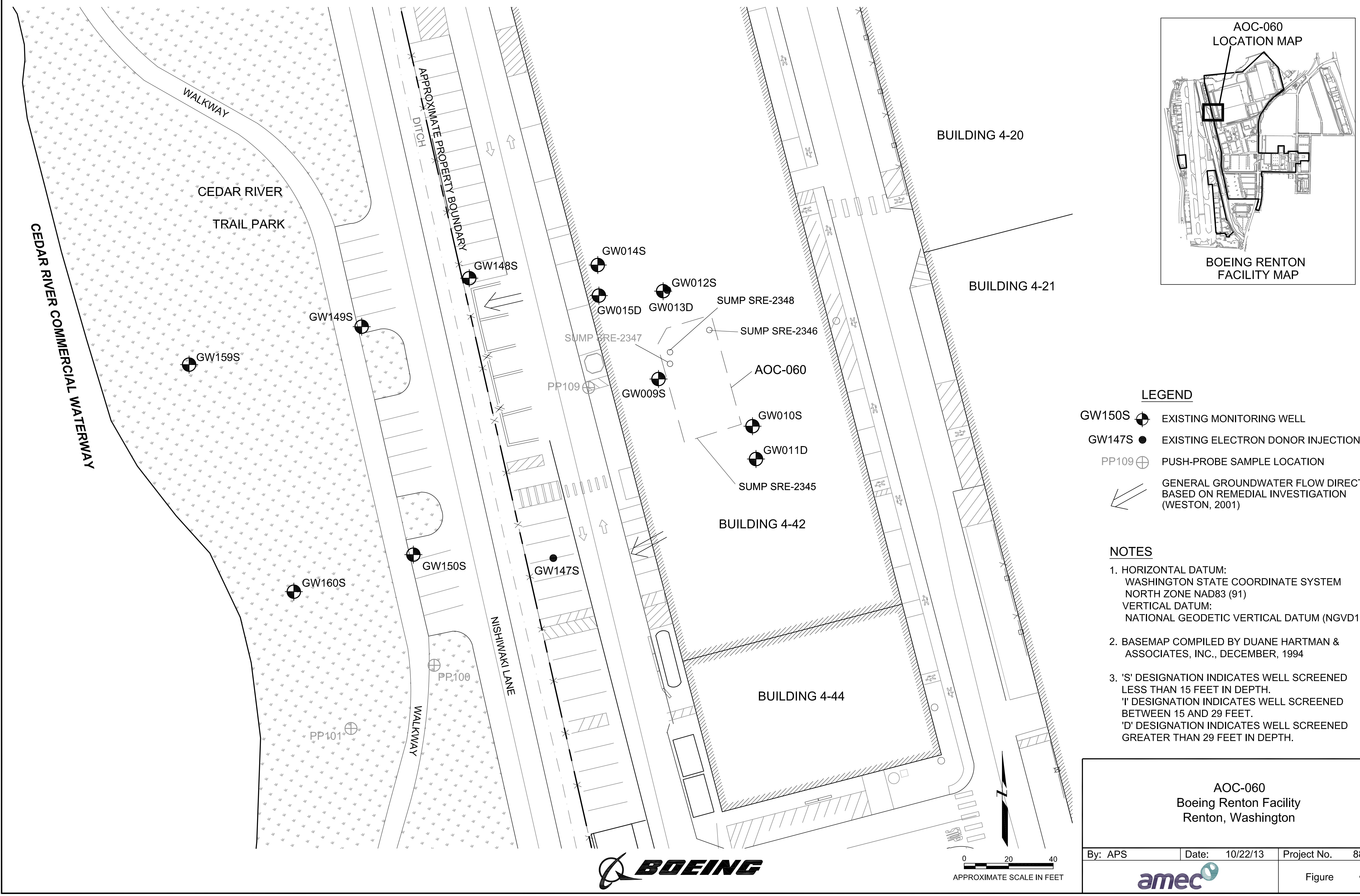
AOC-034 and AOC-035
Boeing Renton Facility
Renton, Washington

By: APS | Date: 10/08/13 | Project No. 8888

amec

Figure 10

Plot Date: 10/08/13 - 5:56pm, Plotted by: adam.stenberg
Drawing Path: S:\8888_2006\069_EDR\, Drawing Name: AOC-034-035_ProposedCleanupAction_092413.dwg



LEGEND

GW150S ⊕	EXISTING MONITORING WELL
GW147S ●	EXISTING ELECTRON DONOR INJECTION WELL
PP109 ⊕	PUSH-PROBE SAMPLE LOCATION
⇙	GENERAL GROUNDWATER FLOW DIRECTION BASED ON REMEDIAL INVESTIGATION (WESTON, 2001)

NOTES

1. HORIZONTAL DATUM:
   WASHINGTON STATE COORDINATE SYSTEM
   NORTH ZONE NAD83 (91)
   VERTICAL DATUM:
   NATIONAL GEODETIC VERTICAL DATUM (NGVD1929)

2. BASEMAP COMPILED BY DUANE HARTMAN & ASSOCIATES, INC., DECEMBER, 1994

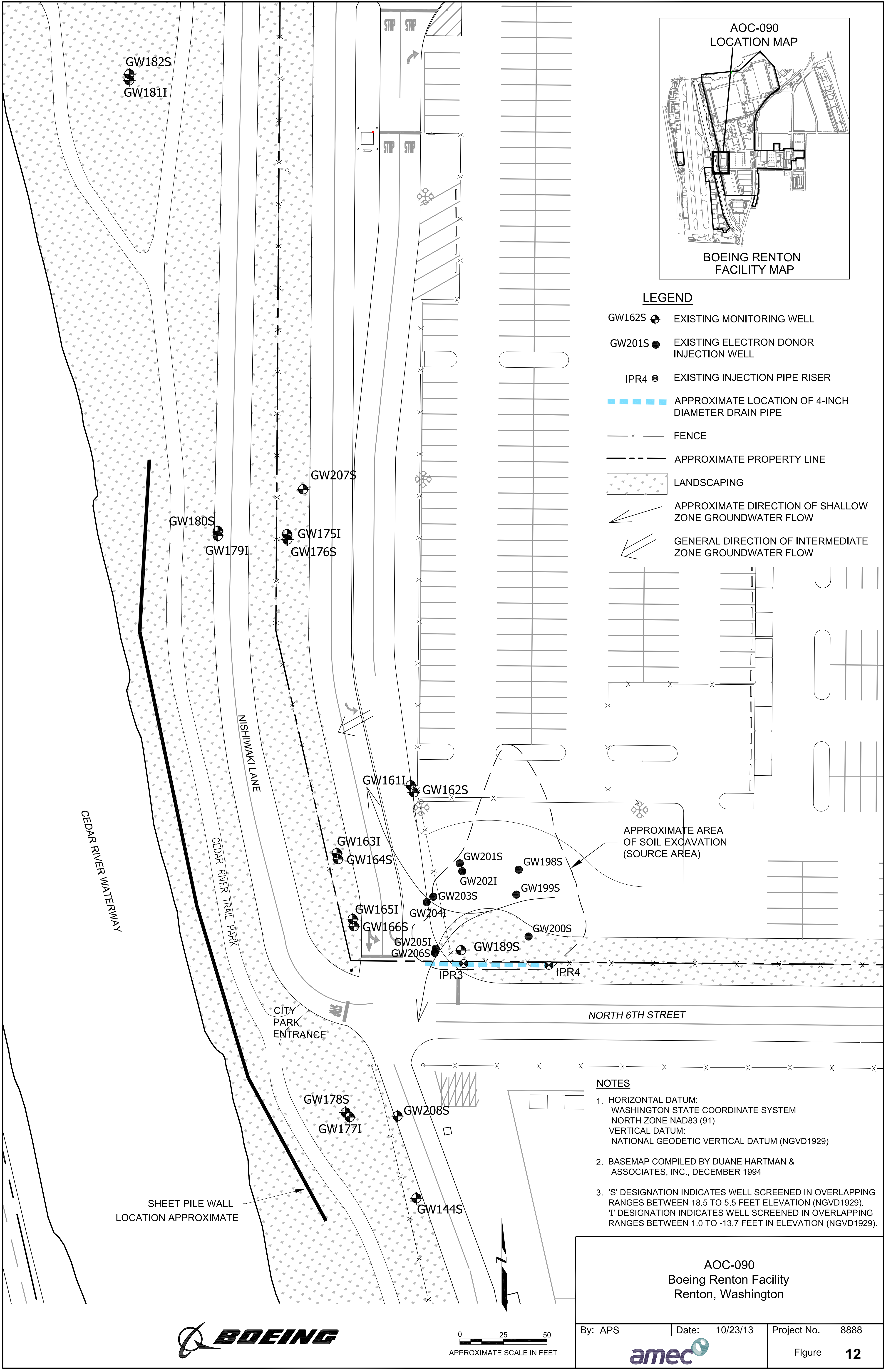
3. 'S' DESIGNATION INDICATES WELL SCREENED LESS THAN 15 FEET IN DEPTH.
   'I' DESIGNATION INDICATES WELL SCREENED BETWEEN 15 AND 29 FEET.
   'D' DESIGNATION INDICATES WELL SCREENED GREATER THAN 29 FEET IN DEPTH.

AOC-060
Boeing Renton Facility
Renton, Washington

By: APS	Date: 10/22/13	Project No. 8888
amec		Figure 11

Plot Date: 10/22/13 - 4:51pm, Plotted by: adam.stenberg
Drawing Path: S:\8888_2006\069_EDR\, Drawing Name: AOC-060_ProposedCleanupAction_092413.dwg

Plot Date: 10/23/13 - 1:56pm, Plotted by: adam.stenberg
Drawing Path: S:\8888_2006\069_EDR\, Drawing Name: AOC-090_ProposedCleanupAction_091613.dwg



LEGEND

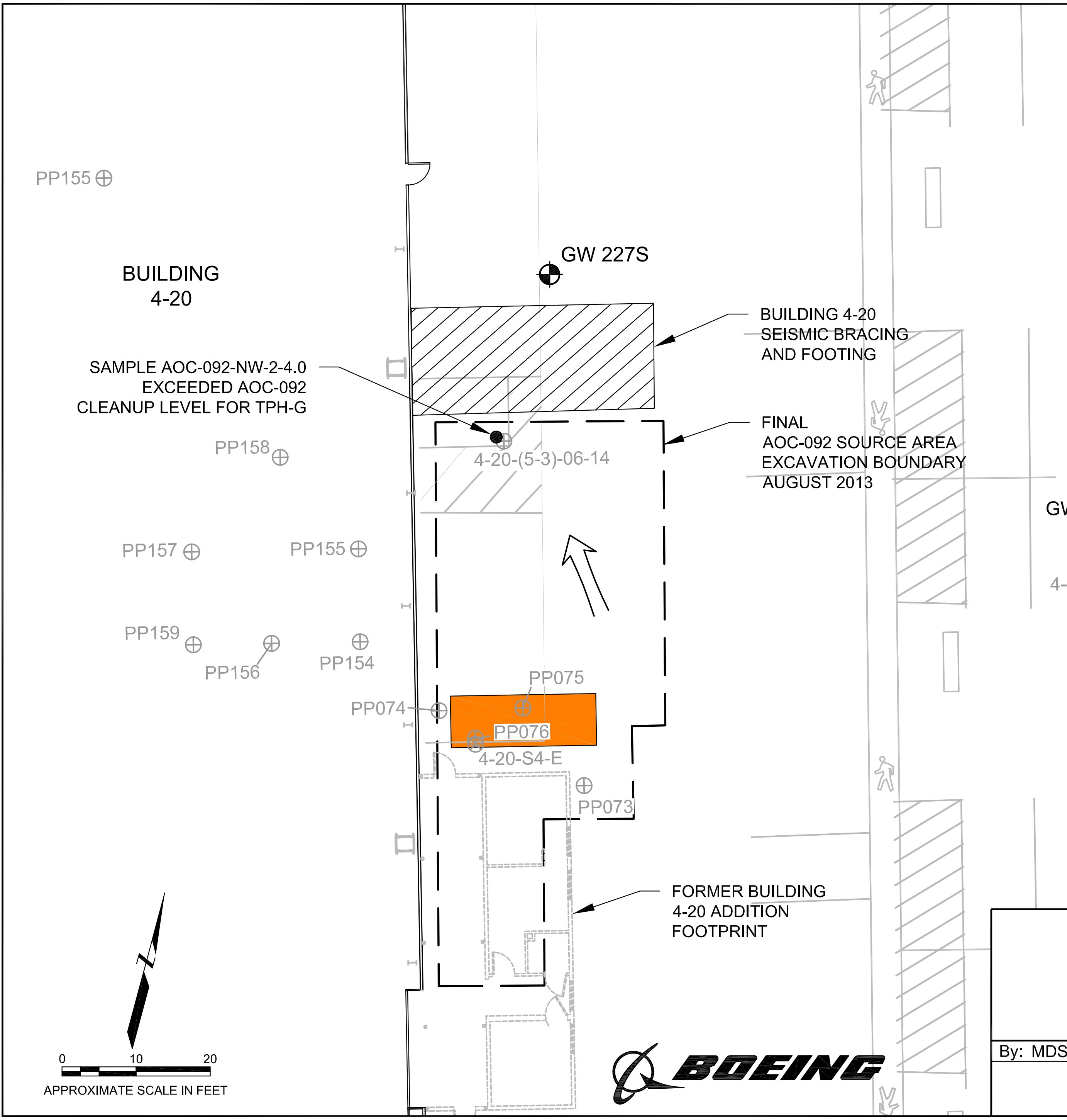
GW162S ⊕	EXISTING MONITORING WELL
GW201S ●	EXISTING ELECTRON DONOR INJECTION WELL
IPR4 ⊗	EXISTING INJECTION PIPE RISER
▬ ▬ ▬	APPROXIMATE LOCATION OF 4-INCH DIAMETER DRAIN PIPE
—— x ——	FENCE
—— - ——	APPROXIMATE PROPERTY LINE
▨	LANDSCAPING
←	APPROXIMATE DIRECTION OF SHALLOW ZONE GROUNDWATER FLOW
⇐	GENERAL DIRECTION OF INTERMEDIATE ZONE GROUNDWATER FLOW

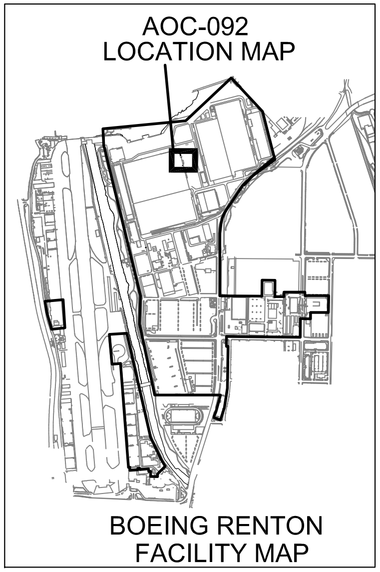
NOTES

1. HORIZONTAL DATUM:
   WASHINGTON STATE COORDINATE SYSTEM
   NORTH ZONE NAD83 (91)
   VERTICAL DATUM:
   NATIONAL GEODETIC VERTICAL DATUM (NGVD1929)
2. BASEMAP COMPILED BY DUANE HARTMAN & ASSOCIATES, INC., DECEMBER 1994
3. 'S' DESIGNATION INDICATES WELL SCREENED IN OVERLAPPING RANGES BETWEEN 18.5 TO 5.5 FEET ELEVATION (NGVD1929). 'I' DESIGNATION INDICATES WELL SCREENED IN OVERLAPPING RANGES BETWEEN 1.0 TO -13.7 FEET IN ELEVATION (NGVD1929).

AOC-090
Boeing Renton Facility
Renton, Washington

By: APS
Date: 10/23/13
Project No. 8888
Figure 12





LEGEND

GW 227S ⊕	EXISTING MONITORING WELL
PP073 ⊕	PUSH-PROBE SAMPLE LOCATION
4-20-S4-E ⊗	SOIL SAMPLE LOCATION 4-20-S4-E COLLECTED AT 5' BGS
🟧	TPH-G SOIL SOURCE AND EXCAVATION AREA FROM CAP
←	GENERAL GROUNDWATER DIRECTION FLOW

NOTES

1. BASEMAP COMPILED FROM DATA SUPPLIED BY DUANE HARTMAN & ASSOCIATES, INC., DECEMBER, 1994 AND WESTON, 2001
2. PUSH PROBE LOCATIONS AND BUILDING 4-20 ADDITION FROM BUILDING 4-20 EXTERIOR, COLUMN S-4 (AOC-092) SOIL AND GROUNDWATER SAMPLING REPORT (WESTON, AUGUST 2001)
3. 'S' DESIGNATION INDICATES WELL SCREENED LESS THAN 15 FEET IN DEPTH.

AOC-092
Boeing Renton Facility
Renton, Washington

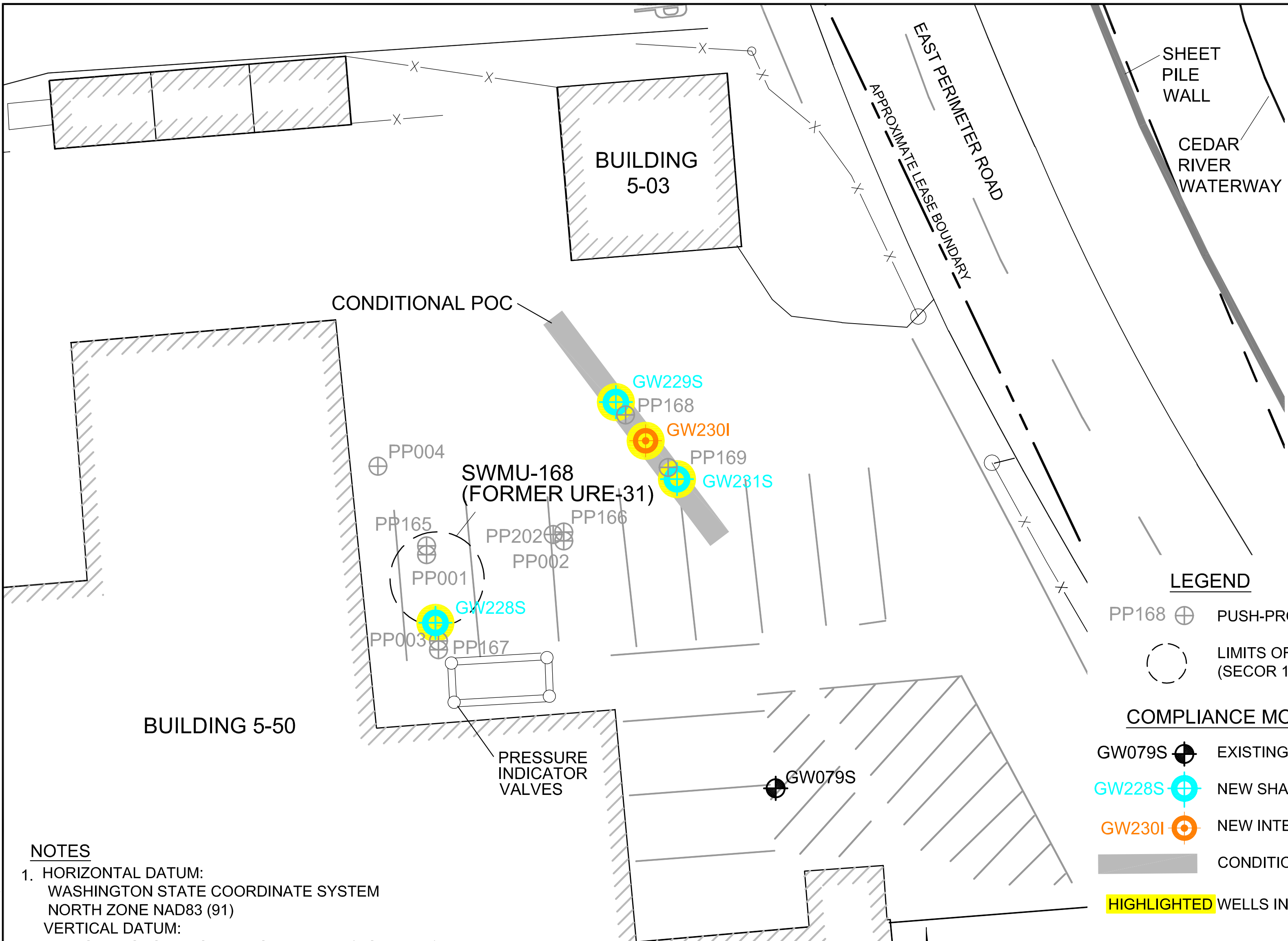
By: MDS
Date: 10/29/13
Project No. 8888
Figure 13

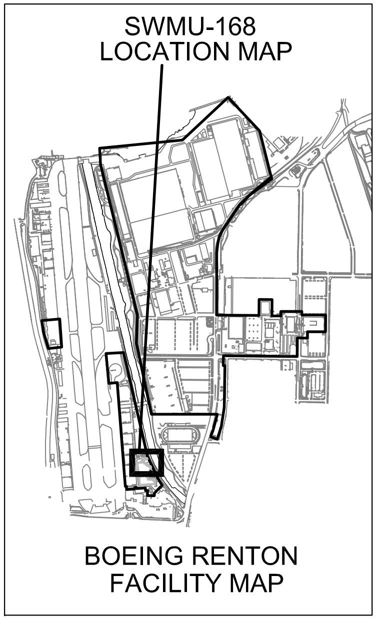
Plot Date: 10/29/13 - 2:31pm, Plotted by: adam.stenberg
Drawing Path: S:\8888_2006\069_EDR\, Drawing Name: AOC-092_ProposedCleanupAction_100313.dwg

APPENDIX A

Design Plans and Specifications

Plot Date: 10/10/13 - 3:57pm, Plotted by: adam.stenberg
Drawing Path: S:\8888_2006\069_EDR\, Drawing Name: SWMU-168_ProposedCleanupAction_092313.dwg





LEGEND

PP168 ⊕	PUSH-PROBE SAMPLE LOCATION
◌	LIMITS OF FORMER EXCAVATION (SECOR 1994)

COMPLIANCE MONITORING NETWORK

GW079S ⊕	EXISTING MONITORING WELL
GW228S ⊕	NEW SHALLOW MONITORING WELL
GW230I ⊙	NEW INTERMEDIATE MONITORING WELL
▬	CONDITIONAL POINT OF COMPLIANCE
HIGHLIGHTED	WELLS INCLUDED IN MONITORING NETWORK

NOTES

1. HORIZONTAL DATUM:
   WASHINGTON STATE COORDINATE SYSTEM
   NORTH ZONE NAD83 (91)
   VERTICAL DATUM:
   NATIONAL GEODETIC VERTICAL DATUM (NGVD1929)
2. BASEMAP COMPILED BY DUANE HARTMAN & ASSOCIATES, INC., DECEMBER 1994
3. PUSH PROBE LOCATIONS FROM FINAL REMEDIAL INVESTIGATION REPORT (WESTON, 2001)
4. 'S' DESIGNATION INDICATES WELL SCREENED LESS THAN 20 FEET IN DEPTH.
   "I" DESIGNATION INDICATES WELL SCREENED GREATER THAN 20 FEET IN DEPTH

BOEING

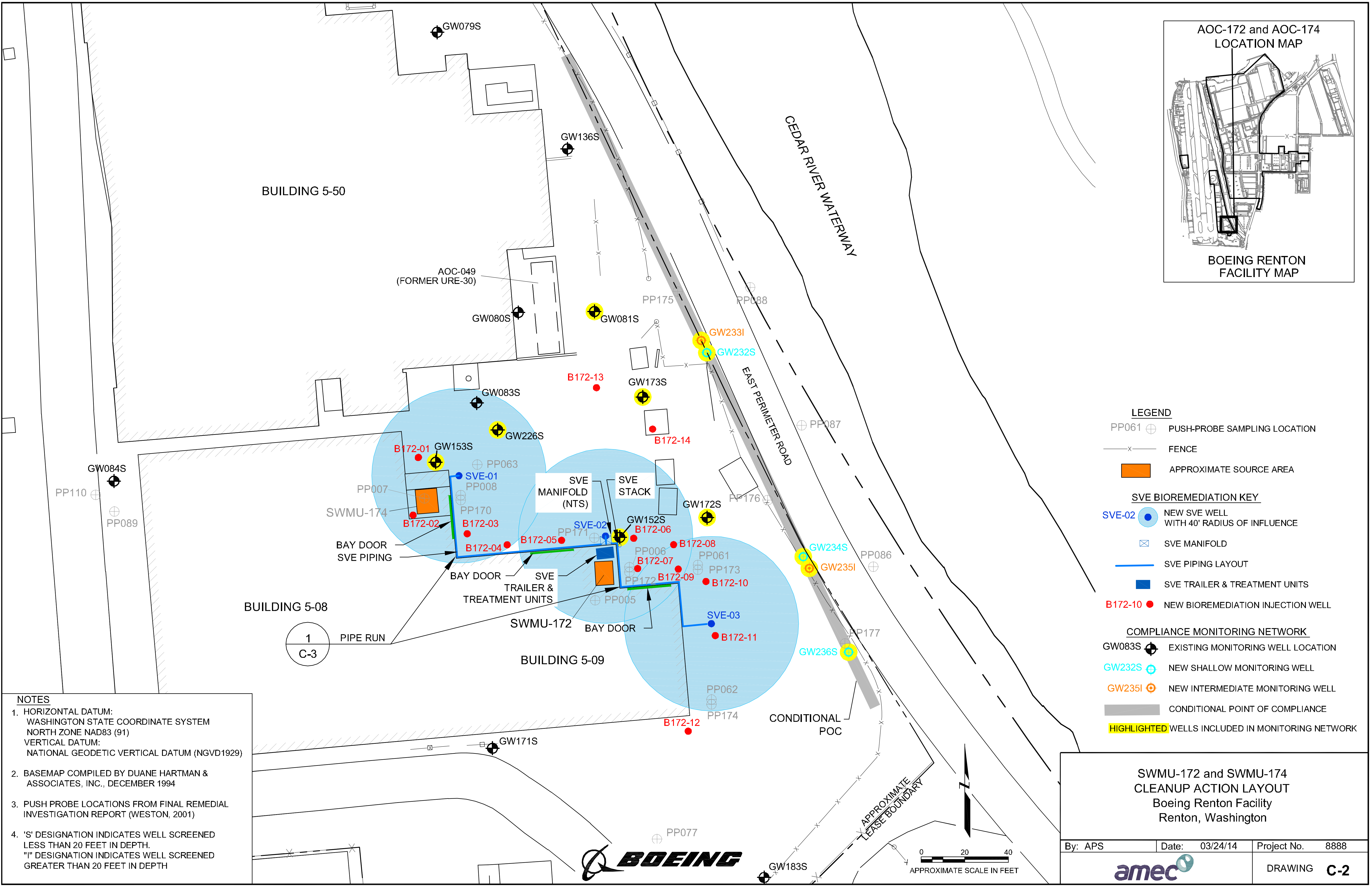
0 10 20
APPROXIMATE SCALE IN FEET

SWMU-168
CLEANUP ACTION LAYOUT
Boeing Renton Facility
Renton, Washington

By: APS
Date: 10/10/13
Project No. 8888

amec

DRAWING C-1



LEGEND

PP061 ⊕ PUSH-PROBE SAMPLING LOCATION

—x— FENCE

🟧 APPROXIMATE SOURCE AREA

SVE BIOREMEDIATION KEY

SVE-02 ● NEW SVE WELL WITH 40' RADIUS OF INFLUENCE

☒ SVE MANIFOLD

— SVE PIPING LAYOUT

🟦 SVE TRAILER & TREATMENT UNITS

B172-10 ● NEW BIOREMEDIATION INJECTION WELL

COMPLIANCE MONITORING NETWORK

GW083S ⊕ EXISTING MONITORING WELL LOCATION

GW232S ⊕ NEW SHALLOW MONITORING WELL

GW235I ⊕ NEW INTERMEDIATE MONITORING WELL

▬ CONDITIONAL POINT OF COMPLIANCE

HIGHLIGHTED WELLS INCLUDED IN MONITORING NETWORK

NOTES

1. HORIZONTAL DATUM:
   WASHINGTON STATE COORDINATE SYSTEM
   NORTH ZONE NAD83 (91)
   VERTICAL DATUM:
   NATIONAL GEODETIC VERTICAL DATUM (NGVD1929)
2. BASEMAP COMPILED BY DUANE HARTMAN & ASSOCIATES, INC., DECEMBER 1994
3. PUSH PROBE LOCATIONS FROM FINAL REMEDIAL INVESTIGATION REPORT (WESTON, 2001)
4. 'S' DESIGNATION INDICATES WELL SCREENED LESS THAN 20 FEET IN DEPTH.
   "I" DESIGNATION INDICATES WELL SCREENED GREATER THAN 20 FEET IN DEPTH

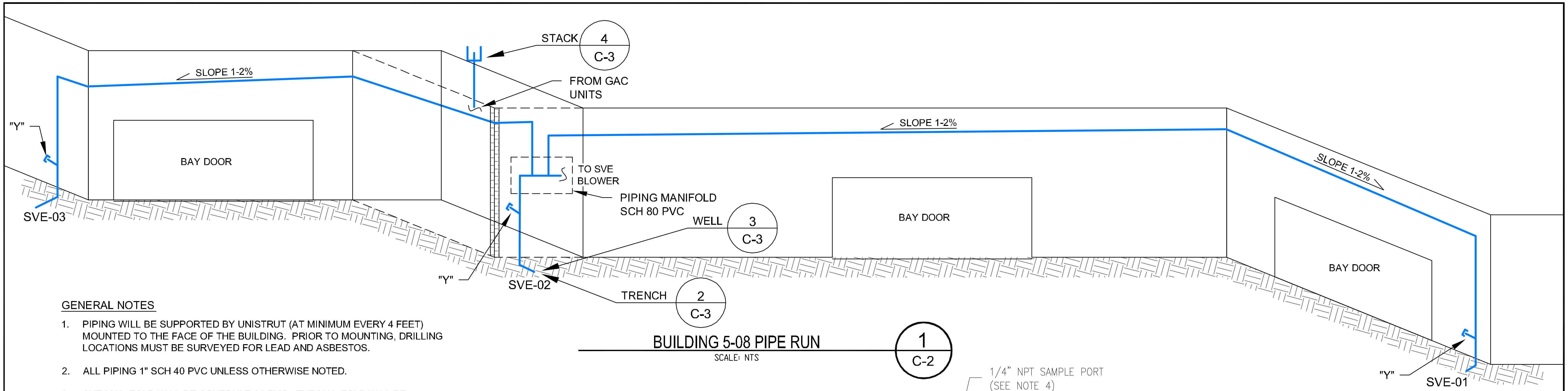
Plot Date: 03/24/14 - 8:04am, Plotted by: mike.stenberg
Drawing Path: S:\8888_2006\069_EDR\, Drawing Name: SWMU-172 and 174_WorkPlanDesign_032414.dwg

SWMU-172 and SWMU-174
CLEANUP ACTION LAYOUT
Boeing Renton Facility
Renton, Washington

By: APS | Date: 03/24/14 | Project No. 8888

amec

DRAWING C-2



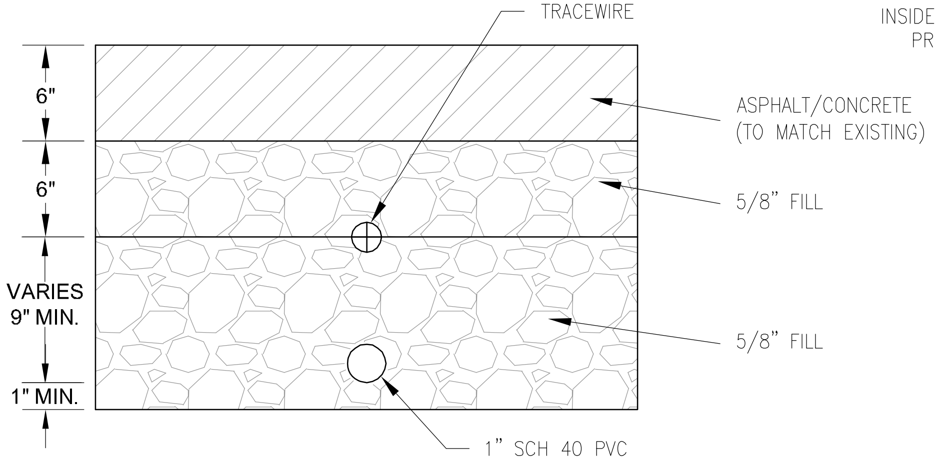
BUILDING 5-08 PIPE RUN

SCALE: NTS

1
C-2

GENERAL NOTES

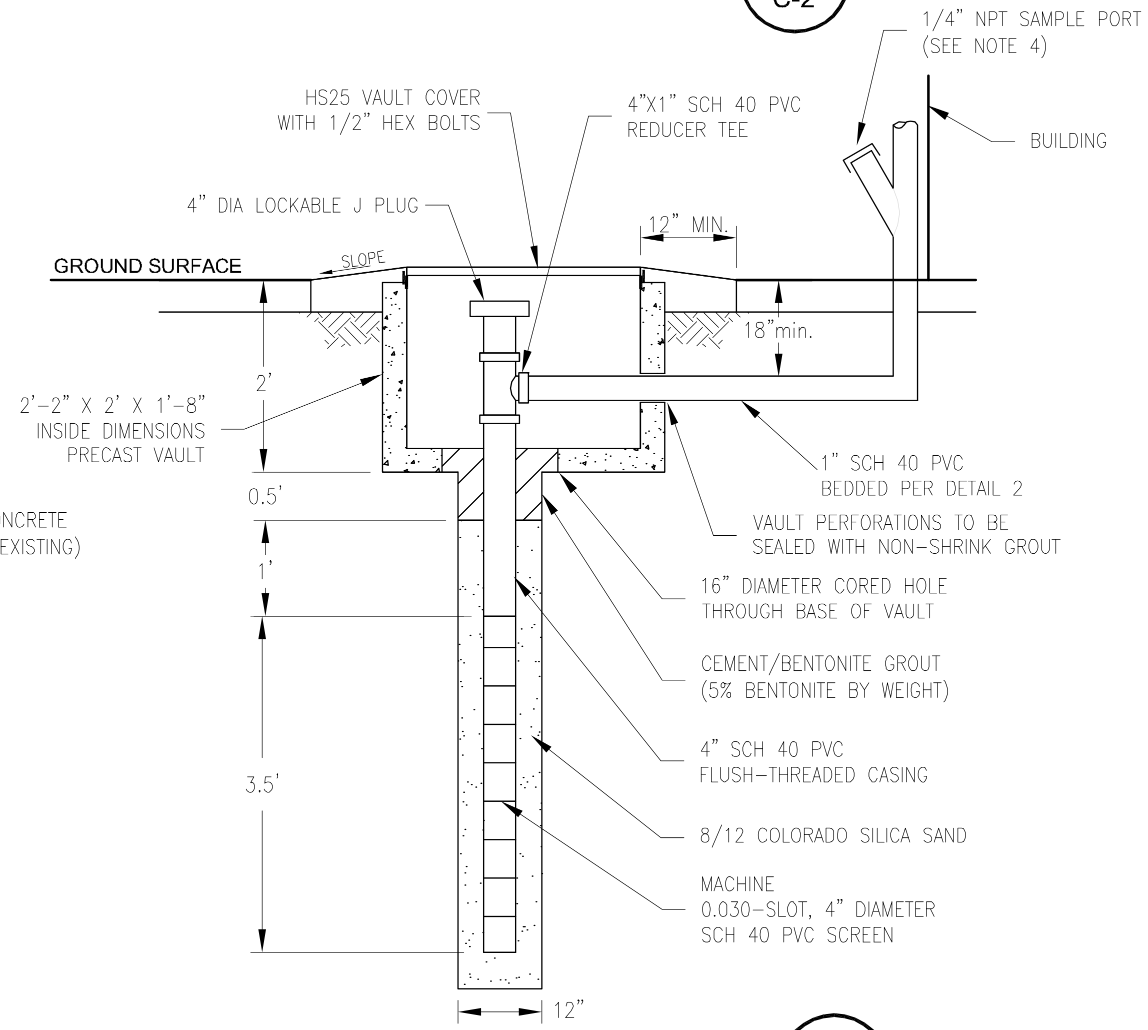
1. PIPING WILL BE SUPPORTED BY UNISTRUT (AT MINIMUM EVERY 4 FEET) MOUNTED TO THE FACE OF THE BUILDING. PRIOR TO MOUNTING, DRILLING LOCATIONS MUST BE SURVEYED FOR LEAD AND ASBESTOS.
2. ALL PIPING 1" SCH 40 PVC UNLESS OTHERWISE NOTED.
3. SVE MANIFOLD WILL BE SCHEDULE 80 PVC. THE MANIFOLD WILL BE MOUNTED ON UNISTRUT AND SET BACK UNDER THE ROOF OVERHANG TO ENSURE PIPING, INSTRUMENTS, AND FITTINGS ARE NOT INTRUDING ON PEDESTRIAN OR VEHICULAR PATHWAYS.
4. "Y" FITTINGS FOR EACH WELL WILL BE MOUNTED AS CLOSE TO GROUND SURFACE AS POSSIBLE. "Y" FITTINGS WILL BE ORIENTED TO ENSURE THAT THE CAPPED ARM OF THE "Y" WILL BE FLUSH TO THE BUILDING (I.E., NOT PROTRUDING OUT FROM BUILDING). A 1/4" SAMPLE PORT WITH BALL VALVE WILL BE MOUNTED IN THE CAP OF THE "Y" FOR VACUUM MEASUREMENT.
5. SEE DRAWING C-6 FOR RE-PAVEMENT SPECIFICATIONS.



TRENCH DETAIL

SCALE: NTS

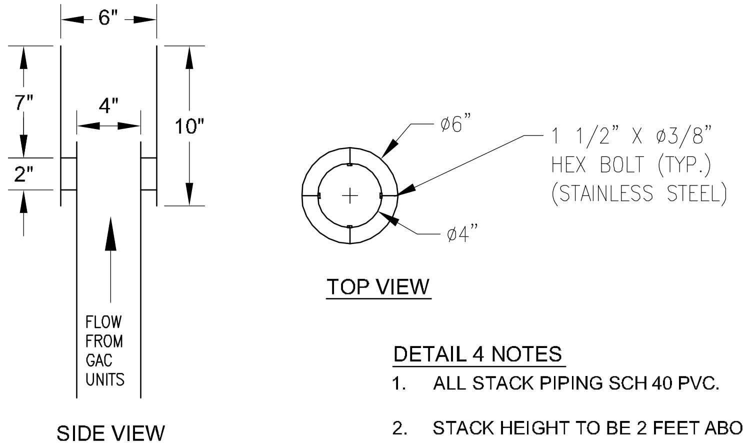
2
C-3



SOIL VAPOR EXTRACTION WELL

SCALE: NTS

3
C-3



DETAIL 4 NOTES

1. ALL STACK PIPING SCH 40 PVC.
2. STACK HEIGHT TO BE 2 FEET ABOVE EDGE OF ROOF

SVE SYSTEM DISCHARGE STACK DETAIL

SCALE: 1" = 1'

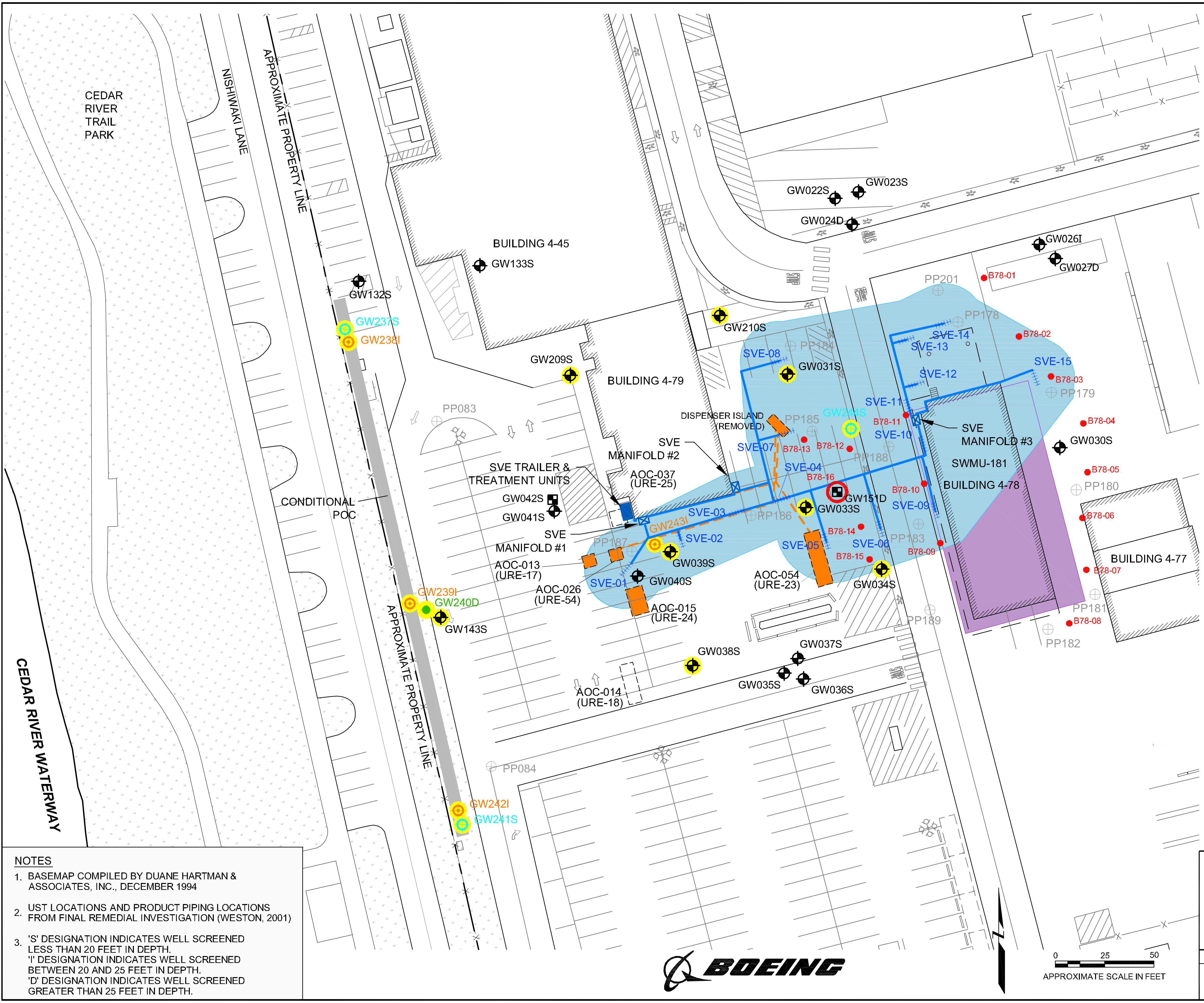
4
C-3

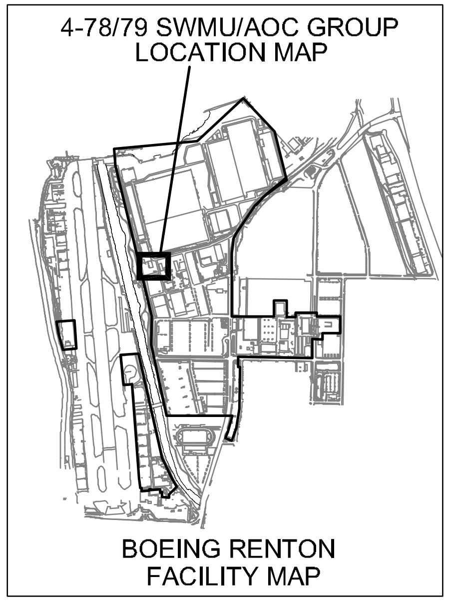
BOEING

SWMU-172 and SWMU-174
SVE DETAILS
Boeing Renton Facility
Renton, Washington

By: APS	Date: 03/24/14	Project No. 8888
amec		DRAWING C-3

Plot Date: 03/24/14 - 8:58am, Plotted by: mike.stenberg
Drawing Path: S:\8888_2006\069_EDR\, Drawing Name: SWMU-172 and 174_WorkPlanDesign_032414.dwg





Plot Date: 03/24/14 - 8:13am, Plotted by: mike.stenberg
Drawing Path: S:\8888_2006\069_EDR\, Drawing Name: Building 4-78 and 79_WorkPlanDesign_032414.dwg

NOTES

1. BASEMAP COMPILED BY DUANE HARTMAN & ASSOCIATES, INC., DECEMBER 1994
2. UST LOCATIONS AND PRODUCT PIPING LOCATIONS FROM FINAL REMEDIAL INVESTIGATION (WESTON, 2001)
3. 'S' DESIGNATION INDICATES WELL SCREENED LESS THAN 20 FEET IN DEPTH.
'I' DESIGNATION INDICATES WELL SCREENED BETWEEN 20 AND 25 FEET IN DEPTH.
'D' DESIGNATION INDICATES WELL SCREENED GREATER THAN 25 FEET IN DEPTH.

LEGEND

GW151S ▣	EXISTING EXTRACTION WELL
PP083 ⊕	PUSH-PROBE SAMPLE LOCATION
– – –	APPROXIMATE FORMER PIPING NETWORK BASED ON HISTORICAL DISPENSER LOCATION
🟪	APPROXIMATE CHLORINATED VOC SOURCE AREA
– – 🟧	APPROXIMATE FUEL AND NON-CHLORINATED VOC SOURCE AREAS
⬚	REMOVED UST (WESTON, 2001)

SVE KEY

⬭	SVE TARGET AREA
SVE-15 ++++	NEW HORIZONTAL SVE WELL
⊠	SVE MANIFOLD
—	SVE PIPING LAYOUT
🟦	SVE TRAILER & TREATMENT UNITS

BIOREMEDIATION KEY

B78-12 ●	NEW BIOREMEDIATION INJECTION WELL
◉	EXTRACTION WELL CONVERTED TO INJECTION WELL

COMPLIANCE MONITORING NETWORK

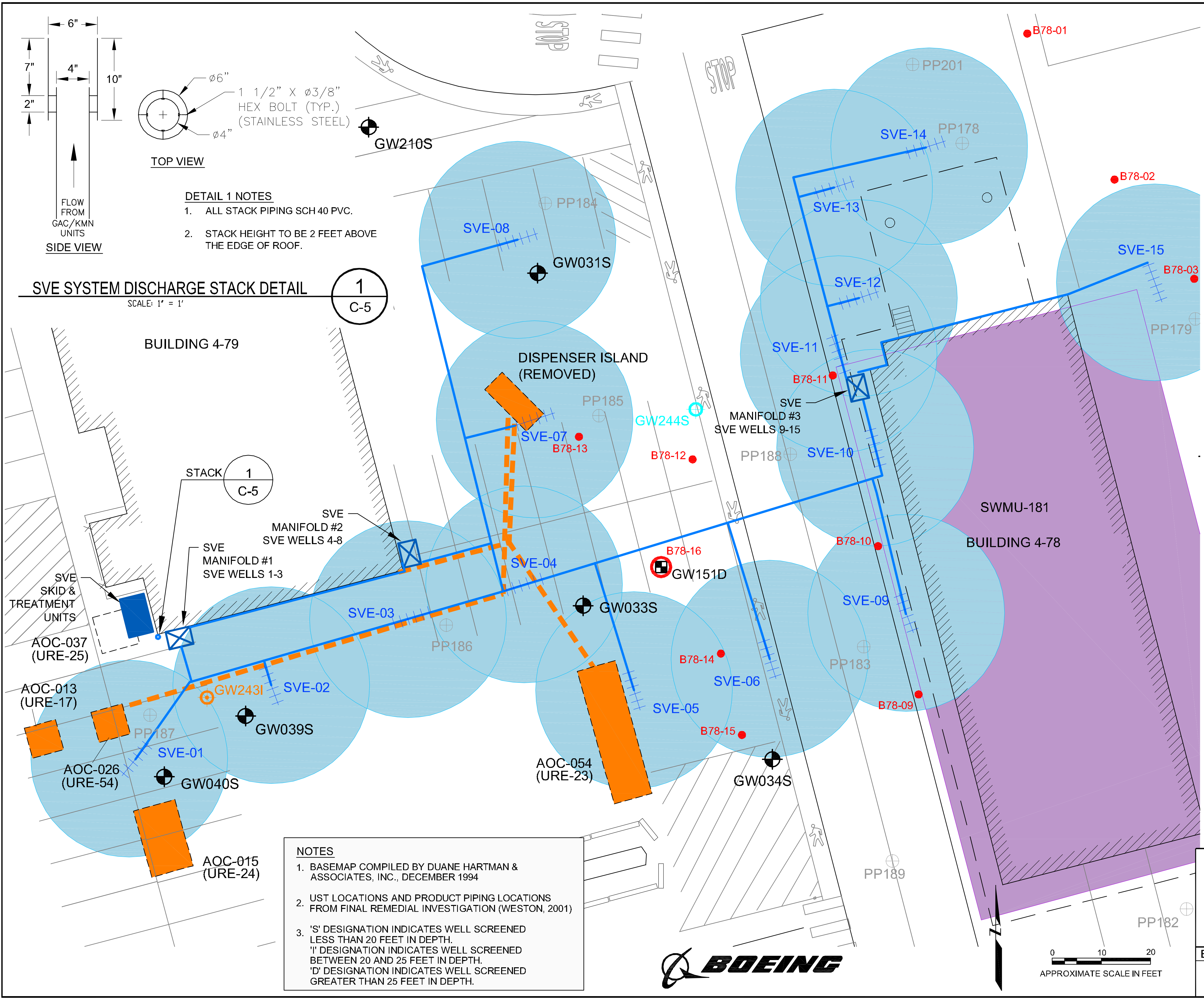
GW033S ⊕	EXISTING MONITORING WELL
GW241S ◎	NEW SHALLOW MONITORING WELL
GW243I ◎	NEW INTERMEDIATE MONITORING WELL
GW240D ●	NEW DEEP MONITORING WELL
▬	CONDITIONAL POINT OF COMPLIANCE
HIGHLIGHTED	WELLS INCLUDED IN MONITORING NETWORK

BUILDING 4-78/79 SWMU/AOC GROUP
CLEANUP ACTION LAYOUT (OVERVIEW)
Boeing Renton Facility
Renton, Washington

By: APS | Date: 03/24/14 | Project No. 8888

amec

DRAWING C-4

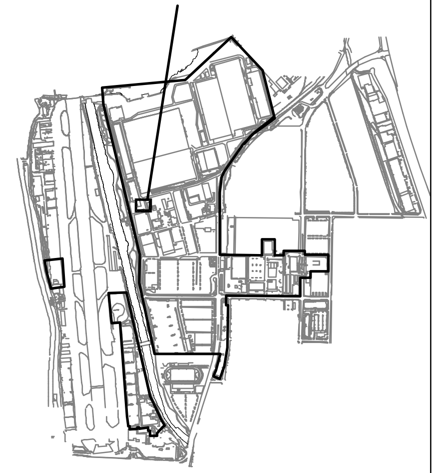


DETAIL 1 NOTES
1. ALL STACK PIPING SCH 40 PVC.
2. STACK HEIGHT TO BE 2 FEET ABOVE THE EDGE OF ROOF.

NOTES
1. BASEMAP COMPILED BY DUANE HARTMAN & ASSOCIATES, INC., DECEMBER 1994
2. UST LOCATIONS AND PRODUCT PIPING LOCATIONS FROM FINAL REMEDIAL INVESTIGATION (WESTON, 2001)
3. 'S' DESIGNATION INDICATES WELL SCREENED LESS THAN 20 FEET IN DEPTH.
'I' DESIGNATION INDICATES WELL SCREENED BETWEEN 20 AND 25 FEET IN DEPTH.
'D' DESIGNATION INDICATES WELL SCREENED GREATER THAN 25 FEET IN DEPTH.

BOEING

4-78/79 SWMU/AOC GROUP LOCATION MAP



BOEING RENTON FACILITY MAP

LEGEND
GW151S ▩ EXISTING EXTRACTION WELL
PP083 ⊕ PUSH-PROBE SAMPLE LOCATION
APPROXIMATE FORMER PIPING NETWORK BASED ON HISTORICAL DISPENSER LOCATION
🟪 APPROXIMATE CHLORINATED VOC SOURCE AREA
🟧 APPROXIMATE FUEL AND NON-CHLORINATED VOC SOURCE AREAS
REMOVED UST (WESTON, 2001)

SVE KEY
SVE-06 NEW HORIZONTAL SVE WELL WITH 20' RADIUS OF INFLUENCE
☒ SVE MANIFOLD
SVE PIPING LAYOUT
🟦 SVE TRAILER & TREATMENT UNITS

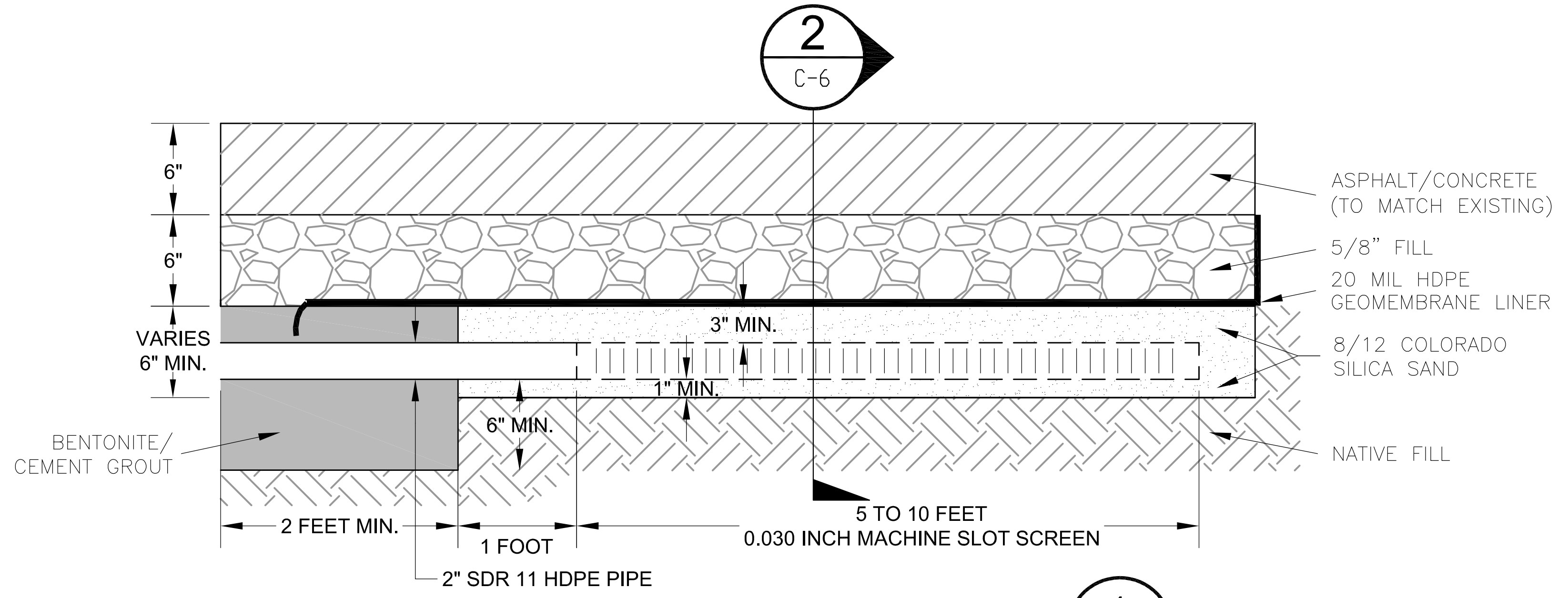
BIOREMEDIATION KEY
B78-09 ● NEW BIOREMEDIATION INJECTION WELL
EXTRACTION WELL CONVERTED TO INJECTION WELL

COMPLIANCE MONITORING NETWORK
GW033S EXISTING MONITORING WELL
GW241S NEW SHALLOW MONITORING WELL
GW243I NEW INTERMEDIATE MONITORING WELL
GW240D ● NEW DEEP MONITORING WELL
CONDITIONAL POINT OF COMPLIANCE
HIGHLIGHTED WELLS INCLUDED IN MONITORING NETWORK

BUILDING 4-78/79 SWMU/AOC GROUP
CLEANUP ACTION LAYOUT (CLOSE-UP)
Boeing Renton Facility
Renton, Washington

By: APS	Date: 03/24/14	Project No. 8888
amec		DRAWING C-5

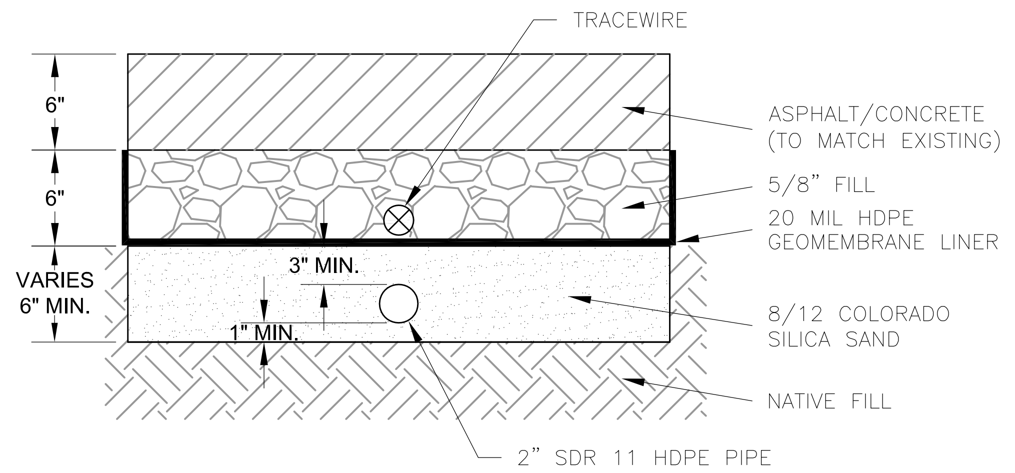
Plot Date: 03/24/14 - 8:22am, Plotted by: mike.stenberg
Drawing Path: S:\8888_2006\069_EDR\, Drawing Name: Building 4-78 and 79_WorkPlanDesign_032414_20scale.dwg



HORIZONTAL WELL DETAIL SIDE VIEW

SCALE: NTS

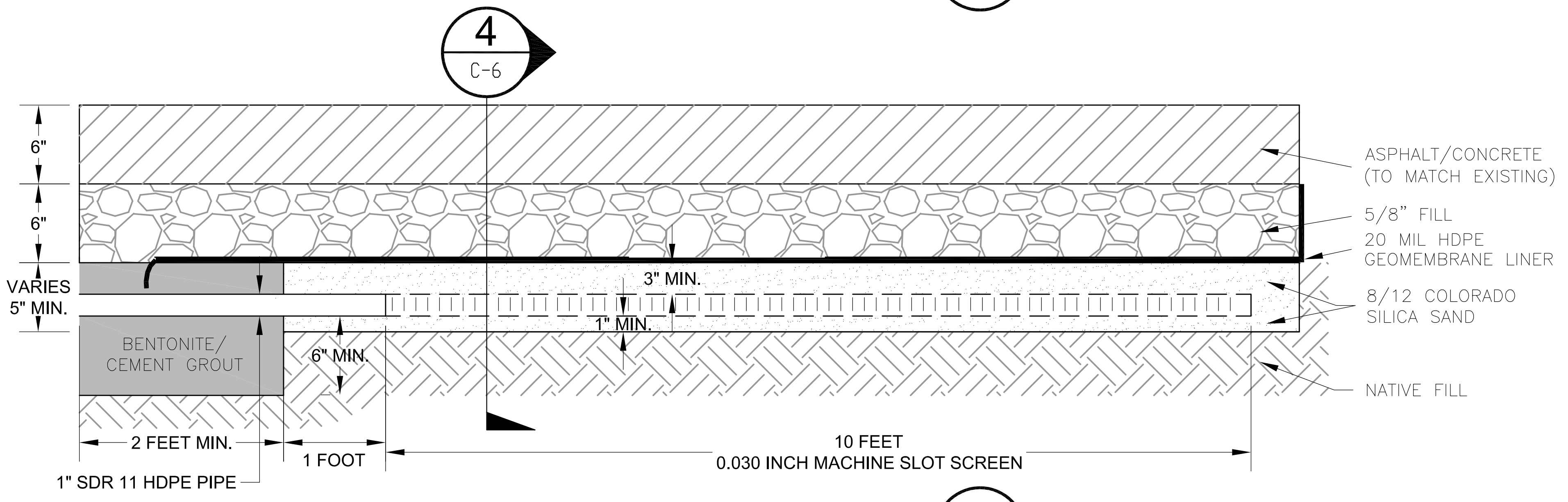
1
P-2



HORIZONTAL WELL DETAIL

SCALE: NTS

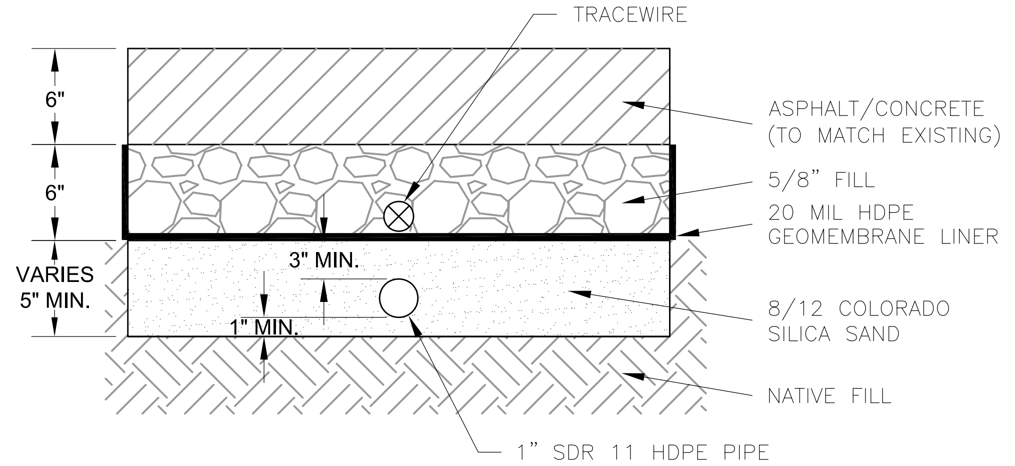
2
C-6



HORIZONTAL WELL DETAIL SIDE VIEW

SCALE: NTS

3
P-2



HORIZONTAL WELL DETAIL

SCALE: NTS

4
C-6

RE-PAVING NOTES

SUBGRADE

1. PAVEMENT SUBGRADE SHALL CONSIST OF MINIMUM 6 INCHES OF ¾ INCH MINUS CRUSHED ROCK MEETING THE REQUIREMENTS OF WSDOT 9-03.9(3) CRUSHED SURFACING TOP COURSE. SUBGRADE SHALL BE COMPACTED TO AT LEAST 95% OF THE MAXIMUM DRY DENSITY (ASTM D1557).

PAVEMENT

1. THE PAVEMENT THICKNESS SHALL MATCH THE EXISTING PAVEMENT THICKNESS, BUT NO LESS THAN 6 INCHES THICK.
2. ALL PAVEMENTS MATERIAL AND PLACEMENT SHALL BE IN ACCORDANCE WITH THE REQUIREMENTS OF WSDOT STANDARD SPECIFICATIONS 2012 (M 41-10).
3. ASPHALT PAVEMENT SHALL CONSIST OF 4 INCHES OF CLASS E BASE COURSE AND 2 INCHES OF CLASS B WEARING COURSE. TACK COAT SHALL BE APPLIED BETWEEN LAYERS AND ALONG THE JOINTS WITH THE EXISTING PAVEMENT.
4. CONCRETE PAVEMENT SHALL HAVE A 28-DAY STRENGTH OF AT LEAST 3,500 PSI AND HAVE 7% AIR ENTRAINMENT. COLLECT SAMPLE CYLINDERS AND BREAK EVERY 7 DAYS. PROVIDE THE TEST RESULTS TO THE ENGINEER.
5. INSTALL DOWELS EVERY 4 FEET ALONG ALL THE JOINTS WITH THE NEW AND EXISTING CONCRETE PAVEMENT.
6. CONCRETE SHALL BE PLACED IN 20-FOOT PANELS, SUCH THAT THERE IS A COLD JOINT EVERY 20 FEET. INSTALL EXPANSION MATERIAL BETWEEN JOINTS.

GENERAL NOTES

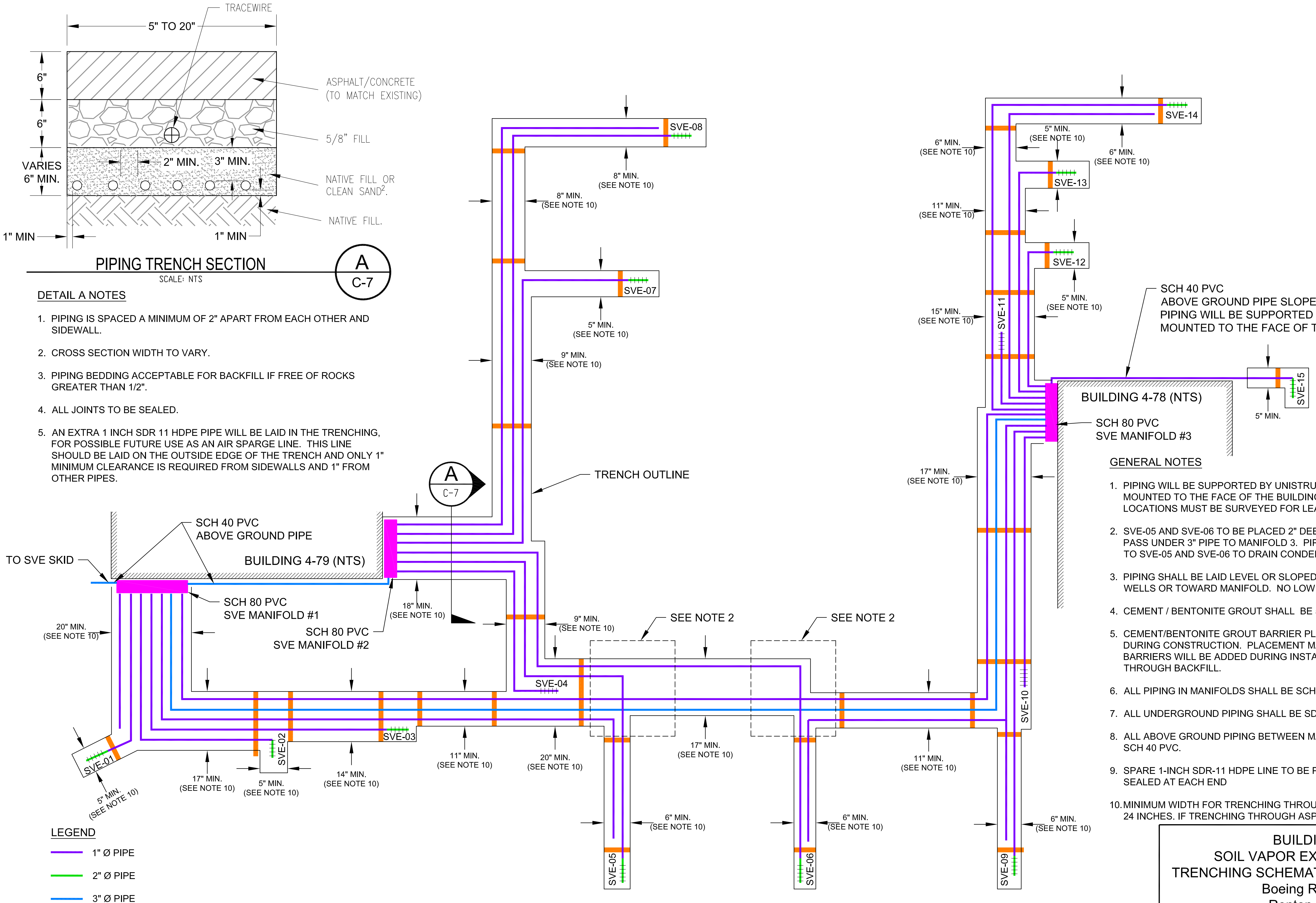
1. ALL CRACKS/JOINTS TO BE SEALED IN SVE TARGET AREAS.
2. HDPE SCREENS HAVE WELDED CAPS AT END.
3. HDPE LINER TO BE LAID AS ONE CONTINUOUS PIECE IF POSSIBLE. LINER WILL COVER ENTIRE WIDTH OF TRENCH IF SVE WELL IS LAID WITH OTHER PIPES.
4. HDPE LINER TO BE LAID OVER BENTONITE/CEMENT GROUT WHILE STILL WET TO ENSURE A GOOD SEAL.
5. CEMENT/BENTONITE GROUT SHALL BE 5% BY WEIGHT AND WILL BE INSTALLED ACROSS ENTIRE WIDTH OF TRENCH (INCLUDING OTHER PIPES IF PRESENT).

BOEING

BUILDING 4-78/79 SWMU/AOC GROUP
HORIZONTAL SVE WELL DETAILS
Boeing Renton Facility
Renton, Washington

By: APS	Date: 10/08/13	Project No. 8888
amec		DRAWING C-6

Plot Date: 10/08/13 - 5:21pm, Plotted by: adam.stenberg
Drawing Path: S:\8888_2006\069_EDR\, Drawing Name: Building 4-78 and 79_WorkPlanDesign_092313_20scale.dwg



PIPING TRENCH SECTION

SCALE: NTS

A
C-7

DETAIL A NOTES

1. PIPING IS SPACED A MINIMUM OF 2" APART FROM EACH OTHER AND SIDEWALL.
2. CROSS SECTION WIDTH TO VARY.
3. PIPING BEDDING ACCEPTABLE FOR BACKFILL IF FREE OF ROCKS GREATER THAN 1/2".
4. ALL JOINTS TO BE SEALED.
5. AN EXTRA 1 INCH SDR 11 HDPE PIPE WILL BE LAID IN THE TRENCHING, FOR POSSIBLE FUTURE USE AS AN AIR SPARGE LINE. THIS LINE SHOULD BE LAID ON THE OUTSIDE EDGE OF THE TRENCH AND ONLY 1" MINIMUM CLEARANCE IS REQUIRED FROM SIDEWALLS AND 1" FROM OTHER PIPES.

GENERAL NOTES

1. PIPING WILL BE SUPPORTED BY UNISTRUT (AT MINIMUM EVERY 4 FEET) MOUNTED TO THE FACE OF THE BUILDING. PRIOR TO MOUNTING, DRILLING LOCATIONS MUST BE SURVEYED FOR LEAD AND ASBESTOS.
2. SVE-05 AND SVE-06 TO BE PLACED 2" DEEPER THAN 3" PIPE IN ORDER TO PASS UNDER 3" PIPE TO MANIFOLD 3. PIPING WILL BE LAID FROM MANIFOLD 2 TO SVE-05 AND SVE-06 TO DRAIN CONDENSATE BACK TO THE WELLS.
3. PIPING SHALL BE LAID LEVEL OR SLOPED UNIFORMLY TO DRAIN BACK TO SVE WELLS OR TOWARD MANIFOLD. NO LOW SPOTS IN MIDDLE OF PIPE RUNS.
4. CEMENT / BENTONITE GROUT SHALL BE 5% BENTONITE BY WEIGHT.
5. CEMENT/BENTONITE GROUT BARRIER PLACEMENT WILL BE EVALUATED DURING CONSTRUCTION. PLACEMENT MAY BE ADJUSTED OR ADDITIONAL BARRIERS WILL BE ADDED DURING INSTALLATION TO PREVENT AIR FLOW THROUGH BACKFILL.
6. ALL PIPING IN MANIFOLDS SHALL BE SCH 80 PVC.
7. ALL UNDERGROUND PIPING SHALL BE SDR 11 HDPE.
8. ALL ABOVE GROUND PIPING BETWEEN MANIFOLDS AND WELLS SHALL BE SCH 40 PVC.
9. SPARE 1-INCH SDR-11 HDPE LINE TO BE PLACED IN TRENCH AS SHOWN AND SEALED AT EACH END
10. MINIMUM WIDTH FOR TRENCHING THROUGH CONCRETE PAVEMENT IS 24 INCHES. IF TRENCHING THROUGH ASPHALT, MINIMUM WIDTH IS AS NOTED.

LEGEND

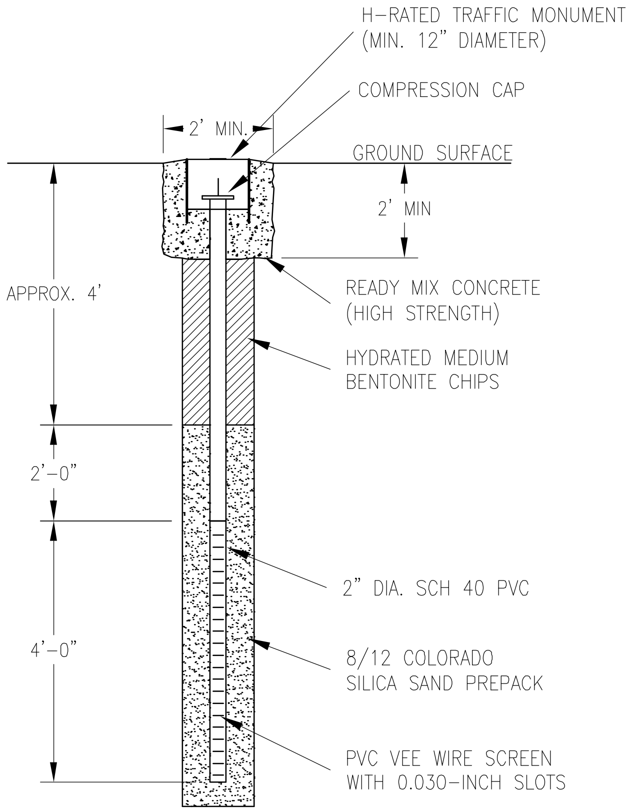
🟪	1" Ø PIPE
🟩	2" Ø PIPE
🟦	3" Ø PIPE
🟪	SVE PIPE MANIFOLD
🟧	CEMENT/BENTONITE FLOW BARRIER

BOEING

BUILDING 4-78/79
SOIL VAPOR EXTRACTION SYSTEM
TRENCHING SCHEMATIC AND TRENCH DETAILS
Boeing Renton Facility
Renton, Washington

By: APS	Date: 10/08/13	Project No. 8888
amec		DRAWING C-7

Plot Date: 10/08/13 - 5:07pm, Plotted by: adam.stenberg
Drawing Path: S:\8888_2006\069_EDR\, Drawing Name: Building 4-78 and 79_WorkPlanDesign PID_092313.dwg

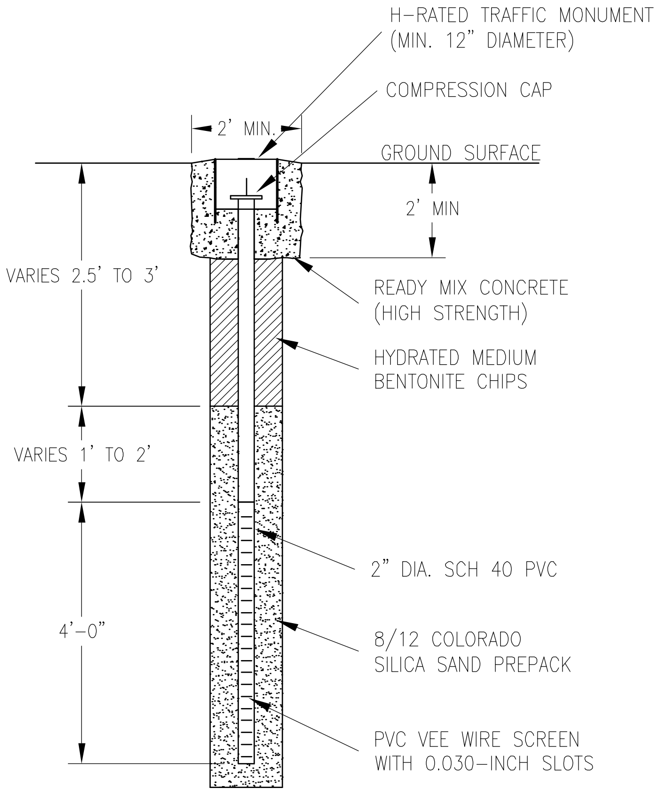


AOC-003

① TYPICAL INJECTION WELL DETAIL

(TOTAL DEPTH 10')

NOT TO SCALE

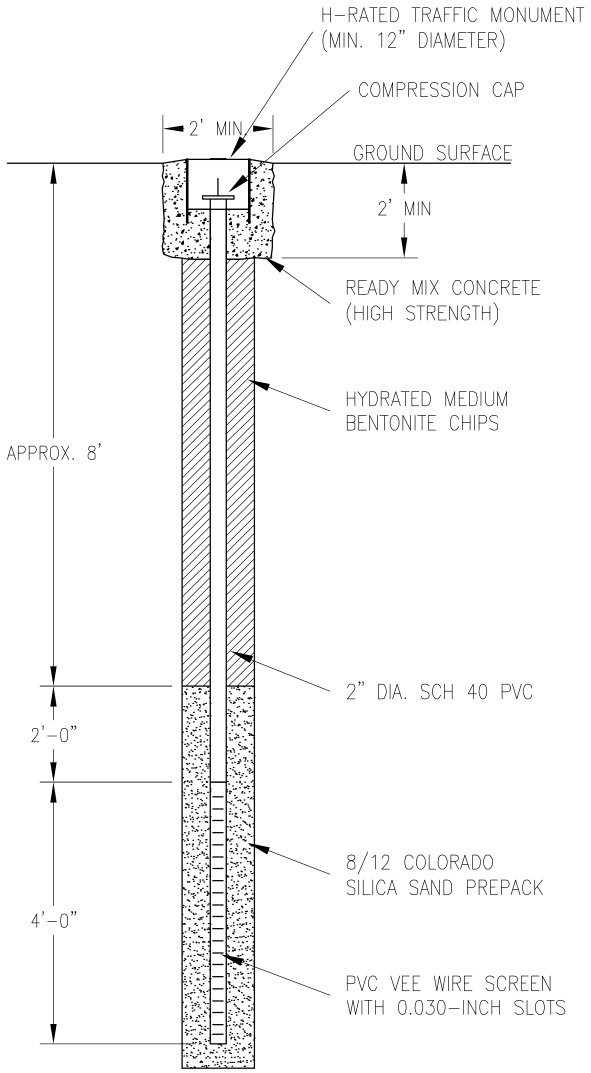


AOC-004

② TYPICAL INJECTION WELL DETAIL

(TOTAL DEPTH 7.5' TO 9')

NOT TO SCALE

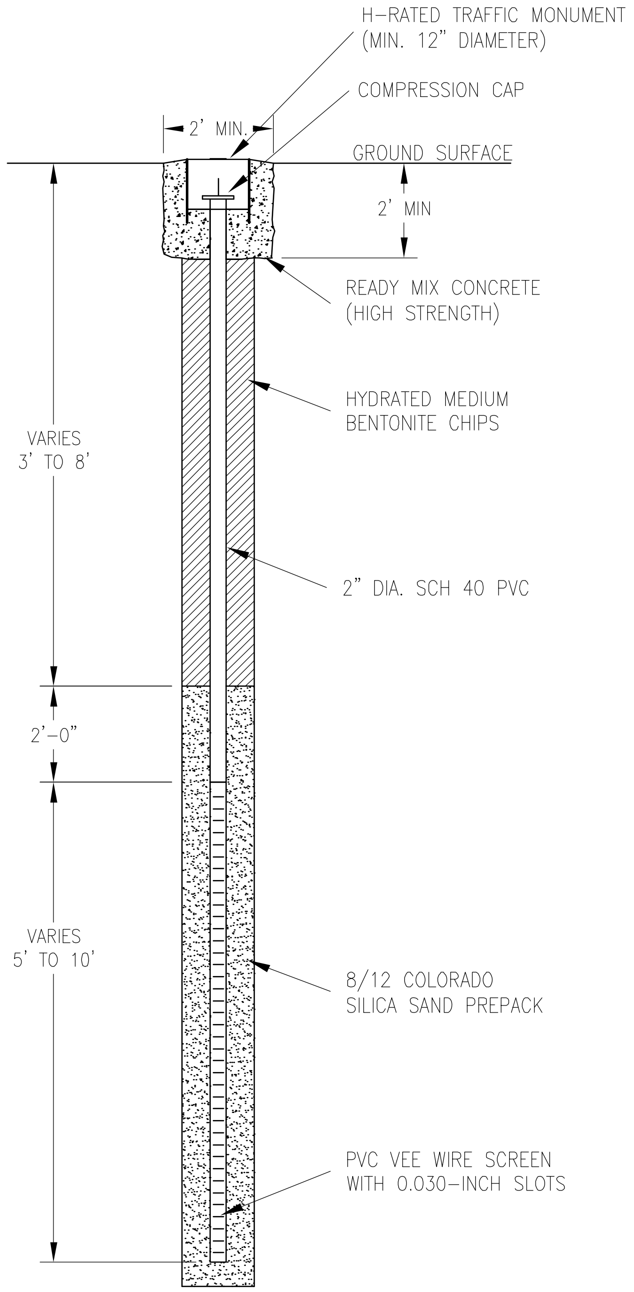


SWMU 172/174

③ TYPICAL INJECTION WELL DETAIL

(TOTAL DEPTH 14')

NOT TO SCALE



BUILDING 4-78/79 SWMU/AOC GROUP

④ TYPICAL INJECTION WELL DETAIL

(TOTAL DEPTH 10' TO 20')

NOT TO SCALE

NOTE

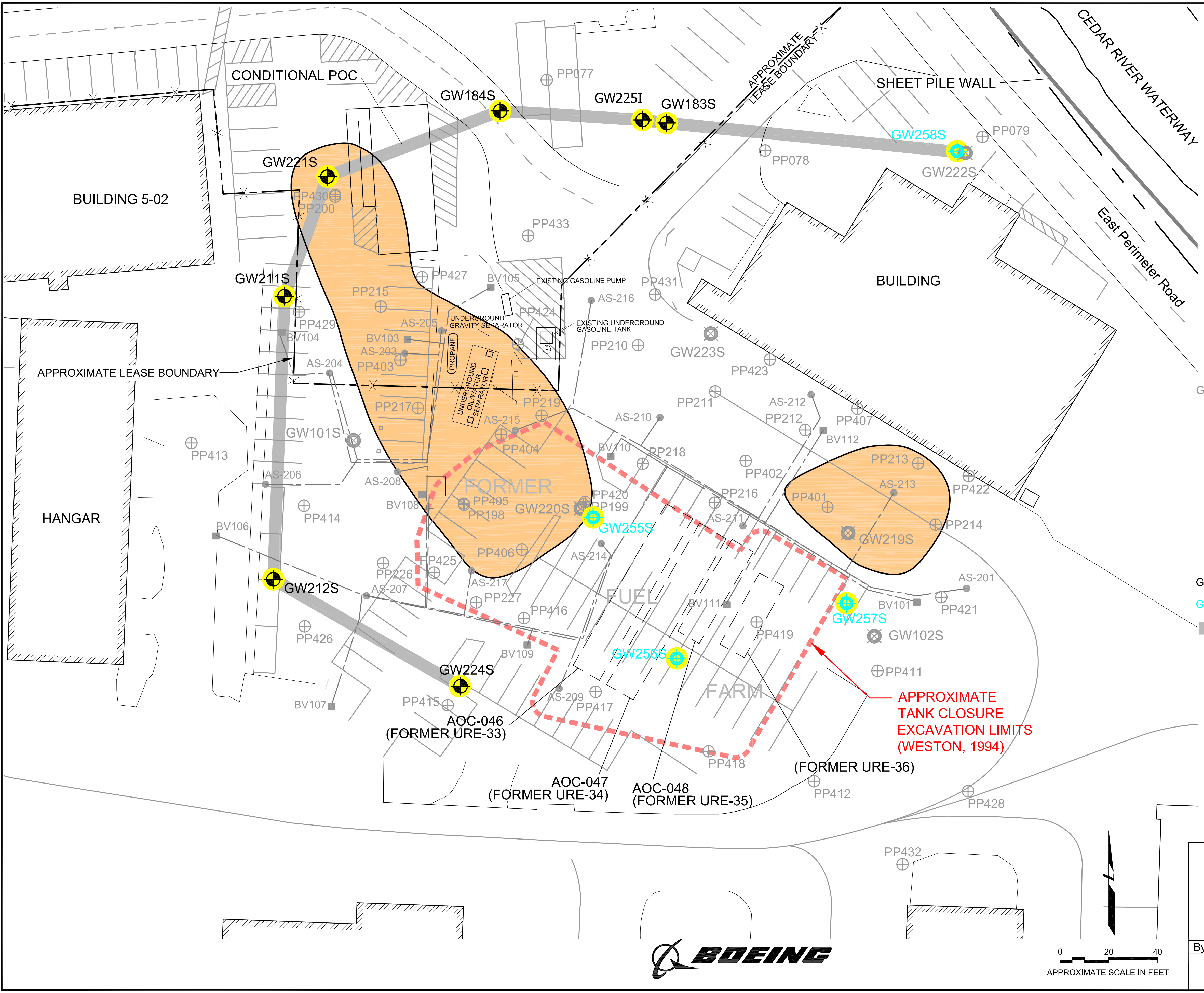
1. WELL DESIGN BASED ON SOIL LITHOLOGY FROM NEARBY WELL LOGS AND THE CROSS SECTIONS PROVIDED IN THE REMEDIAL INVESTIGATION REPORT. DEPTH OF SCREENS WILL BE ADJUSTED BY GEOLOGIST BASED ON OBSERVATIONS OF LITHOLOGY DURING INSTALLATION.

BOEING

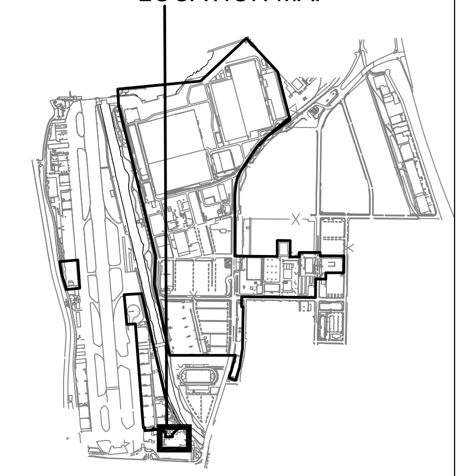
BIOREMEDIATION INJECTION WELL DETAILS
Boeing Renton Facility
Renton, Washington

By: APS	Date: 03/18/14	Project No. 8888
amec		DRAWING C-8

Plot Date: 03/18/14 - 10:55am, Plotted by: mike.stenberg
Drawing Path: S:\8888_2006\069_EDR\, Drawing Name: SWMU-172 and 174_WorkPlanDesign_031814.dwg



FORMER FUEL FARM AOC GROUP LOCATION MAP



BOEING RENTON FACILITY MAP

LEGEND

PP420 ⊕	PUSH-PROBE SAMPLE LOCATION
GW223S ⊗	ABANDONED MONITORING WELL
AS-204 ●	ABANDONED AIR SPARGING WELL
BV112 ■	ABANDONED BIOVENTING WELL
— · —	ABANDONED LINES
—x—	FENCE
▨	TPH-JET SOIL AND GROUNDWATER SOURCE AREAS AS IDENTIFIED IN THE 1999 REMEDIAL INVESTIGATION. CONCENTRATIONS AND BOUNDARIES MAY NO LONGER BE REPRESENTATIVE OF CURRENT CONDITIONS.

COMPLIANCE MONITORING NETWORK

GW101S ⊕	EXISTING MONITORING WELL
GW256S ⊕	NEW SHALLOW MONITORING WELL
▬	CONDITIONAL POINT OF COMPLIANCE
HIGHLIGHTED	WELLS INCLUDED IN MONITORING NETWORK

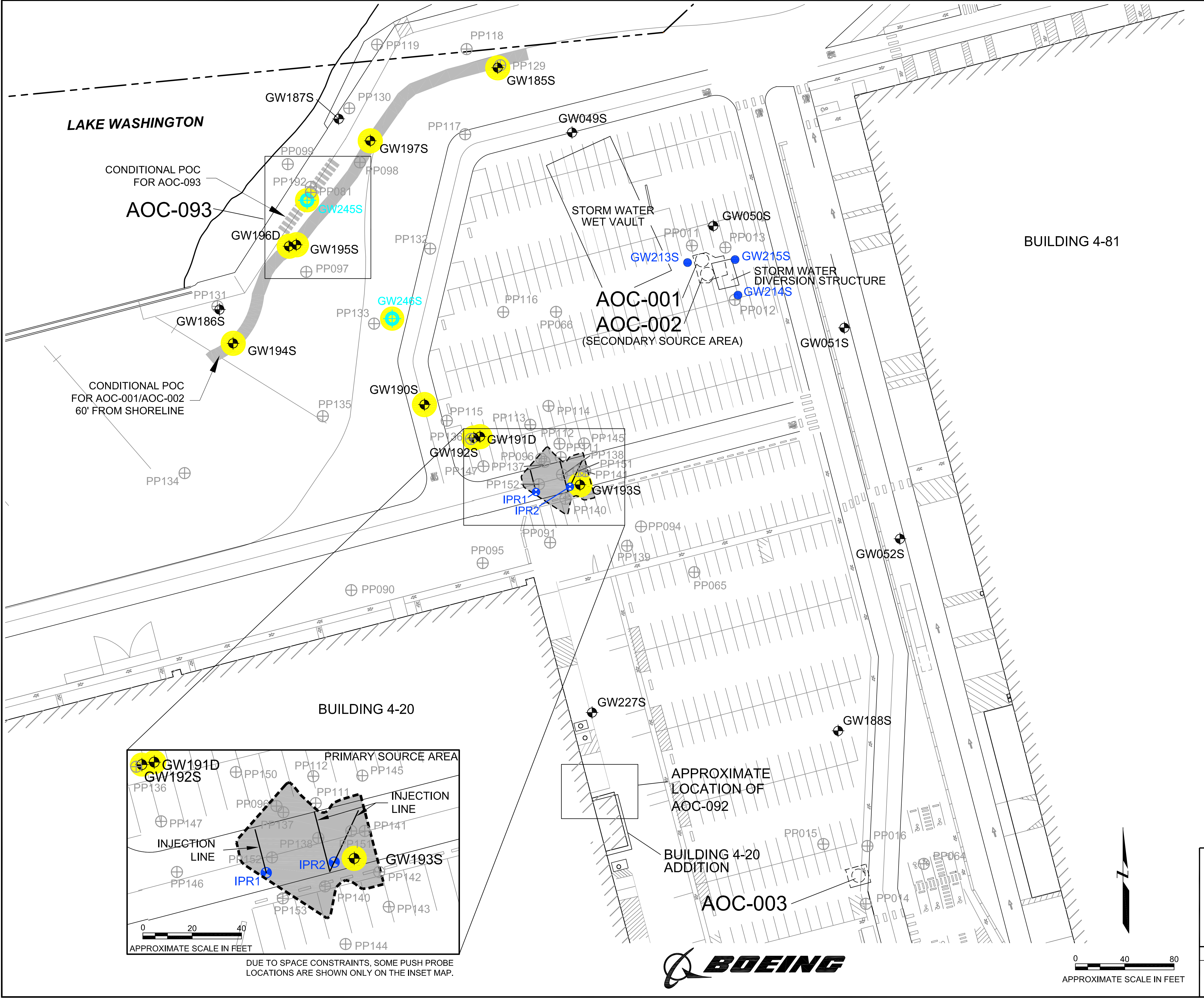
NOTES

1. BASEMAP COMPILED BY DUANE HARTMAN & ASSOCIATES, INC., DECEMBER 1994.
2. PUSH-PROBE LOCATIONS FROM FINAL REMEDIAL INVESTIGATION REPORT (WESTON, 2001).
3. PIPING LOCATIONS APPROXIMATE.
4. 'S' DESIGNATION INDICATES WELL SCREENED LESS THAN 18 FEET IN DEPTH.
'I' DESIGNATION INDICATES WELL SCREENED GREATER THAN 20 FEET IN DEPTH.

FORMER FUEL FARM
CLEANUP ACTION LAYOUT
Boeing Renton Facility
Renton, Washington

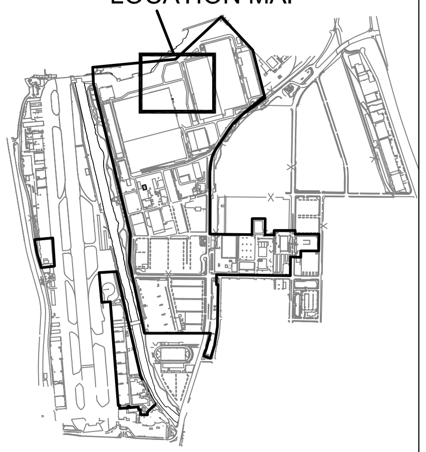
By: APS	Date: 10/08/13	Project No. 8888
amec		DRAWING C-9

Plot Date: 10/08/13 - 5:34pm, Plotted by: adam.stenberg
Drawing Path: S:\8888_2006\069_EDR\, Drawing Name: FormerFuelFarm_ProposedCleanupAction_092313.dwg



DUE TO SPACE CONSTRAINTS, SOME PUSH PROBE LOCATIONS ARE SHOWN ONLY ON THE INSET MAP.

AOC-001 AND AOC-002
LOCATION MAP



BOEING RENTON
FACILITY MAP

LEGEND

PP011 ⊕ PUSH-PROBE SAMPLE LOCATION

— — — APPROXIMATE PROPERTY LINE

▨ APPROXIMATE NOVEMBER 2005 EXCAVATION AREA, SHOWING EXISTING REMEDIATION PORTS AND LINES.

BIOREMEDIATION KEY

GW215S ● EXISTING ELECTRON DONOR INJECTION WELL

IPR1 ⊗ EXISTING INJECTION PIPE RISER

COMPLIANCE MONITORING NETWORK

GW050S ⊕ EXISTING MONITORING WELL

GW245S ⊕ NEW SHALLOW MONITORING WELL

▬ CONDITIONAL POINT OF COMPLIANCE

HIGHLIGHTED WELLS INCLUDED IN MONITORING NETWORK

NOTES

1. HORIZONTAL DATUM:
WASHINGTON STATE COORDINATE SYSTEM
NORTH ZONE NAD83 (91)
VERTICAL DATUM:
NATIONAL GEODETIC VERTICAL DATUM (NGVD1929)

2. BASEMAP COMPILED BY DUANE HARTMAN & ASSOCIATES, INC., DECEMBER 1994

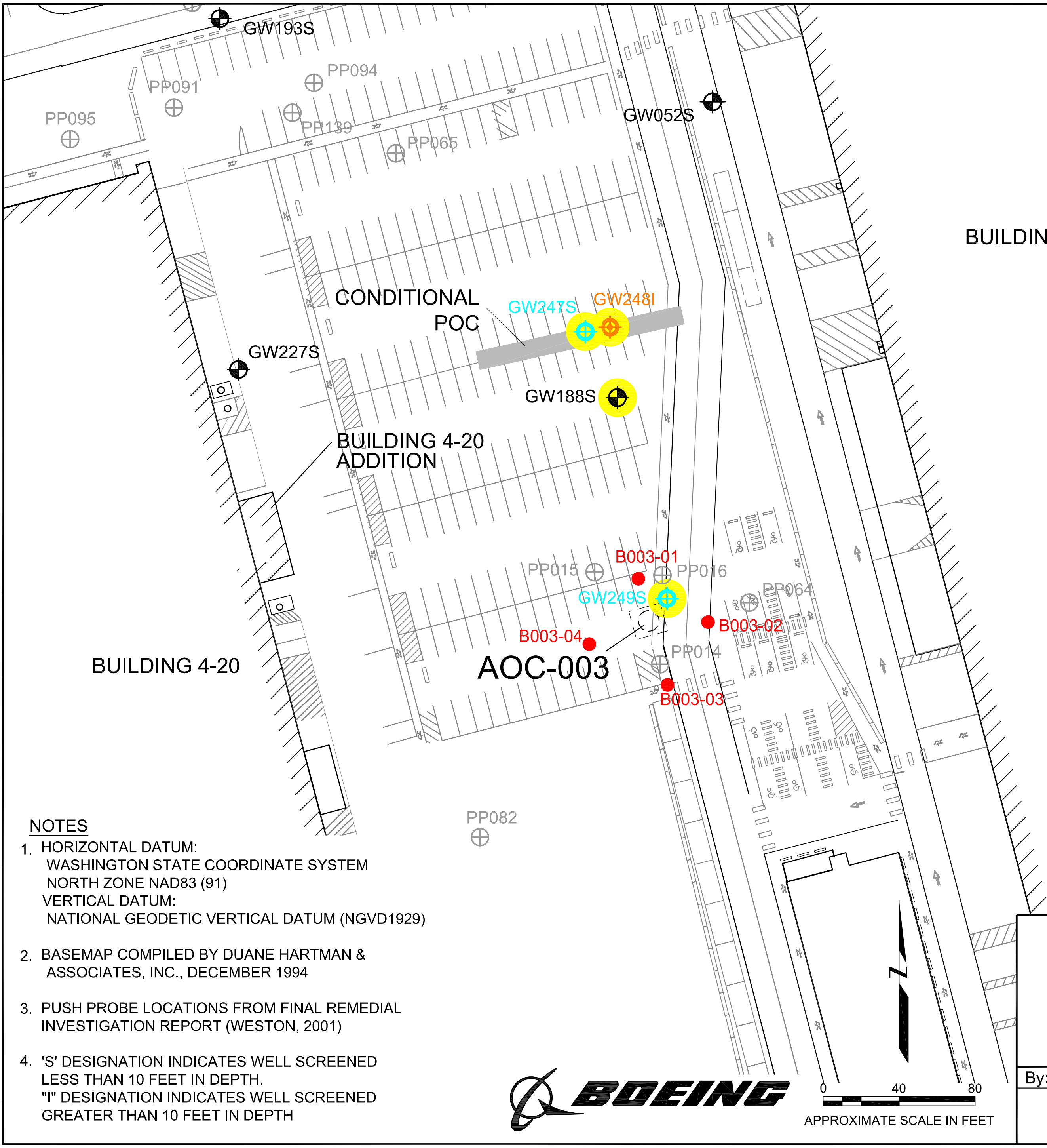
3. 'S' DESIGNATION INDICATES WELL SCREENED LESS THAN 24 FEET IN DEPTH.
'D' DESIGNATION INDICATES WELL SCREENED GREATER THAN 24 FEET IN DEPTH.

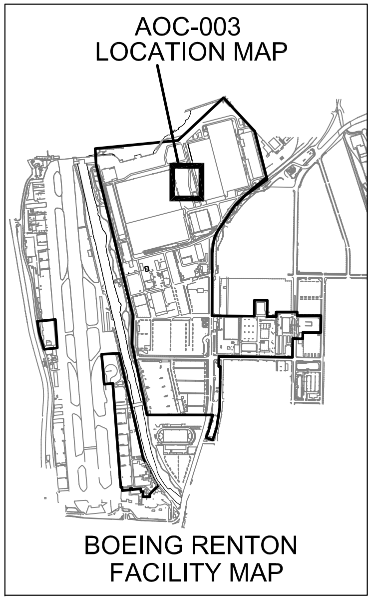
BOEING

AOC-001, AOC-002 and AOC-093
CLEANUP ACTION LAYOUT
Boeing Renton Facility
Renton, Washington

By: APS	Date: 10/08/13	Project No. 8888
amec		DRAWING C-10

Plot Date: 10/08/13 - 5:41pm, Plotted by: adam.stenberg
Drawing Path: S:\8888_2006\069_EDR\, Drawing Name: AOC-001-002_ProposedCleanupAction_092413.dwg





LEGEND

PP016 ⊕	PUSH-PROBE SAMPLE LOCATION

BIOREMEDIATION KEY

B003-01 ●	NEW BIOREMEDIATION INJECTION WELL

COMPLIANCE MONITORING NETWORK

GW188S ⊕	EXISTING MONITORING WELL
GW247S ⊕	NEW SHALLOW MONITORING WELL
GW248I ⊕	NEW INTERMEDIATE MONITORING WELL
▬	CONDITIONAL POINT OF COMPLIANCE
HIGHLIGHTED	WELLS INCLUDED IN MONITORING NETWORK

NOTES

1. HORIZONTAL DATUM:
   WASHINGTON STATE COORDINATE SYSTEM
   NORTH ZONE NAD83 (91)
   VERTICAL DATUM:
   NATIONAL GEODETIC VERTICAL DATUM (NGVD1929)
2. BASEMAP COMPILED BY DUANE HARTMAN & ASSOCIATES, INC., DECEMBER 1994
3. PUSH PROBE LOCATIONS FROM FINAL REMEDIAL INVESTIGATION REPORT (WESTON, 2001)
4. 'S' DESIGNATION INDICATES WELL SCREENED LESS THAN 10 FEET IN DEPTH.
   "I" DESIGNATION INDICATES WELL SCREENED GREATER THAN 10 FEET IN DEPTH

BOEING

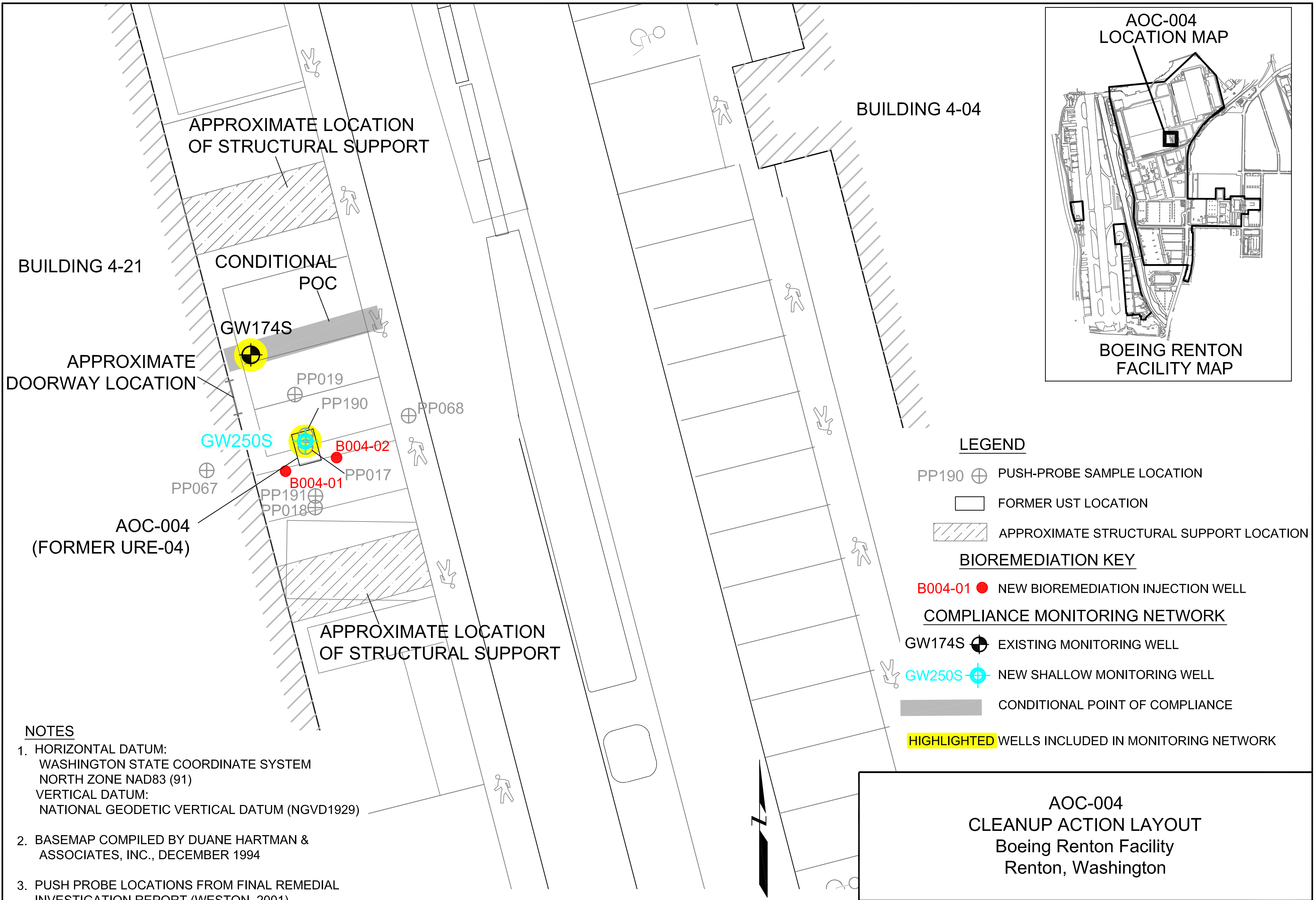
AOC-003
CLEANUP ACTION LAYOUT
Boeing Renton Facility
Renton, Washington

By: APS
Date: 10/10/13
Project No. 8888

amec

DRAWING **C-11**

Plot Date: 10/10/13 - 4:33pm, Plotted by: adam.stenberg
Drawing Path: S:\8888_2006\069_EDR\, Drawing Name: AOC-003_WorkPlanDesign_092413.dwg



LEGEND

PP190 ⊕	PUSH-PROBE SAMPLE LOCATION
☐	FORMER UST LOCATION
▨	APPROXIMATE STRUCTURAL SUPPORT LOCATION

BIOREMEDIATION KEY

B004-01 ●	NEW BIOREMEDIATION INJECTION WELL

COMPLIANCE MONITORING NETWORK

GW174S ⊕	EXISTING MONITORING WELL
GW250S ⊕	NEW SHALLOW MONITORING WELL
▬	CONDITIONAL POINT OF COMPLIANCE
HIGHLIGHTED	WELLS INCLUDED IN MONITORING NETWORK

NOTES

1. HORIZONTAL DATUM:
   WASHINGTON STATE COORDINATE SYSTEM
   NORTH ZONE NAD83 (91)
   VERTICAL DATUM:
   NATIONAL GEODETIC VERTICAL DATUM (NGVD1929)
2. BASEMAP COMPILED BY DUANE HARTMAN & ASSOCIATES, INC., DECEMBER 1994
3. PUSH PROBE LOCATIONS FROM FINAL REMEDIAL INVESTIGATION REPORT (WESTON, 2001)
4. 'S' DESIGNATION INDICATES WELL SCREENED LESS THAN 10 FEET IN DEPTH.

BOEING

AOC-004
CLEANUP ACTION LAYOUT
Boeing Renton Facility
Renton, Washington

By: APS	Date: 06/30/14	Project No. 8888
amec		DRAWING C-12

Plot Date: 06/30/14 - 3:35pm, Plotted by: adam.stenberg
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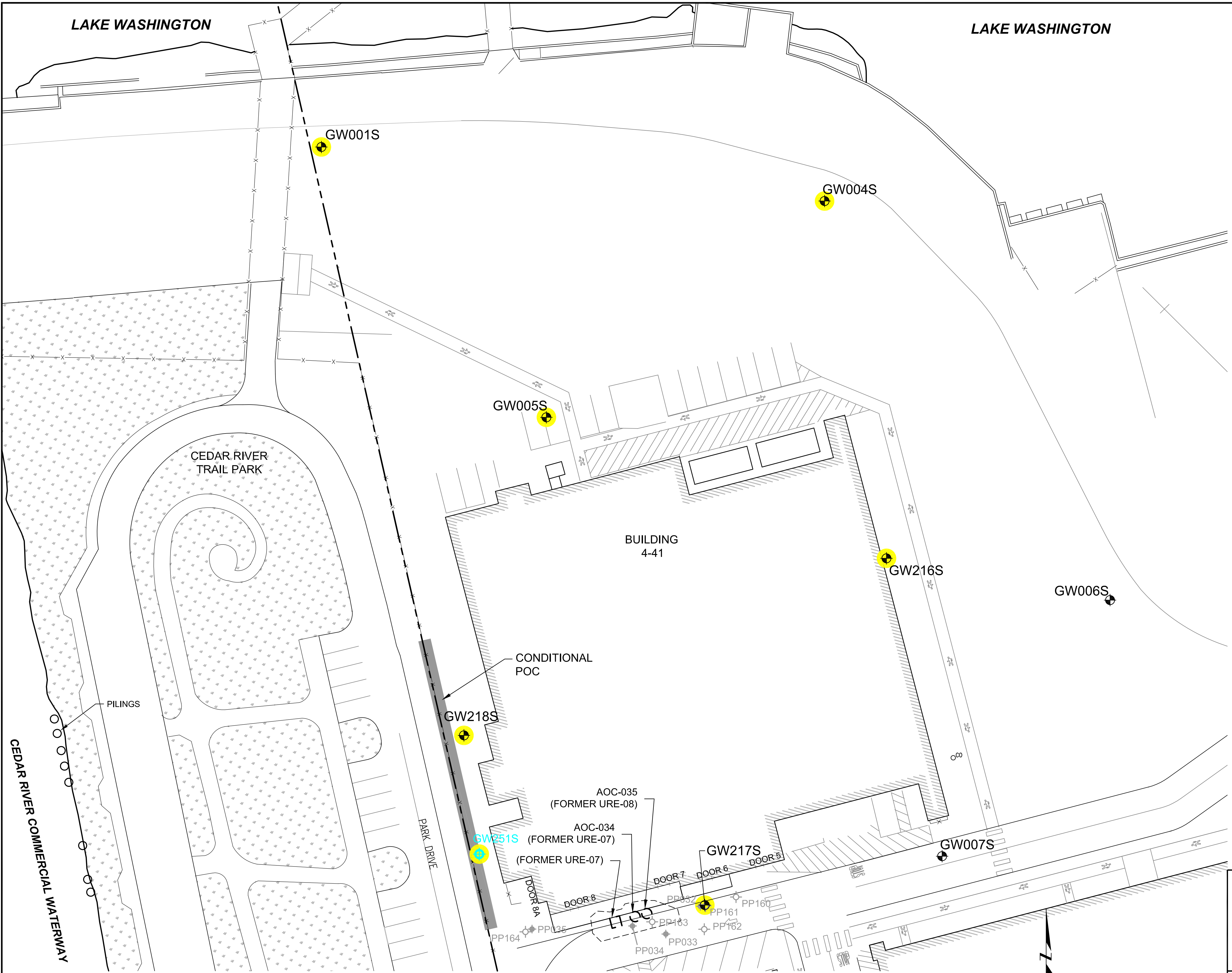

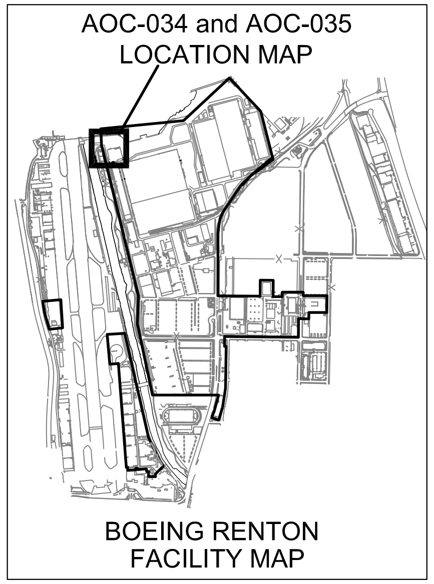

AOC-034 and AOC-035
LOCATION MAP

BOEING RENTON
FACILITY MAP

LEGEND

PP162 ⌖	12/14/2006 PUSH-PROBE SOIL AND GROUNDWATER SAMPLE LOCATION
PP032 ✦	HISTORICAL PUSH-PROBE SAMPLE LOCATION
┌ ┐	LIMITS OF PREVIOUS EXCAVATION
[ ]	FORMER UST LOCATION
—x—	FENCE

COMPLIANCE MONITORING NETWORK

GW218S ⊕	EXISTING MONITORING WELL
GW251S ⊕	NEW SHALLOW MONITORING WELL
▬	CONDITIONAL POINT OF COMPLIANCE
HIGHLIGHTED	WELLS INCLUDED IN MONITORING NETWORK

NOTES

1. HORIZONTAL DATUM:
   WASHINGTON STATE COORDINATE SYSTEM
   NORTH ZONE NAD83 (91)
   VERTICAL DATUM:
   NATIONAL GEODETIC VERTICAL DATUM (NGVD1929)
2. BASEMAP COMPILED BY DUANE HARTMAN & ASSOCIATES, INC., DECEMBER 1994
3. 'S' DESIGNATION INDICATES WELL SCREENED LESS THAN 24 FEET IN DEPTH.
   'D' DESIGNATION INDICATES WELL SCREENED GREATER THAN 24 FEET IN DEPTH.

0 25 50
APPROXIMATE SCALE IN FEET

BOEING

AOC-034 and AOC-035
CLEANUP ACTION LAYOUT
Boeing Renton Facility
Renton, Washington

By: APS
Date: 10/08/13
Project No. 8888
amec
DRAWING C-13

Plot Date: 10/08/13 - 5:54pm, Plotted by: adam.stenberg
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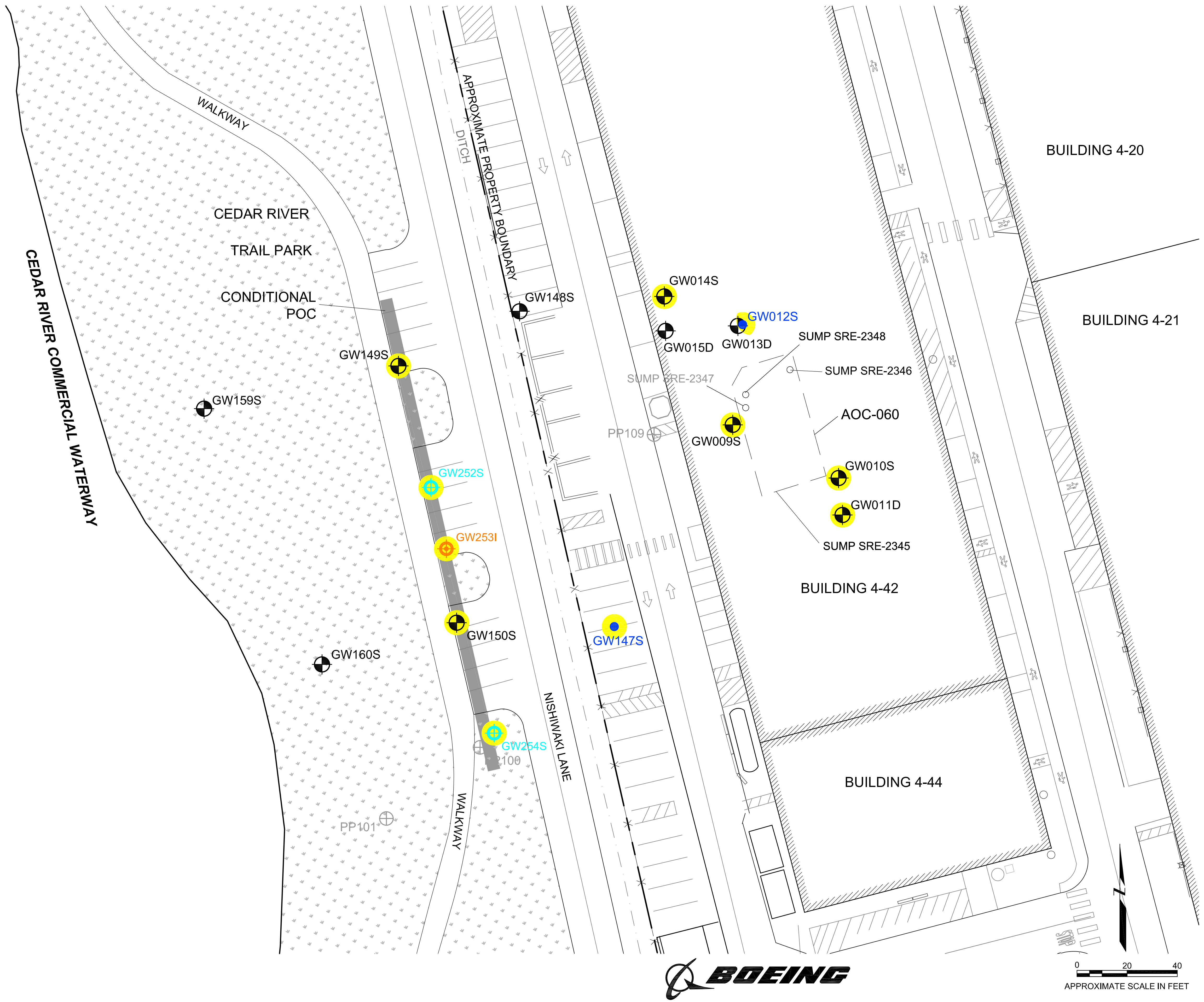
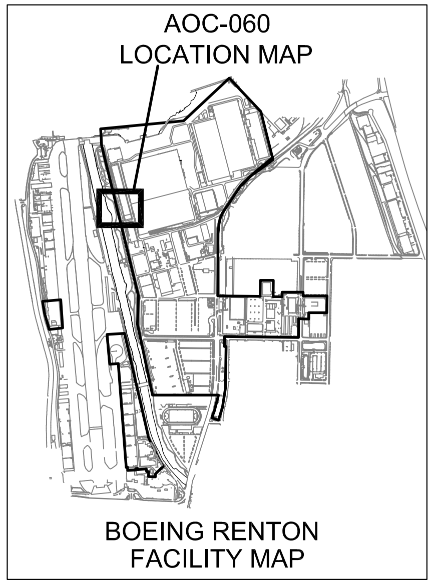




LEGEND

PP109 ⊕ PUSH-PROBE SAMPLE LOCATION

BIOREMEDIATION KEY

GW012S ● EXISTING ELECTRON DONOR INJECTION WELL

COMPLIANCE MONITORING NETWORK

GW050S ⊕ EXISTING MONITORING WELL

GW245S ⊕ NEW SHALLOW MONITORING WELL

GW255I ⊕ NEW INTERMEDIATE MONITORING WELL

▬ CONDITIONAL POINT OF COMPLIANCE

HIGHLIGHTED WELLS INCLUDED IN MONITORING NETWORK

NOTES

1. HORIZONTAL DATUM:
WASHINGTON STATE COORDINATE SYSTEM
NORTH ZONE NAD83 (91)
VERTICAL DATUM:
NATIONAL GEODETIC VERTICAL DATUM (NGVD1929)

2. BASEMAP COMPILED BY DUANE HARTMAN & ASSOCIATES, INC., DECEMBER, 1994

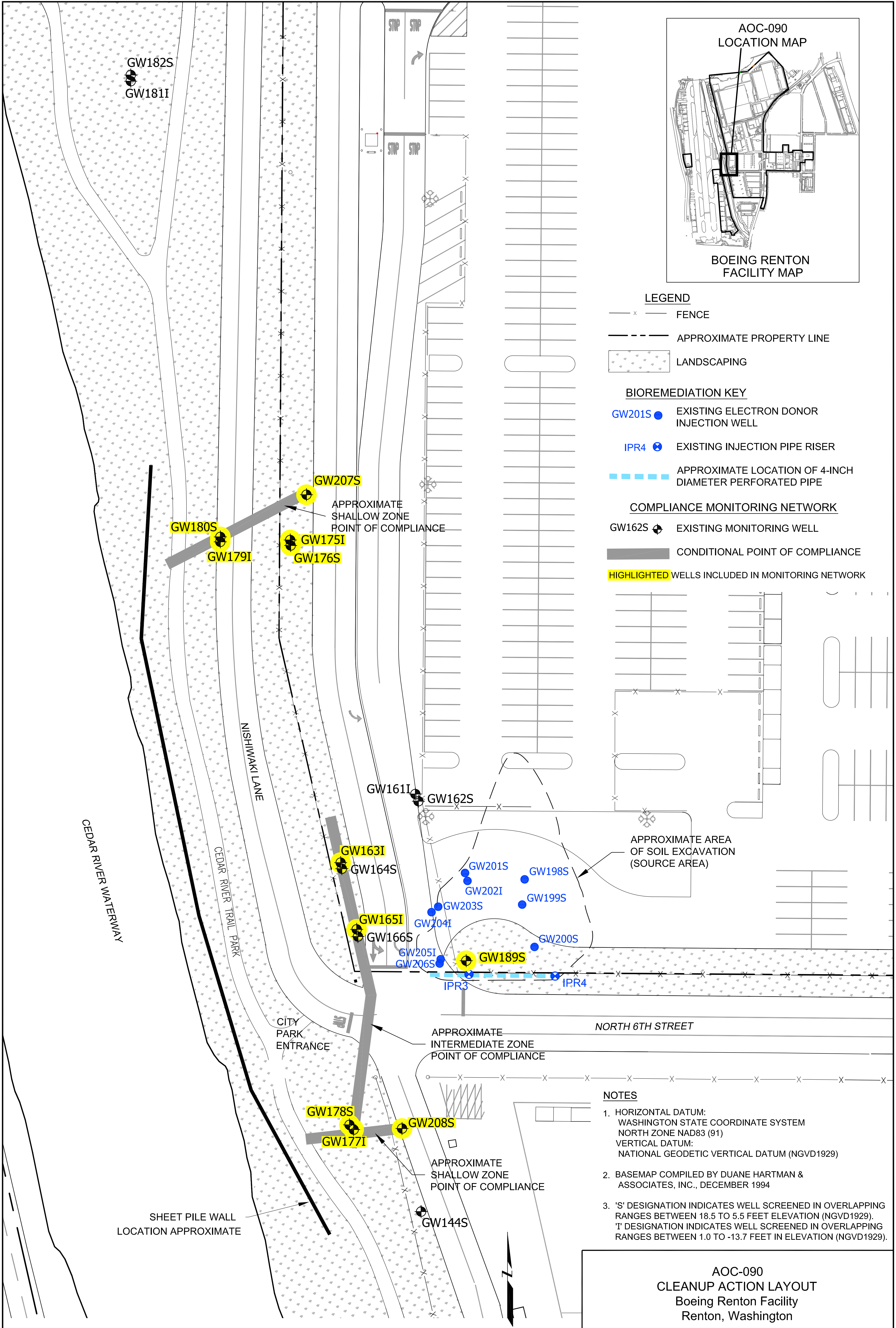
3. 'S' DESIGNATION INDICATES WELL SCREENED LESS THAN 15 FEET IN DEPTH.
'I' DESIGNATION INDICATES WELL SCREENED BETWEEN 15 AND 29 FEET.
'D' DESIGNATION INDICATES WELL SCREENED GREATER THAN 29 FEET IN DEPTH.

AOC-060
CLEANUP ACTION LAYOUT
Boeing Renton Facility
Renton, Washington

By: APS
Date: 10/22/13
Project No. 8888
DRAWING C-14

Plot Date: 10/22/13 - 4:48pm, Plotted by: adam.stenberg
Drawing Path: S:\8888_2006\069_EDR\, Drawing Name: AOC-060_ProposedCleanupAction_092413.dwg

Plot Date: 10/23/13 - 1:54pm, Plotted by: adam.stenberg
Drawing Path: S:\8888_2006\069_EDR\, Drawing Name: AOC-090_ProposedCleanupAction_091613.dwg



LEGEND

—x— FENCE

— - — APPROXIMATE PROPERTY LINE

▨ LANDSCAPING

BIOREMEDIATION KEY

GW201S ● EXISTING ELECTRON DONOR INJECTION WELL

IPR4 ⊗ EXISTING INJECTION PIPE RISER

▬ ▬ ▬ APPROXIMATE LOCATION OF 4-INCH DIAMETER PERFORATED PIPE

COMPLIANCE MONITORING NETWORK

GW162S ⊕ EXISTING MONITORING WELL

▬ CONDITIONAL POINT OF COMPLIANCE

HIGHLIGHTED WELLS INCLUDED IN MONITORING NETWORK

NOTES

1. HORIZONTAL DATUM:
WASHINGTON STATE COORDINATE SYSTEM
NORTH ZONE NAD83 (91)
VERTICAL DATUM:
NATIONAL GEODETIC VERTICAL DATUM (NGVD1929)

2. BASEMAP COMPILED BY DUANE HARTMAN & ASSOCIATES, INC., DECEMBER 1994

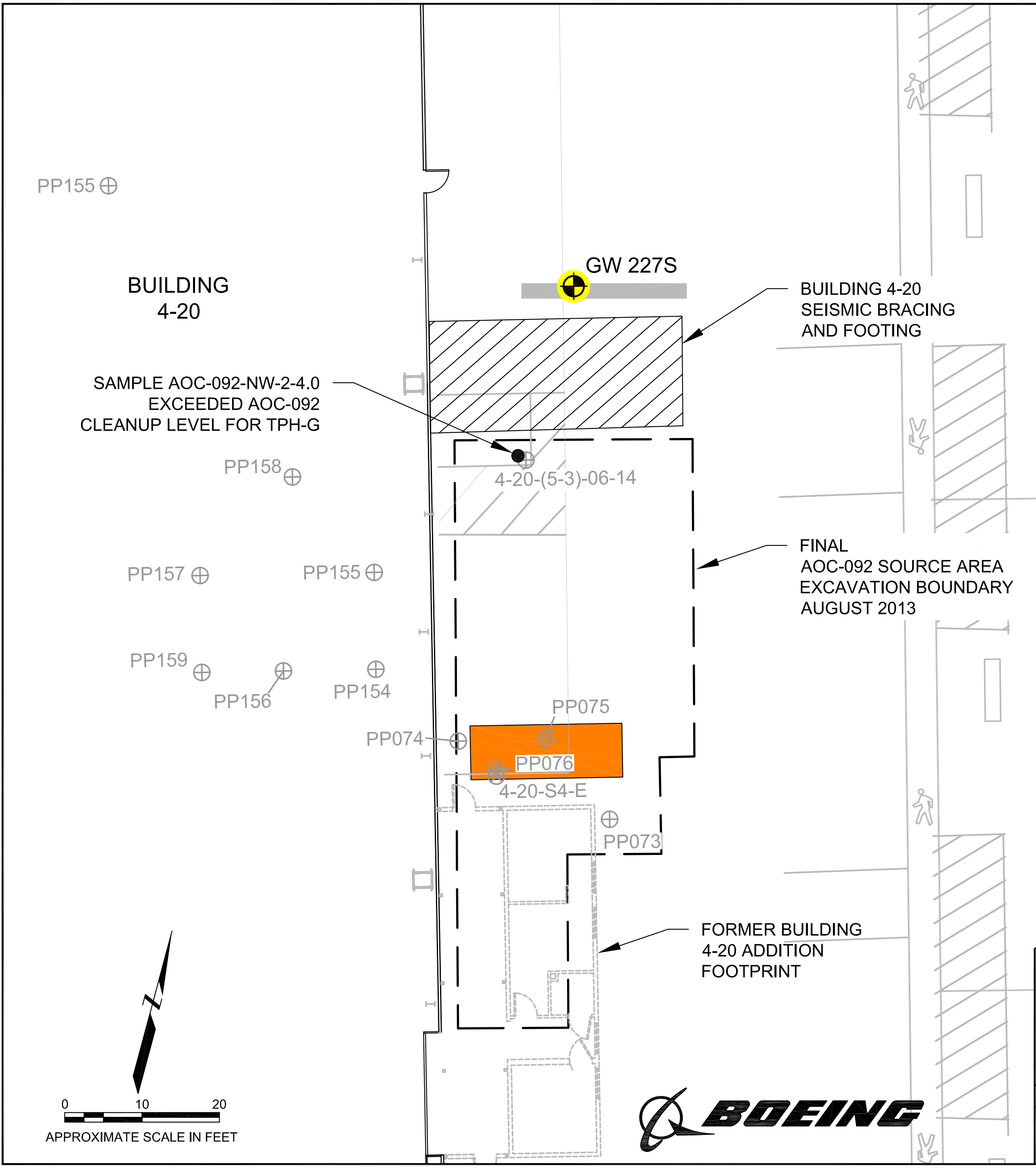
3. 'S' DESIGNATION INDICATES WELL SCREENED IN OVERLAPPING RANGES BETWEEN 18.5 TO 5.5 FEET ELEVATION (NGVD1929). 'I' DESIGNATION INDICATES WELL SCREENED IN OVERLAPPING RANGES BETWEEN 1.0 TO -13.7 FEET IN ELEVATION (NGVD1929).

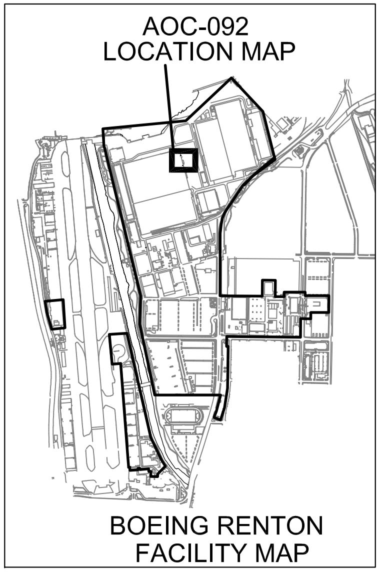
BOEING

0 25 50
APPROXIMATE SCALE IN FEET

AOC-090
CLEANUP ACTION LAYOUT
Boeing Renton Facility
Renton, Washington

By: APS
Date: 10/23/13
Project No. 8888
amec
DRAWING C-15





LEGEND

PP073 ⊕	PUSH-PROBE SAMPLE LOCATION
4-20-S4-E ⊗	SOIL SAMPLE LOCATION 4-20-S4-E COLLECTED AT 5' BGS
🟧	TPH-G SOIL SOURCE AND EXCAVATION AREA FROM CAP

COMPLIANCE MONITORING NETWORK

GW 227S ⊕	EXISTING MONITORING WELL
▬	CONDITIONAL POINT OF COMPLIANCE
HIGHLIGHTED	WELLS INCLUDED IN MONITORING NETWORK

NOTES

1. BASEMAP COMPILED FROM DATA SUPPLIED BY DUANE HARTMAN & ASSOCIATES, INC., DECEMBER, 1994 AND WESTON, 2001
2. PUSH PROBE LOCATIONS AND BUILDING 4-20 ADDITION FROM BUILDING 4-20 EXTERIOR, COLUMN S-4 (AOC-092) SOIL AND GROUNDWATER SAMPLING REPORT (WESTON, AUGUST 2001)
3. 'S' DESIGNATION INDICATES WELL SCREENED LESS THAN 15 FEET IN DEPTH.

AOC-092
CLEANUP ACTION LAYOUT
Boeing Renton Facility
Renton, Washington

By: MDS
Date: 10/28/13
Project No. 8888

amec

DRAWING **C-16**

Plot Date: 10/28/13 - 3:34pm, Plotted by: adam.stenberg
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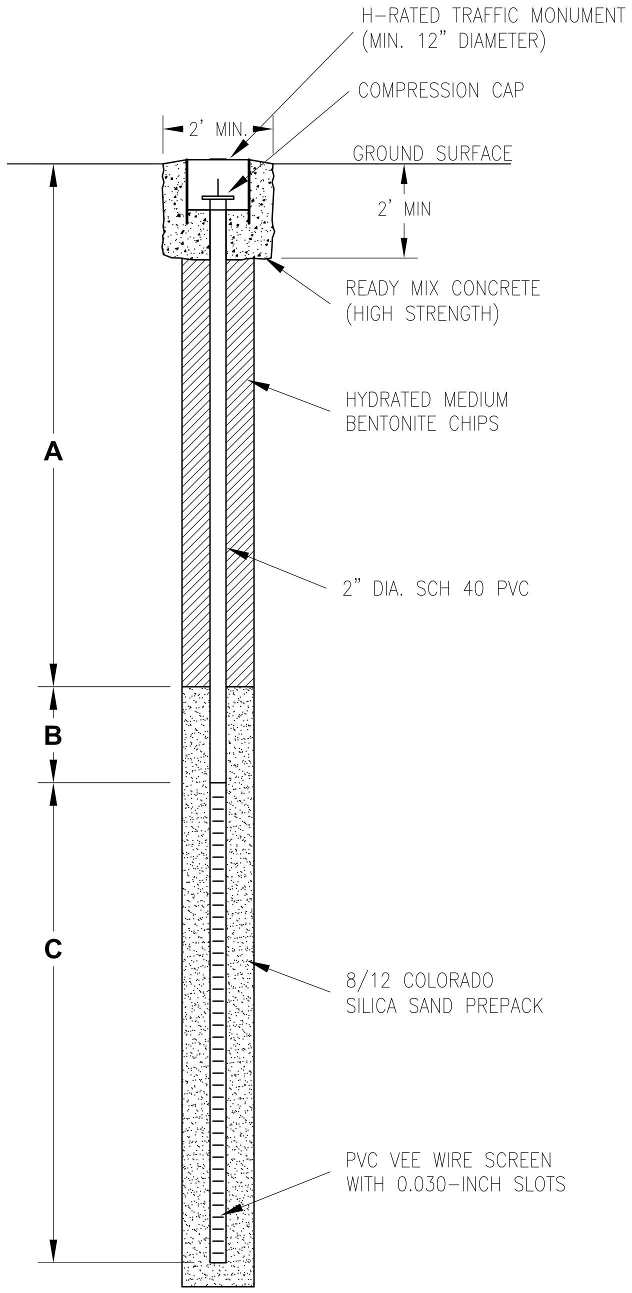


1 MONITORING WELL DETAIL

NOT TO SCALE

AOC/SWMU Group	Drawing Dimension	New Monitoring Wells		
		Shallow	Intermediate	Deep
SWMU-168	A	2' 0"	2' 0"	--
	B	2' 0"	2' 0"	--
	C	5' 0"	10' 0"	--
SWMU-172/ SWMU-174	A	3' 0"	6' 0"	--
	B	2' 0"	2' 0"	--
	C	10' 0"	10' 0"	--
Building 4-78/79	A	2' 0"	2' 0"	8' 0"
	B	2' 0"	2' 0"	2' 0"
	C	10' 0"	15' 0"	15' 0"
Former Fuel Farm	A	4' 0"	--	--
	B	2' 0"	--	--
	C	10' 0"	--	--
AOC-001/ AOC-002	A	2' 0"	--	--
	B	2' 0"	--	--
	C	10' 0"	--	--
AOC-003	A	2' 0"	8' 0"	--
	B	2' 0"	2' 0"	--
	C	10' 0"	10' 0"	--
AOC-004	A	2' 0"	--	--
	B	2' 0"	--	--
	C	10' 0"	--	--
AOC-034/ AOC-035	A	2' 0"	--	--
	B	2' 0"	--	--
	C	10' 0"	--	--
AOC-060	A	2' 0"	8' 0"	--
	B	2' 0"	2' 0"	--
	C	10' 0"	10' 0"	--
AOC-092	A	2' 0"	--	--
	B	2' 0"	--	--
	C	10' 0"	--	--
AOC-093*	A	2' 0"	--	--
	B	2' 0"	--	--
	C	10' 0"	--	--

* AOC-093 REQUIRES THE USE OF A HEAVY-DUTY SHERWOOD WELL MONUMENT SINCE THE WELL IS IN A TOW PATH.

NOTE:

1. WELL DEPTHS AND SCREEN INTERVALS ARE APPROXIMATE. FINAL DEPTH WILL BE DETERMINED BASED ON FIELD OBSERVATIONS.

BOEING

NEW MONITORING WELL DETAILS
Boeing Renton Facility
Renton, Washington

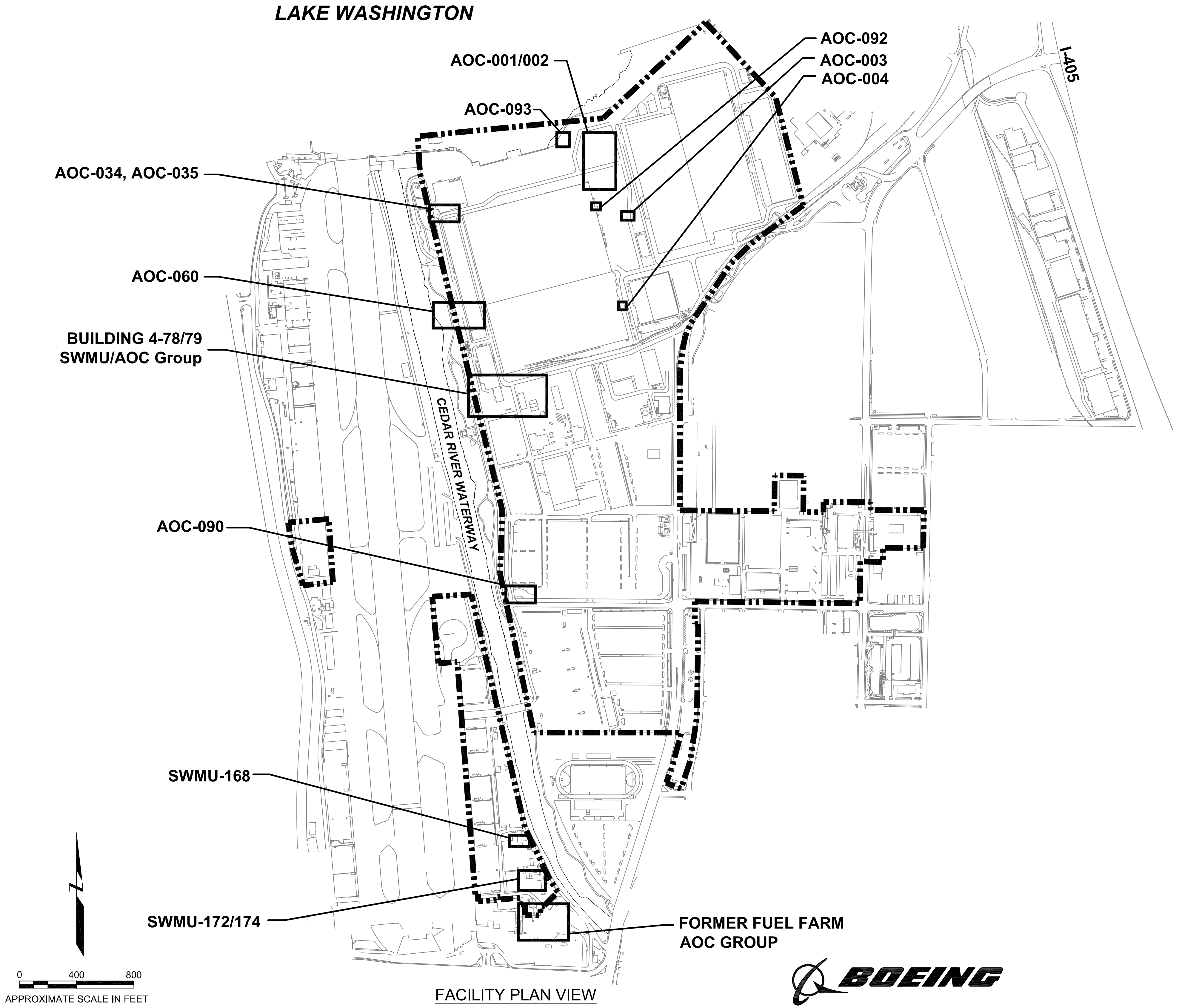
By: APS
Date: 10/08/13
Project No. 8888
amec
DRAWING C-17

Plot Date: 10/08/13 - 5:19pm, Plotted by: adam.stenberg
Drawing Path: S:\8888_2006\069_EDR\, Drawing Name: SWMU-172 and 174_WorkPlanDesign_092313.dwg

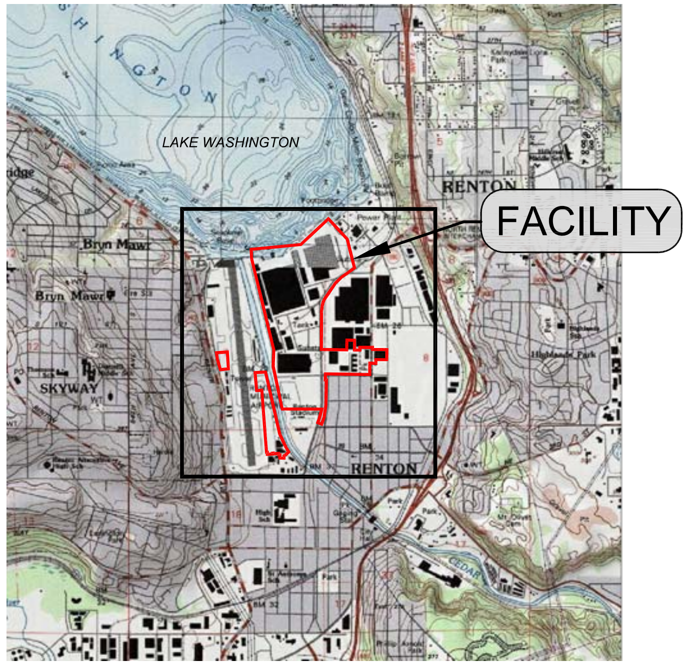
ENGINEERING DESIGN REPORT
PLANS AND SPECIFICATIONS
BOEING RENTON FACILITY
RENTON, WASHINGTON

DRAWING LIST

G-1	COVER SHEET
C-1	SWMU-168 CLEANUP ACTION LAYOUT
C-2	SWMU-172 AND SWMU-174 CLEANUP ACTION LAYOUT
C-3	SWMU-172 AND SWMU-174 SVE DETAILS
C-4	BUILDING 4-78/79 SWMU/AOC GROUP CLEANUP ACTION LAYOUT (OVERVIEW)
C-5	BUILDING 4-78/79 SWMU/AOC GROUP CLEANUP ACTION LAYOUT (CLOSE-UP)
C-6	BUILDING 4-78/79 SWMU/AOC GROUP HORIZONTAL SVE WELL DETAILS
C-7	BUILDING 4-78/79 SOIL VAPOR EXTRACTION SYSTEM TRENCHING SCHEMATIC
C-8	BIOREMEDIATION INJECTION WELL DETAILS
C-9	FORMER FUEL FARM CLEANUP ACTION LAYOUT
C-10	AOC-001, AOC-002 AND AOC-093 CLEANUP ACTION LAYOUT
C-11	AOC-003 CLEANUP ACTION LAYOUT
C-12	AOC-004 CLEANUP ACTION LAYOUT
C-13	AOC-034 AND AOC-35 CLEANUP ACTION LAYOUT
C-14	AOC-060 CLEANUP ACTION LAYOUT
C-15	AOC-090 CLEANUP ACTION LAYOUT
C-16	AOC-092 CLEANUP ACTION LAYOUT
C-17	NEW MONITORING WELL DETAILS
P-1	SWMU-172 AND SWMU-174 SOIL VAPOR EXTRACTION SYSTEM PROCESS AND INSTRUMENTATION DIAGRAM
P-2	BUILDING 4-78/79 SOIL VAPOR EXTRACTION SYSTEM PROCESS AND INSTRUMENTATION DIAGRAM



FACILITY PLAN VIEW



LEGEND

▭ GENERAL LOCATION OF SWMUs AND AOCs

-·-·- FACILITY BOUNDARY

NOTES

1. BASEMAP COMPILED BY DUANE HARTMAN & ASSOCIATES INC., DECEMBER, 1994

COVER SHEET
Boeing Renton Facility
Renton, Washington

By: APS
Date: 10/28/13
Project No. 8888
amec
DRAWING G-1

Plot Date: 10/28/13 - 10:39am, Plotted by: adam.stenberg
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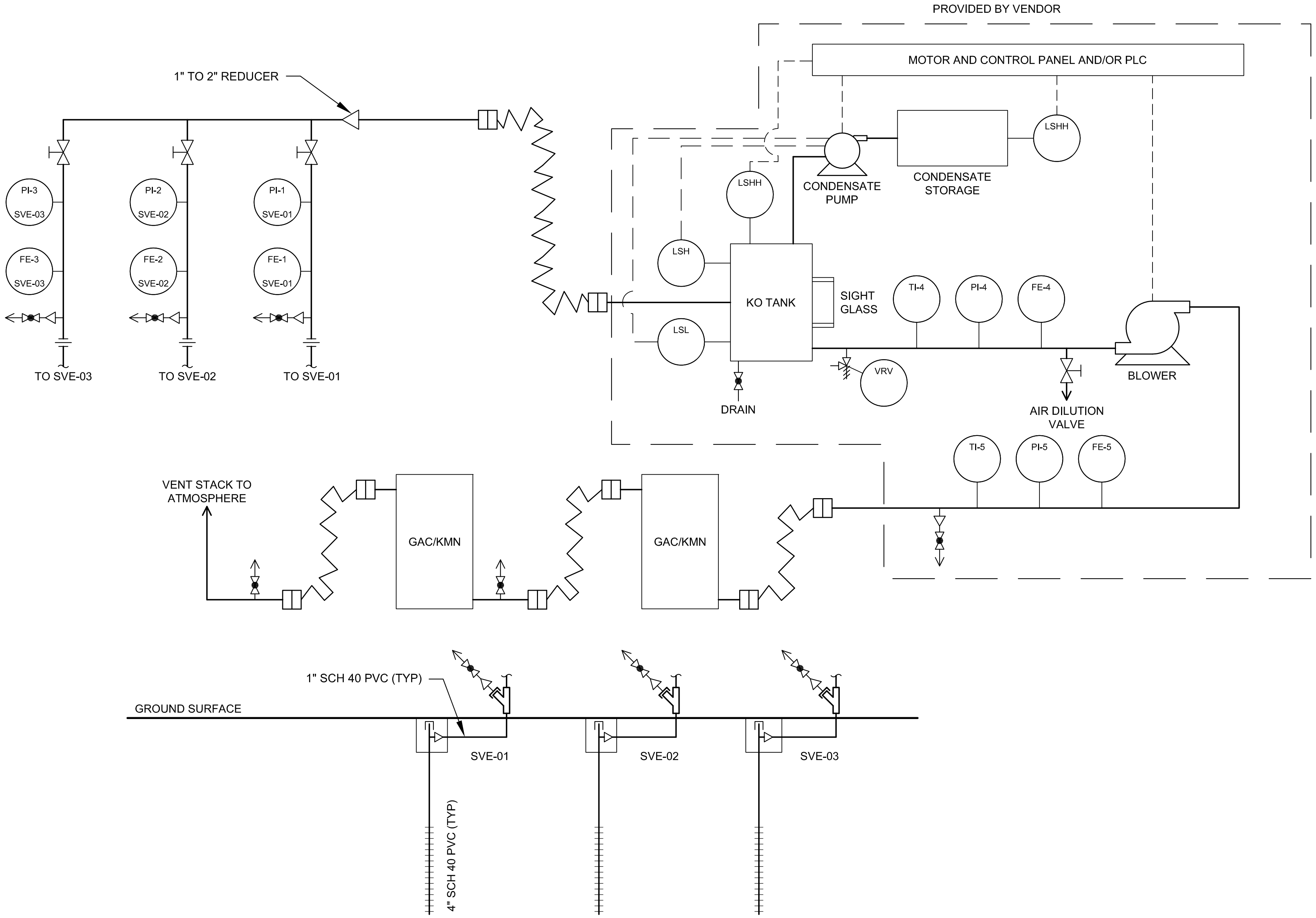
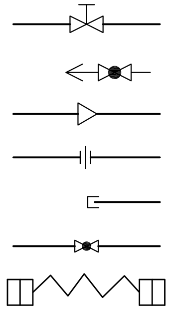


NOTES

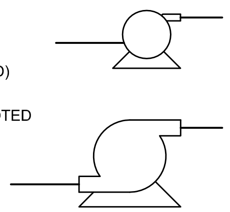
1. PIPING BETWEEN WELLS AND SVE SKID SHALL SLOPE TO WELLS OR SKID. NO LOW POINTS BETWEEN THE TWO LOCATIONS.
2. STACK SHALL BE MOUNTED ON BUILDING 5-09 NEAREST GW152S ON CORNER OF OVERHANG PER DRAWING C-3, DETAIL 1.
3. KO TANK SHALL HAVE VISIBLE SIGHT GLASS FOR LEVEL INDICATION.
4. KO TANK SHALL CONTAIN FLOAT SWITCH WITH AUTOMATIC SHUT DOWN DUE TO HIGH WATER LEVEL IN TANK.
5. PI-1, PI-2, AND PI-3 SHALL BE VACCUUM GAGES WITH RANGE 0 TO 15" WC.
6. PI-4 SHALL BE VACUUM GAGE CAPABLE OF -30" WC.
7. PI-5 SHALL BE PRESSURE GAGE CAPABLE OF 30" WC.
8. FLOW ELEMENTS ON MANIFOLDS SHALL BE KING INSTRUMENT COMPANY MODEL 7200-0151 WITH 0 TO 20 SCFM RANGE AND 1" FNPT OR AN EQUIVALENT FLOW ELEMENT APPROVED BY THE ENGINEER.
9. FE-4 AND FE-5 SHALL BE 2" AMETEK ROTRON FM20C125Q FLOW METERS CAPABLE OF 25 TO 125 SCFM OR EQUIVALENT, IF APPROVED BY THE ENGINEER.
10. BLOWER SHALL BE CAPABLE OF 50 SCFM AT -10" WC.
11. ALL GATE VALVES SHALL BE 1" SCH 80 PVC.
12. PIPING SHALL BE 1" SCH 40 PVC UNLESS OTHERWISE NOTED.
13. HOSE SHALL BE 2" PVC, CAM LOCKS SHALL BE ALUMINUM.
14. AUTOMATIC OPERATION OF THE SVE SYSTEM MAY BE BY PLC OR BY ELECTRICAL CONTROLS UTILIZING A COMBINATION OF SWITCHES AND RELAYS WIRED TO THE MOTOR CONTROL PANEL.
15. BLOWER AND CONDENSATE PUMP OPERATIONAL HOURS SHALL BE RECORDED (BY PLC OR HOUR METER). BLOWER SHALL SHUT DOWN IF CONDENSATE PUMP FAILS OR HIGH LEVEL SHUTOFF TRIGGERED IN KO TANK OR CONDENSATE STORAGE TANK.
16. ALL VALVES SHALL BE SPEARS OR EQUIVALENT OR APPROVED BY ENGINEER.
17. ABOVEGROUND PIPING RUNS MOUNTED ON BUILDING SHALL BE SCH 40 PVC SUPPORTED EVERY 4'.

PIPING SYMBOLS



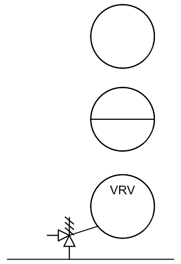
GATE VALVE
1/4" NPT SAMPLE PORT (NORMALLY CLOSED)
REDUCER, 4" TO 1" UNLESS OTHERWISE NOTED
UNION
CAP
BALL VALVE
FLEX HOSE WITH CAMLOCK FITTINGS

EQUIPMENT SYMBOLS



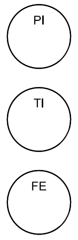
CONDENSATE PUMP
BLOWER

INSTRUMENT LEGEND



FIELD MOUNTED
CONTROL PANEL MOUNTED
VACUUM RELIEF VALVE

INSTRUMENT LEGEND CON'T



PRESSURE INDICATOR
TEMPERATURE INDICATOR
FLOW ELEMENT (PITOT TUBE)

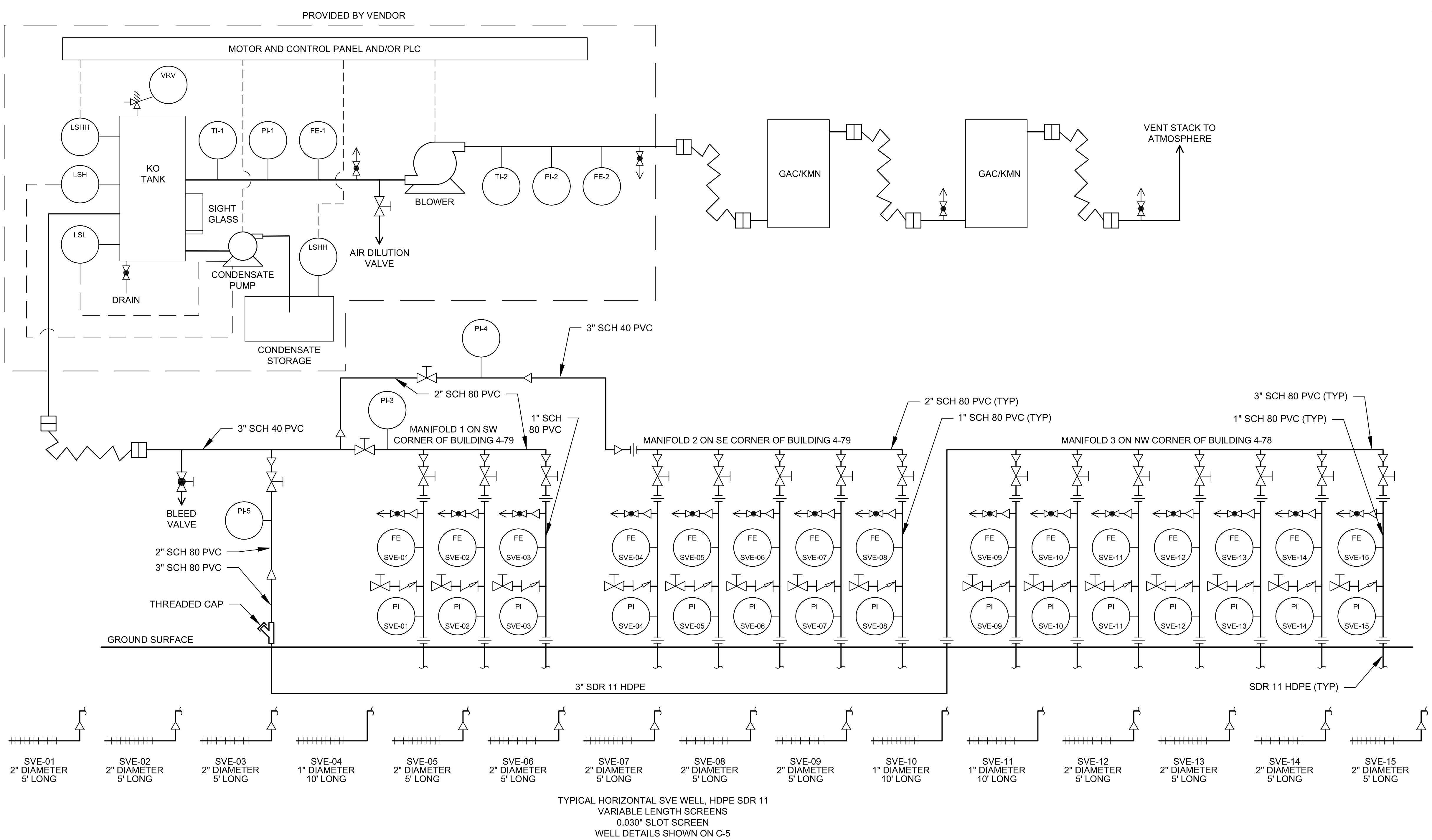
ABBREVIATIONS

TYP	TYPICAL
PVC	POLYVINYL CHLORIDE
SCH	SCHEDULE
GAC	GRANULAR ACTIVATED CARBON
KMN	POTASSIUM PERMANGANATE
KO	KNOCKOUT
LSH	LEVEL SWITCH HIGH
LSHH	LEVEL SWITCH HIGH HIGH
LSL	LEVEL SWITCH LOW
PLC	PROGRAMMABLE LOGIC CONTROLLER

SWMU-172 and SWMU-174
SOIL VAPOR EXTRACTION SYSTEM
PROCESS AND INSTRUMENTATION DIAGRAM
Boeing Renton Facility
Renton, Washington

By: APS
Date: 06/18/14
Project No. 8888
DRAWING P-1

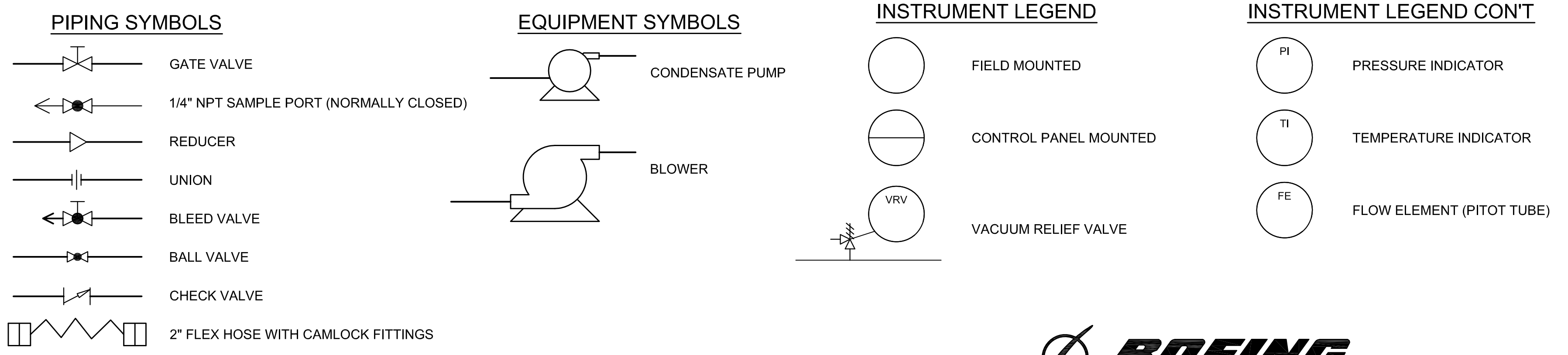
Plot Date: 06/18/14 - 9:45am, Plotted by: adam.stenberg
Drawing Path: S:\8888_2006\069_EDR\, Drawing Name: SWMU-172 and 174_WorkPlanDesign_032414.dwg



TYPICAL HORIZONTAL SVE WELL, HDPE SDR 11
VARIABLE LENGTH SCREENS
0.030" SLOT SCREEN
WELL DETAILS SHOWN ON C-5

NOTES

1. ALL UNDERGROUND PIPING SHALL BE HDPE SDR 11.
2. ALL MANIFOLDS SHALL BE SCH 80 PVC.
3. ABOVEGROUND PIPING RUNS MOUNTED ON BUILDINGS SHALL BE SCH 40 PVC SUPPORTED EVERY 4'.
4. ALL PIPING SHALL BE SLOPED BACK TO WELLS OR SVE MANIFOLD.
5. KO TANK SHALL CONTAIN FLOAT SWITCH WITH AUTOMATIC SHUT DOWN DUE TO HIGH WATER LEVEL IN TANK.
6. CONNECTION BETWEEN HDPE AND SCH 80 PVC SHALL BE NPT.
7. FLOW ELEMENTS ON MANIFOLDS SHALL BE KING INSTRUMENT COMPANY MODEL 7200-0151 WITH 0 TO 20 SCFM RANGE AND 1" FNPT OR AN EQUIVALENT FLOW ELEMENT APPROVED BY THE ENGINEER.
8. FE-1 AND FE-2 SHALL BE 2" AMETEK ROTRON FM20C175Q FLOW METERS CAPABLE OF 35 TO 175 SCFM OR EQUIVALENT, IF APPROVED BY THE ENGINEER.
9. PRESSURE INDICATORS ON MANIFOLDS SHALL BE CAPABLE OF 0 TO -15" WC.
10. PI-1, PI-3, PI-4, AND PI-5 SHALL BE CAPABLE OF 0 TO -30" WC.
11. PI-2 SHALL BE CAPABLE OF 0 TO 30" WC.
12. HOSE SHALL BE 2" PVC, CAM LOCKS SHALL BE ALUMINUM.
13. AUTOMATIC OPERATION OF THE SVE SYSTEM MAY BE BY PLC OR BY ELECTRICAL CONTROLS UTILIZING A COMBINATION OF SWITCHES AND RELAYS WIRED TO THE MOTOR CONTROL PANEL.
14. BLOWER AND CONDENSATE PUMP OPERATIONAL HOURS SHALL BE RECORDED (BY PLC OR HOUR METER). BLOWER SHALL SHUT DOWN IF CONDENSATE PUMP FAILS OR HIGH LEVEL SHUTOFF TRIGGERED IN KO TANK OR CONDENSATE STORAGE TANK.
15. BLEED VALVE ON MANIFOLD IS NORMALLY CLOSED. VALVE USED FOR VENT WELL OPERATION.
16. ALL VALVES SHALL BE SPEARS OR EQUIVALENT OR APPROVED BY THE ENGINEER.



ABBREVIATIONS

TYP	TYPICAL
PVC	POLYVINYL CHLORIDE
SCH	SCHEDULE
GAC	GRANULAR ACTIVATED CARBON
KMN	POTASSIUM PERMANGANATE
KO	KNOCKOUT
LSH	LEVEL SWITCH HIGH
LSHH	LEVEL SWITCH HIGH HIGH
LSL	LEVEL SWITCH LOW
PLC	PROGRAMMABLE LOGIC CONTROLLER

BOEING

BUILDING 4-78/79
SOIL VAPOR EXTRACTION SYSTEM
PROCESS AND INSTRUMENTATION DIAGRAM
Boeing Renton Facility
Renton, Washington

By: APS
Date: 06/18/14
Project No. 8888
amec
DRAWING P-2

Plot Date: 06/18/14 - 9:44am, Plotted by: adam.stenberg
Drawing Path: S:\8888_2006\069_EDR\, Drawing Name: Building 4-78 and 79_WorkPlanDesign PID_061814.dwg

APPENDIX B

AOC-092 Source Area Excavation Work Plan

AOC-092 SOURCE AREA EXCAVATION WORK PLAN

Boeing Renton Facility

Renton, Washington

Prepared for:

The Boeing Company
Seattle, Washington

Prepared by:

AMEC Environment & Infrastructure, Inc.
600 University Street, Suite 600
Seattle, Washington 98101
(206) 342-1760

June 2013

Project No. 0088880100.2013.50

TABLE OF CONTENTS

FIGURES

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AOC-092 SOURCE AREA EXCAVATION WORK PLAN
Boeing Renton Facility
Renton, Washington

1.0 INTRODUCTION

The Boeing Company (Boeing) has been working with the Washington State Department of Ecology (Ecology) to implement the final Cleanup Action Plan (CAP) for the Boeing Renton Facility (Facility, Figure 1) located in Renton, Washington. Boeing has entered into Agreed Order No. 8191 with Ecology to implement the CAP.

Production capabilities at the Facility are being expanded, requiring new building construction and relocation of underground utilities. Planned construction, which is projected for completion during the summer of 2013, will occur in the vicinity of Area of Concern 092 (AOC-092), as shown on Figure 1. The planned construction includes placement of a building addition that will be constructed over AOC-092. The CAP specifies a cleanup action for AOC-092; including excavation of affected soil and placement of a bioremediation amendment, followed by groundwater monitoring to confirm attainment of cleanup levels in groundwater. Boeing proposes to complete excavation of affected soil and placement of the bioremediation amendment in mid-June 2013 to support the new plant construction. This Source Area Excavation Work Plan (Work Plan) has been prepared to document excavation plans and demonstrate conformance to the requirements in the CAP.

The constituents of concern (COCs) identified for AOC-092 are total petroleum hydrocarbons-gasoline range (TPH-G) and benzene in both soil and groundwater. This Work Plan describes the planned excavation of the soil source area and TPH-G-affected soils in AOC-092, as well as placement of the bioremediation amendment to support enhanced attenuation for groundwater. Groundwater monitoring for AOC-092 will be addressed in the Engineering Design Report that is currently being prepared.

1.1 SITE HISTORY AND BACKGROUND

AOC-092 is located just north of the Building 4-20 Addition, along the east side of Building 4-20 (Figure 1). This area has historically been used for employee parking and as a roadway. TPH-G was found at this AOC during trenching activities related to replacement of a fire protection water line in 2001. One grab sample, 4-20-S4-E, was collected in February 2001, but no impacted soil was removed, due to structural concerns regarding the Building 4-20 foundation (Boeing, 2001). In July 2001, as part of the post-remedial investigation (RI) site investigation, five direct push borings (PP073 to PP077) were installed in the source area. Boring PP077 encountered refusal and was not completed. The locations of these borings, along with their soil and groundwater analytical results, are shown on Figure 1 and discussed in Sections 1.2.2 and 1.2.3.

In November 2005, a subsequent investigation of AOC-092 was performed as part of Facility improvements in the adjacent Building 4-20, when the concrete slab floor inside Building 4-20 was removed and replaced. The portion of the floor that was removed inside Building 4-20 was located northwest of and is inferred to be downgradient from the known source area at AOC-092 (see Figure 1). In order to determine whether the affected soil related to the AOC-092 release extended underneath Building 4-20 to the area of concrete slab removal, soil and groundwater samples were collected from six direct push borings (PP154 to PP159) located around the removed slab. The locations of these borings, along with their soil and groundwater analytical results, are shown on Figure 1 and discussed in Sections 1.2.2 and 1.2.3.

In March 2013, soil and groundwater samples were collected at various locations near AOC-92. Sample location 4-20-(5-3)-06-14 was found to contain elevated levels of TPH. The location of this boring along with the soil and groundwater analytical results, are shown on Figure 1 and discussed in Sections 1.2.2 and 1.2.3.

1.2 RESULTS OF PREVIOUS INVESTIGATIONS

The following sections summarize hydrogeologic conditions and soil and groundwater quality results from the previous investigations listed above.

1.2.1 Hydrogeologic Conditions

The direction of groundwater flow in the vicinity of AOC-92 is difficult to determine accurately since the local groundwater gradient was measured at less than 0.0001(Weston, 2001b). Historically, groundwater in the vicinity flows to the north-northwest toward Lake Washington, which is similar to the observed groundwater flow direction at the adjacent AOC-001 and AOC-002 area.

1.2.2 Soil Analytical Results

Figure 1 shows direct push boring locations where soil cleanup levels were exceeded in previous investigations in 2001, 2005, and 2013 as well as the analytical results for soil as presented in previous reports. The soil sample results of previous investigations at and in the vicinity of AOC-092 source soil area showed that:

- TPH-G was detected in grab sample 4-20-S4-E from the fire line excavation at 22,000 milligrams per kilogram (mg/kg).
- The only other soil sample with a concentration above the TPH-G cleanup level (CUL) of 30 mg/kg for soil affected by both benzene and gasoline was PP073 at 150 mg/kg.

- Aromatic hydrocarbons were also detected in PP073 to PP076, but below their respective soil CULs.
- PP076 was installed at the same sample location where soil sample 4-20-S4-E was collected, but the sample did not contain TPH-G above the detection limit.
- All of the soil sample results from PP154 to PP159 were non-detect for TPH-G and benzene. Therefore, the affected soil appears to be limited to the AOC-092 source area, but may extend south under the Building 4-20 Addition footprint.
- Sample 4-20-(5-3)-06-14 was obtained from a location north of the area identified as AOC-92. TPH-G was detected in shallow soil (3'-3.5' bgs) at 820 mg/kg, and TPH-D was detected at 53 mg/kg). TPH was not detected in a deeper soil sample obtained at 7.6' to 8.2' bgs.

The approximate extent of the TPH-G soil source area has been defined as shown in Figures 1 and 2.

1.2.3 Groundwater Results

Groundwater samples were collected from the direct push investigation borings completed in 2001 in the vicinity the fire line trench area and from the six inferred down-gradient push probe investigation completed inside Building 4-20 in November 2005 (Figure 1).The groundwater sample results from these previous investigations showed that:

- TPH-G was detected above the CUL of 0.8 milligrams per liter (mg/L) in all four 2001 push probe samples, at concentrations up to 8.7 mg/L.
- TPH-G was detected in two of the six 2005 push probe locations around the concrete slab, but no TPH-G concentrations exceeded the CUL.
- Benzene was detected in samples collected from the 2001 push probes at concentrations up to 4.2 micrograms per liter (μg/L), but none exceeded the CUL of 5.0 μg/L.
- Benzene was detected in the 2005 push probe PP154, the boring closest to the AOC-092 soil source area, at a concentration of 5.9 μg/L, which exceeds the CUL.
- Benzene was detected in three other 2005 push probe locations, but none exceeded the CUL.
- TPH-G was detected at 2.7 mg/L, and TPH-D was detected at 0.5 mg/L at sample location 4-20-(5-3)-06-14. Benzene was not detected at this location.

The nature and extent of groundwater affected by TPH-G and benzene were not defined to the south and southwest, due to the proximity of the Building 4-20 Addition footprint.

2.0 OBJECTIVES AND SCOPE

The objective of this Work Plan is to remove, to the extent practicable, soil affected by TPH-G and benzene in the AOC-092 source area and to place the bioremediation amendment to facilitate enhanced attenuation of affected groundwater. As noted above, this work is being performed on an expedited schedule to support construction a new addition to Building 4-20. The footprint of this new building is shown in Figure 2, along with the outline of the AOC-092 source area. The footprint of the new building is much larger than the AOC-092 source area. Boeing is planning to clean up affected soils from the AOC-92 source area prior to completing the larger foundation excavation for the new building.

This Work Plan outlines the specific steps that will be taken for the excavation at AOC-092. The scope for this work includes: (1) source soil excavation to the extent practicable; (2) use of an enhanced bioremediation treatment to accelerate site cleanup; and (3) preparation of a report documenting the excavation of the source soil area excavation and enhanced bioremediation activities conducted on site.

The Engineering Design Report will address monitored attenuation program as well as institutional controls supporting the final remedy specified in the CAP.

3.0 SOIL CLEANUP LEVELS

The goal of the source soil excavation is to remove soil affected by the COCs, TPH-G and benzene at concentrations above the soil CULs specified in the CAP. The soil cleanup level for TPH-G is 30 mg/kg (co-located with benzene), or 100 mg/kg if benzene is not detected. The soil cleanup level for benzene is 0.15 mg/kg.

Confirmation sampling will be performed as described in Section 4.1. If a soil confirmation sample exceeds either soil CUL, additional soil will be removed from the appropriate area to the extent possible and the newly excavated area will be re-sampled. Constraints to soil excavation include groundwater depth, presence of utilities in the excavation area, and structural concerns regarding Building 4-20 foundations and support structures. The final location, dimensions, and depth of the excavation will be measured by an AMEC Environment & Infrastructure, Inc. (AMEC) field geologist and recorded for reporting and monitoring purposes.

4.0 SOIL EXCAVATION APPROACH

This section describes the approach that will be used to complete the soil removal at AOC-092. The planned approach includes first excavating the source soil area, then expanding the excavation extent until shallow groundwater is encountered at the excavation base and the AMEC staff geologist has no positive field indications for affected soil at the excavation sidewalls. Maintaining sidewall stability may require 1:1 excavation slopes to limit the potential for sidewall failure. The excavation may be confined by building structures located to the north, south and west of the source area.

The overall plan is to remove contaminated soils from the construction area prior to initiating the new construction. Therefore, AOC-092 soils will be excavated to the extent practicable prior to demolition and construction. As shown on Figure 2, the new building construction will require that the Building 4-20 Addition to the south of the AOC-092 source area must be demolished. If confirmation sampling indicates that soil exceeding cleanup levels remains along the south wall of the excavation, additional excavation of affected soil to the south will be performed as described below.

4.1 DELINEATION AND SOURCE AREA SOIL EXCAVATION

The general extent of the soil source area has been delineated from previous investigations and is depicted on Figures 1 and 2. The limits of impacted soil have been reasonably characterized by previous subsurface investigations conducted by Roy F. Weston in 2001, by Geomatrix Consultants, Inc., (now AMEC) in 2005, and by supplemental sampling conducted by AMEC during 2013. The actual extent of affected soil is not known, but will be established during the source area excavation.

A “one call” will be placed with the Northwest Utility Notification Center at least 48 hours in advance of the planned excavation. In addition to the standard one call notification, the private utility locating service Applied Professional Services will be contracted to locate electromagnetic utilities, such as electrical service and metallic pipes in the vicinity of the excavation.

Excavation will be performed using a conventional backhoe. It is expected that the excavation will extend slightly below the water table encountered during excavation. Confirmation soil samples will be collected from the sidewalls and base of the excavation area once the planned extent of excavation has been reached and field screening indicates that only clean soil remains. Samples also will be taken from the base of the excavation, which is expected to be approximately 5 to 6 feet below ground surface (bgs). Soil samples will be collected from the bucket of the backhoe performing the excavation; AMEC shall direct the backhoe operator to the target sampling locations. A minimum of eight sidewall soil confirmation samples (two from each sidewall) and four base soil confirmation samples will be collected. If analytical results from a sidewall confirmation sample exceed the CUL, additional soil will be excavated from that sidewall to the extent practicable and the area will be re-sampled for confirmation. Additional soil samples may be collected if field screening indicates that additional soil sampling is warranted.

It is expected that the excavation described above will remove affected soil from AOC-092. However, if confirmation sample analyses for the south wall of the excavation exceed CULs, additional soil excavation will be completed as described in this Work Plan after the Building 4-20 Addition has been demolished and prior to construction of the new maintenance building. Additional excavation in this area may be limited by structures and foundations that will not be demolished for the new construction.

Sample collection and handling will be conducted in accordance with the Ecology-approved RI Work Plan (Weston, 1998) and as amended with subsequent revisions, which includes field methods for sample collection, sample designation, equipment decontamination, and documentation.

All work activities within the excavation area (exclusion zone) will be conducted using Level D personal protective equipment (PPE). A Site-Specific Health & Safety Plan (HASP) will specify appropriate contaminant action level, PPE, and safe working procedures. The final HASP will be prepared and be available in the field prior to performing the source area excavation.

Soil sampling procedures for TPH-G and benzene will incorporate U.S. Environmental Protection Agency (EPA) Method 5035A soil sampling method following Ecology's Implementation Memo #5 (Ecology, 2004). This method requires a discrete soil sampler to minimize volatile organic compound loss and storing the soil samples in 40-mL glass vials with Teflon© septa. Soil samples collected will be analyzed for TPH-G using the NWTPH-Gx method, and benzene using EPA Method 8021B with 24- to 48-hour turnaround. Lancaster Laboratories of Lancaster Pennsylvania or Analytical Resources, Inc. of Tukwila, Washington will analyze the soil samples. Both labs are Washington State Certified analytical laboratories.

It is assumed that it will take approximately two days to complete the initial excavation. In consultation with Boeing, the AMEC staff geologist will determine the excavation extent and collect soil confirmation samples as described in this Work Plan.

Excavated soil from the AOC-092 source area will be properly managed on site prior to off-site disposal. Excavated soil will be placed directly in roll-off boxes or liner-equipped dump trucks. Soil may be stockpiled within the excavation area to ensure that water is drained from soil prior to loading into trucks, provided that all soil is contained within the excavation area and soil is prevented from entering storm drains. No stockpiling of soil will occur outside of the excavation area. If dewatering is necessary, groundwater will be pumped to a portable tank for sampling prior to disposal.

After confirmation samples indicate that affected soil has been removed to the extent practicable from the AOC-092, a bioremediation amendment that will slowly release oxygen to groundwater will be placed into the base of the excavation, as described in Section 5.0. After placement of the bioremediation amendment, the excavation will be backfilled with clean fill material and compacted according to Boeing's requirements. The area will then be prepared as required to meet Boeing's specifications and Facility requirements for the planned construction.

4.2 PERMITTING

State Environmental Policy Act (SEPA) requirements for the AOC-092 excavation have been addressed as part of the CAP process. All grading and SEPA permitting needed for the AOC-092 excavation will be handled as part of Boeing's overall construction work for the plant modification.

4.3 WASTE MANAGEMENT

Waste management will be performed in accordance with applicable regulations. Contaminated soil from the excavation will be managed by Boeing. Excavated soil will be loaded directly in roll-off boxes or trucks. Any water draining from the soil will be either shipped off site for proper disposal or tested and treated at Boeing Renton's industrial wastewater treatment plant. Soil will be shipped off site following proper characterization and disposal in accordance with applicable state and federal regulations. Contaminated soil will be placed in roll-off containers for truck transport to the Waste Management Alaska Street reload facility, or other approved facility if the Waste Management facility does not have the capacity to receive this material. All disposable PPE and dedicated equipment will be double-bagged and disposed of in Boeing waste containers.

4.4 STORMWATER MANAGEMENT

Appropriate stormwater best management practices will be implemented and maintained during AOC-092 source area excavation as necessary in order to prevent stormwater runon and runoff into or from the excavation area.

5.0 ENHANCED BIOREMEDIATION

Once the extent of the excavation has been reached, approximately 500 pounds of PermeOx® Plus will be poured from the ground surface into the excavation. PermeOx® Plus is a slow oxygen release compound that promotes aerobic biodegradation of TPH-G and benzene. The backhoe operator will then place the solid PermeOx® Plus evenly across the base of the excavation and mix the material into the soil. Over the course of approximately one year, PermeOx® Plus will slowly release oxygen into the subsurface to support aerobic microbial respiration, thereby enhancing the natural process of bioremediation of TPH. The PermeOx® Plus will be placed into the capillary fringe/smear zone, which should support bioremediation of the more highly contaminated area.

6.0 REPORTING

A technical memorandum will be submitted to Ecology after completing excavation of the AOC-092 source area to document the field observations and soil confirmation sample analytical results. The laboratory analytical data will be validated. The analytical results above the method detection limit will be posted on a base map in order to depict any COCs remaining in AOC-092 source area soils.

7.0 SCHEDULE

Excavation of the source soil area and petroleum impacted soil at AOC-092 is anticipated to begin in mid-June 2013. The soil removal is expected to take two to three days. The preliminary analytical results for soil cleanup confirmation samples are expected within 24 to 48 hours; a complete data package will be provided within seven days of when preliminary results are provided.

8.0 REFERENCES

The Boeing Company (Boeing), 2001, Letter from Boeing to Washington State Department of Ecology re. Newly Discovered Potential Release, Building 4-20, Column S4, Exterior, Boeing Commercial Aircraft Group, Renton Plant, WAD 009 262 171 RCRA Corrective Action Agreed Order No. DE 97HZ-N233, March 27.

Roy F. Weston (Weston), 1998, Remedial Investigation Work Plan, Boeing Renton Plant, Renton, Washington.

Weston, 2001, Building 4-20 Exterior, Column S-4 (AOC-092) Soil and Groundwater Sampling Report: Prepared for The Boeing Company, Boeing Shared Services Group, Energy and Environmental Affairs, August 30.

Weston, 2001b, Remedial Investigation Report, Boeing Renton Plant, Renton, Washington, August.

Washington State Department of Ecology (Ecology), 2004, Implementation Memorandum #5, Collecting and Preparing Soil Samples for VOC Analysis, 04-09-087, June 17.

FIGURES

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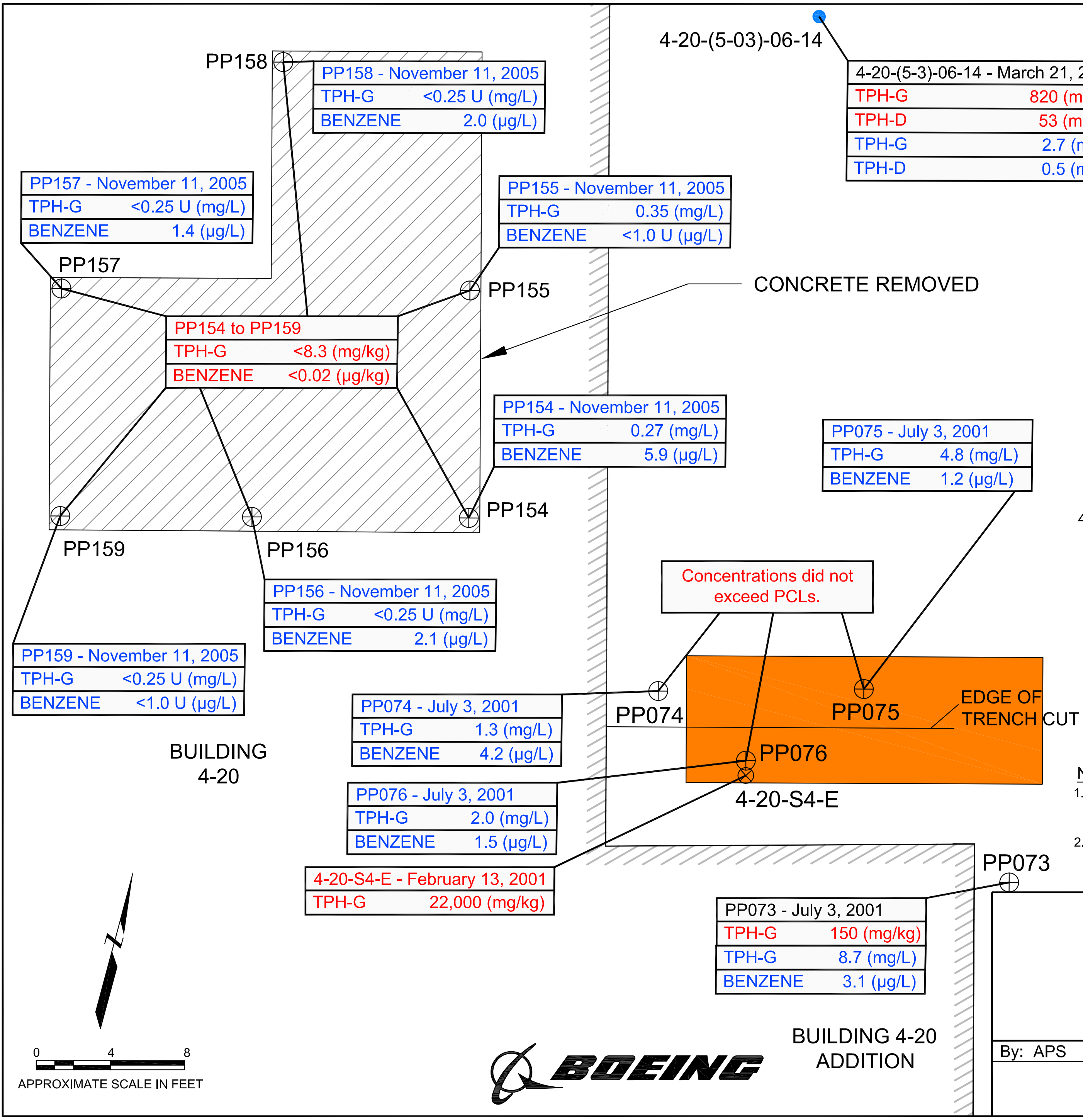


PP158 - November 11, 2005	
TPH-G	<0.25 U (mg/L)
BENZENE	2.0 (µg/L)

PP157 - November 11, 2005	
TPH-G	<0.25 U (mg/L)
BENZENE	1.4 (µg/L)

PP155 - November 11, 2005	
TPH-G	0.35 (mg/L)
BENZENE	<1.0 U (µg/L)

4-20-(5-3)-06-14 - March 21, 2013	
TPH-G	820 (mg/kg)
TPH-D	53 (mg/kg)
TPH-G	2.7 (mg/L)
TPH-D	0.5 (mg/L)

PP154 to PP159	
TPH-G	<8.3 (mg/kg)
BENZENE	<0.02 (µg/kg)

PP154 - November 11, 2005	
TPH-G	0.27 (mg/L)
BENZENE	5.9 (µg/L)

PP075 - July 3, 2001	
TPH-G	4.8 (mg/L)
BENZENE	1.2 (µg/L)

PP156 - November 11, 2005	
TPH-G	<0.25 U (mg/L)
BENZENE	2.1 (µg/L)

PP159 - November 11, 2005	
TPH-G	<0.25 U (mg/L)
BENZENE	<1.0 U (µg/L)

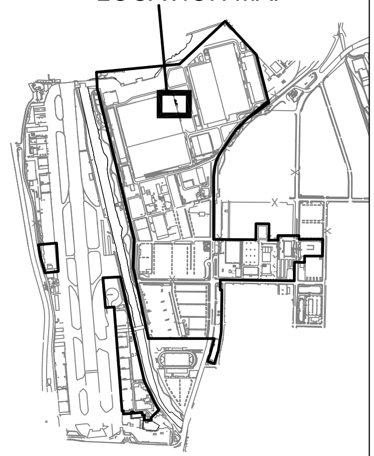
PP074 - July 3, 2001	
TPH-G	1.3 (mg/L)
BENZENE	4.2 (µg/L)

PP076 - July 3, 2001	
TPH-G	2.0 (mg/L)
BENZENE	1.5 (µg/L)

4-20-S4-E - February 13, 2001	
TPH-G	22,000 (mg/kg)

PP073 - July 3, 2001	
TPH-G	150 (mg/kg)
TPH-G	8.7 (mg/L)
BENZENE	3.1 (µg/L)

AOC-092
LOCATION MAP



BOEING RENTON
FACILITY MAP

LEGEND

● 4-20-(5-3)-06-14	PRECONSTRUCTION SOIL CLASSIFICATION SAMPLE LOCATION
PP074 ⊕	EXISTING PUSH-PROBE LOCATION
4-20-S4-E ⊗	SOIL SAMPLE LOCATION 4-20-S4-E COLLECTED AT 5' BGS
🟧	TPH-G SOIL SOURCE AREA
TPH-G	Total Petroleum Hydrocarbons-Gasoline fraction
U	Analyte was not detected above value shown

RED TEXT INDICATES SOIL ANALYTICAL DATA
BLUE TEXT INDICATES GROUNDWATER ANALYTICAL DATA

NOTES

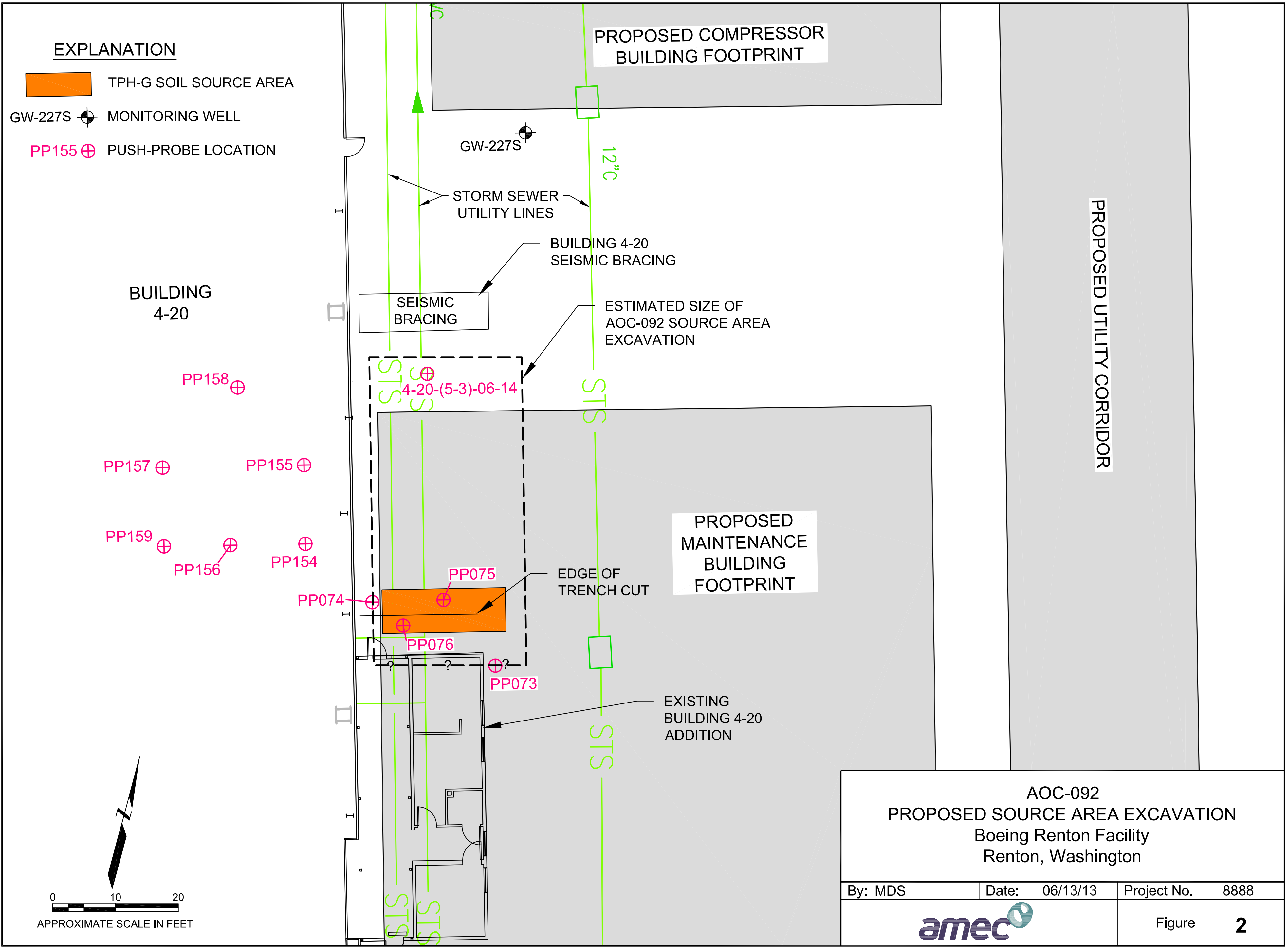
1. BASEMAP COMPILED FROM DATA SUPPLIED BY DUANE HARTMAN & ASSOCIATES, INC., DECEMBER, 1994 AND WESTON, 2001
2. PUSH PROBE LOCATIONS AND BUILDING 4-20 ADDITION FROM BUILDING 4-20 EXTERIOR, COLUMN S-4 (AOC-092) SOIL AND GROUNDWATER SAMPLING REPORT (WESTON, AUGUST 2001)

AOC-092 SITE LOCATION
AND COC RESULTS
Boeing Renton Facility
Renton, Washington

By: APS | Date: 06/06/13 | Project No. 8888

amec

Figure 1



AOC-092
PROPOSED SOURCE AREA EXCAVATION
Boeing Renton Facility
Renton, Washington

By: MDS	Date: 06/13/13	Project No. 8888
amec		Figure 2

Plot Date: 06/13/13 - 9:44am, Plotted by: adam.stenberg
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APPENDIX C

AOC-092 Source Area Soil Excavation Report

AOC-092 SOURCE AREA SOIL EXCAVATION REPORT

Boeing Renton Facility

Renton, Washington

Prepared for:

The Boeing Company
Seattle, Washington

Prepared by:

AMEC Environment & Infrastructure, Inc.
600 University Street, Suite 600
Seattle, Washington 98101
(206) 342-1760

October 2013

Project No. 0088880100.2013.50

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AOC-092 SOURCE AREA
SOIL EXCAVATION REPORT
Boeing Renton
Renton, Washington

1.0 INTRODUCTION

This source area excavation and sampling report summarizes activities associated with the removal of soil affected by gasoline-range total petroleum hydrocarbons (TPH-G) from Area of Concern (AOC) 092 at the Boeing Renton Facility (Facility) in Renton, Washington (Figure 1). This report has been prepared to document excavation activities and demonstrate conformance to the requirements in the final Cleanup Action Plan (CAP) for the Facility (AMEC 2012), which is being implemented under Agreed Order No. 8191 issued by the Washington State Department of Ecology (Ecology).

1.1 SITE HISTORY AND BACKGROUND

AOC-092 is located along the northeast side of Building 4-20, which is located in the north central portion of the Facility (Figure 2). Soil affected by petroleum hydrocarbons was discovered at this location in 2001 during trenching activities to install a fire protection water line. Subsequent investigations in 2001, 2005, and 2013 defined a limited extent of soil contamination to the east of Building 4-20, possibly extending south beneath the former Building 4-20 addition.

The constituents of concern (COCs) identified for AOC-092 are TPH-G and benzene in both soil and groundwater. The CAP specifies that the final cleanup action for this area includes excavation of affected soil, placement of soil amendments to support enhanced bioremediation for groundwater, and follow-up monitored attenuation to confirm attainment of groundwater cleanup levels.

Starting in early 2013, Boeing has been implementing a planned expansion of production capabilities at the Boeing Renton plant, which include new building construction and relocation of underground utilities in the vicinity of AOC-092. A new building will be constructed above much of the AOC-092 area; the construction included demolition of the former Building 4-20 addition that was immediately south of AOC-092. This planned construction presented an opportunity to implement the cleanup actions specified in the CAP with minimal disruption to plant operations. The proposed cleanup was presented in the AOC-092 Source Area Excavation Work Plan ([Work Plan], AMEC, 2013); this Work Plan was subsequently approved by Ecology and has been implemented.

1.2 SITE HYDROGEOLOGIC CONDITIONS

Groundwater flow direction in the vicinity of AOC-092 is generally to the north-northwest, towards Lake Washington, as observed in adjacent AOC-001 and AOC-002. The local groundwater gradient at AOC-092 has been measured at less than 0.0001 (Weston, 2001).

1.3 OVERVIEW OF CLEANUP ACTION

The cleanup action specified for AOC-092 in the CAP includes the following:

- **Excavation of the Source Area.** The estimated extent of the source area in the CAP was 6 ft wide and 17 feet long; it was projected to be approximately 8 feet in depth. The total estimated volume of soil to be removed was estimated to be 30 cubic yards (CY)
- **Enhanced Bioremediation.** Bioremediation for this site was specified in the CAP to consist of placement of a terminal electron acceptor, such as an oxygen-releasing material in the excavation prior to backfilling. It was estimated that 200 lb of a Regenesis product, ORC, would be placed in the excavation.
- **Monitored Attenuation.** Monitored attenuation was specified to assess groundwater cleanup after source area excavation and placement of an oxygen releasing soil amendment have been completed. The CAP projected that groundwater monitoring would be conducted semiannually in 3 monitoring wells, one located in the source area, one downgradient of the source area, and one at the conditional point of compliance (CPOC). Monitored attenuation for AOC-092 is described in the Engineering Design Report (EDR) prepared to fully implement the Facility remedies specified in the CAP.
- **Institutional Controls.** Institutional controls were specified in the CAP to provide long-term protection for industrial and temporary construction workers. Institutional controls for AOC-092 are described in the EDR.

The excavation and enhanced bioremediation cleanup action components specified in the CAP have been implemented for AOC-092 with modifications, as described below. Boeing is expanding production facilities at Renton; this expansion includes construction of a new maintenance building in the vicinity of AOC-092. Due to this ongoing construction project, modifications are necessary for the monitored attenuation groundwater monitoring well network proposed in the CAP. The AOC-092 source area excavation and proposed construction are shown on Figure 3. The AOC-092 source area shown in the CAP was located immediately north of the former Building 4-20 addition (Figure 3); the new maintenance building will completely cover the AOC-092 area and CPOC identified in the CAP.

The excavation was significantly larger than described in the CAP, and effectively removed the source area. Over 600 cubic yards of soil was excavated for offsite disposal. Due to demolition of the Building 4-20 addition as part of the plant construction work prior to the AOC-092 excavation, the excavation could be extended to the south, removing affected soil that was expected to remain in place after remedy implementation. The excavation also extended north, encompassing the area identified in the

CAP for the CPOC. Confirmation samples indicated that cleanup levels were achieved along the excavation base and sidewalls, except for a small soil area on the north wall that could not be excavated due to proximity to an existing structure. Since affected soil has been effectively removed from AOC-092, the CPOC area has been excavated, and new or existing buildings or structures will cover most of the area around AOC-092, the source area and downgradient monitoring wells shown in the CAP will not be installed or monitored. The CPOC has also been moved to the north side of the seismic brace, to the location of well GW 227S, so that groundwater will be monitored downgradient of the north sidewall of the AOC-092 excavation. This well will be monitored to assess attenuation of groundwater COCs. The cleanup action objectives for the excavation and bioremediation components of the remedy have been achieved.

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2.0 SOIL EXCAVATION, SAMPLING, AND PERMEOX® PLUS APPLICATION

This section of the report describes the methods for excavation, confirmation soil sampling, and application of PermeOx® Plus, a slow-acting oxygen release compound that promotes aerobic biodegradation of TPH.

2.1 NOTIFICATIONS

AMEC prepared the AOC-092 Source Area Excavation Work Plan (Work Plan) detailing the plans for AOC-092 soil removal and application of PermeOx® Plus (AMEC, 2013). Boeing submitted the Work Plan to Ecology in June 2013; Ecology approved the work plan for implementation. Follow-up notification to Ecology of a planned start date was sent via email on July 31, 2013.

Prior to beginning excavation, utility clearances were made by notifying the Washington State One-Call Utility Notification Center. In addition to the one-call notification, AMEC subcontracted a private utility locator (Applied Professional Services) to identify and mark potential underground utilities in the area of excavation.

2.2 SOIL EXCAVATION

As described in the Work Plan, the objectives of this cleanup action were to remove, to the extent practicable, soil affected by TPH-G and benzene in the AOC-092 source area, and to place a bioremediation amendment to facilitate enhanced attenuation of affected groundwater. This work was performed in conjunction with preparation for construction of a new building adjacent to Building 4-20, the footprint of which overlaps the AOC-092 source area. When completed, the new building foundation will extend to approximately 12 feet in depth. The primary goal was to ensure affected soils from the AOC-092 source area were removed prior to completion of the excavation for the larger foundation.

On August 5, 2013, AMEC personnel and Boeing's excavation contractor, Glacier Environmental Services, Inc., of Mukilteo, Washington (Glacier), mobilized to the site. Excavation of the AOC-092 source area began at the north end of the excavation, but after encountering active utilities, which were supposed to have been re-routed prior to excavating AOC-092, the excavation was postponed until the utility re-route was complete. Excavation resumed from August 13 through August 15, 2013, working from the northern end towards the south. On August 15, excavation continued south of the SV-19 fire protection water line, which was active. The excavation was halted, and a 10-foot-wide strip of soil was left in place near the water line. On August 26, the water line had been re-routed and the remaining soil was removed. Additional soil was removed on August 28, 2013, when one of the sidewall samples exceeded the TPH-G cleanup level.

Soil removal was conducted as specified in the work plan by removing soil with an excavator until field screening suggested that only clean soil remained. Field screening indicators included visual appearance, olfactory evidence, and photoionization detector (PID) readings using a PID equipped with a 10.7 electron-volt lamp. PID readings were taken from headspace in a sealed plastic bag containing a sample of the soil.

TPH-G affected soil was primarily located in bedding soils underneath and adjacent to a former 4-inch diameter clay stormwater line aligned parallel to Building 4-20. Field screening indicated that potentially affected soil was not present in bedding soils around other utilities encountered within the excavation, which included a larger 18-inch diameter stormwater line parallel to the 4-inch diameter line, a former air line, the SV-19 fire protection water line, and an unknown utility line south of the SV-19 water line. The former air line and the water line were located at a shallower depth than the clay stormwater lines, while the unknown utility line south of the water line was located deeper than the former stormwater lines. All utility lines within the extent of the excavation were removed; with the exception of the unknown utility line south of the SV-19 fire protection water line, which was left in place within the excavation. All utility lines were left in place beyond the excavation boundaries,

The excavation was bounded to the north by the concrete footing for a large seismic brace for Building 4-20, and to the west by the foundation for Building 4-20. The eastern and southern sides of the excavation were defined by field screening and confirmation soil sample analytical results indicating that impacted soil had been removed. Although the Building 4-20 foundation prevented excavation further to the west, field screening and confirmation sidewall soil samples analytical results indicated soil samples on the western sidewall were below cleanup levels.

Limited TPH-G-affected soil was left in place along the north sidewall, adjacent to the seismic bracing footing, and is discussed further in Section 2.3. The final excavation depth varied from 4.5 feet below ground surface (bgs) to 6-feet bgs, depending on the depth at which TPH-G affected soils were encountered. Water was encountered entering the excavation at approximately 4.5 to 5 feet bgs.

In total, 676.6 tons of soil were removed and loaded directly on trucks and transported to Waste Management's Alaska Street transfer station in Seattle, Washington, to be loaded onto train cars for disposal at Waste Management's Columbia Ridge Landfill in Arlington, Oregon. Copies of the Waste Management invoices are included in Appendix A. The quantity of soil excavated from AOC-092 is substantially greater than the 30 cubic yards (approximately 45 tons) of soil projected for excavation in the CAP. However, larger volumes of soil were excavated as a conservative measure to ensure that soil removed for construction of the new building foundation would not be impacted by residual concentrations of benzene or TPH from this AOC.

After source area excavation was finished, the excavation was left open pending additional soil removal as part of construction activities.

2.3 CONFIRMATION SOIL SAMPLING METHODOLOGY

After field screening indicated that potentially affected soil had been removed, confirmation soil samples were collected. Sampling was conducted as specified in the Work Plan and in accordance with the Ecology-approved RI Work Plan (Weston, 1998), as amended in subsequent revisions. Soil samples were analyzed for TPH-G and benzene in accordance with the Quality Assurance Project Plan appended to the CAP. Sampling was conducted following U.S. Environmental Protection Agency Method 5035A, and Ecology's Implementation Memo #5, Collecting and Preparing Soil Samples for VOC analysis (Ecology, 2004). Soil samples were retrieved from the excavation using the excavator bucket, and samples were immediately collected from soil that had not been in contact with the excavator bucket.

A total of seven bottom samples and 14 sidewall samples (including over-excavated sidewall samples) were collected (Figure 3). Samples were identified by the prefix 'AOC-92' designating the source area and either a 'B' to indicate a bottom sample, or a direction indicator (N, S, E, W) and a 'W' to indicate a sidewall sample. In addition, each sample was given a number indicating how many samples of that type had been collected, and the depth the sample was collected from. For example, sample "AOC-92-NW-2-4.0" was the second sample collected from the north sidewall, from 4.0 feet bgs, and sample "AOC-92-B4-4.5" was the fourth bottom sample, collected from a depth of 4.5 feet bgs. One sample, AOC-92-North-21-4.5, was collected beyond the boundaries of the AOC-092 excavation to assess soil quality north of the seismic brace that limited the AOC-092 excavation; this sample is discussed further in Section 3.0.

Samples were collected from areas where impacted soil was considered by the field geologist to be most likely to be encountered or where field screening results indicated potentially impacted soil was present. Bottom samples along the western half of the excavation (AOC-92-B2-6.0, AOC-92-B3-6.0, AOC-92-B5-5.5, and AOC-92-B6-5.0,) were all collected beneath the former 4-inch clay stormwater line where the greatest concentration of TPH-affected soil was encountered. Sidewall samples AOC-92-NW-2-4.0 and AOC-92-SW-1-5.0 were collected from the north and south sidewalls, respectively, beneath the same 4-inch stormwater line. Field screening did not suggest any other locations were potentially affected, so the remaining samples were collected on approximately equal spacing across the bottom and around the sidewalls. Soil samples were analyzed by Analytical Resources Incorporated (ARI) of Tukwila, Washington, a Washington State certified analytical laboratory.

Soils in the vicinity of sidewall sample AOC-92-SW-2-4.0 were removed during additional excavation after the SV-19 fire protection water line had been re-routed. Soils near sidewall sample

AOC-92-EW-4-4.0 also were removed during additional excavation because of a TPH-G detection above cleanup levels, which is discussed further in Section 3.0.

2.4 PERMEOX® PLUS APPLICATION

PermeOx® Plus is a slow-acting oxygen release compound designed to slowly release oxygen into groundwater over the course of approximately one year. The objective of placing it in the excavation is to help promote aerobic microbial respiration and to enhance bioremediation for any TPH that remains in the soil or groundwater.

Once the excavation was complete and confirmation soil samples had been collected, Boeing utilized a vacuum truck to remove standing water from the excavation prior to placement of the PermeOx® Plus. This water was taken to the Boeing Renton water treatment plant for treatment. After the excavation was cleared of water, Glacier then spread 500 pounds of PermeOx® Plus along the west and north sidewalls, placing more of the amendment along the north sidewall where TPH-impacted soil exceeding the cleanup level was left in place beneath the footing of the Building 4-20 seismic bracing. Although all of the west sidewall samples were below cleanup levels, PermeOx® Plus was also placed preferentially adjacent to Building 4-20. The PermeOx® Plus was placed along the bottom and lower portions of the sidewalls at the approximate elevation of the water table and capillary fringe/smear zone, where TPH-affected soils are likely to be present. PermeOx® Plus was not applied in significant quantities elsewhere in the excavation since the majority of the excavation area will be over-excavated during construction of a new addition to Building 4-20.

The EDR describes the monitored attenuation program for this site, as well as any institutional controls supporting the final remedy, as specified in the CAP. Copies of the PermeOx® Plus order confirmation are included in Appendix B.

3.0 CONFIRMATION SAMPLING RESULTS

Soil confirmation samples were collected and analyzed as described in the Work Plan to confirm attainment of cleanup levels and to assess soil quality in areas that could not be excavated. If confirmation sampling indicated that COC concentrations exceeded cleanup levels, additional excavation was conducted to remove the affected soil unless excavation was constrained by structures. Analytical results are summarized in Table 1. Copies of the laboratory reports are included in Appendix C.

As discussed in Section 2.3, additional soil in the vicinity of two sidewall sample locations was removed, as analytical results indicated that the soil exceeded cleanup levels ,. Soil near sidewall sample AOC-92-SW-2-4.0 was removed during additional excavation around the former SV-19 fire protection water line after the line had been re-routed. Soil near sidewall sample AOC-92-EW-4-4.0 was removed because the sample contained TPH-G at a concentration of 31 milligrams per kilogram (mg/kg); which exceeded the cleanup level for TPH-G in soil for AOC-092 (30 mg/kg). Subsequent soil confirmation sample analysis along the east sidewall (sample AOC-92-EW-5-4.0) following additional excavation was non-detect for both TPH-G and benzene.

After the soil confirmation samples were all below the soil cleanup levels cited in the Work Plan for TPH-G (100 mg/kg without benzene present, 30 mg/kg with benzene present) and for benzene (0.15 mg/kg), with the exception of one sample from the north sidewall of the excavation collected below the former 4-inch stormwater line, the excavation was considered complete. The sample exceeding the TPH-G cleanup level, AOC-92-NW-2-4.0, had a TPH-G detection of 3,600 mg/kg. The excavation could not be extended further north because it was adjacent to the Building 4-20 seismic bracing and footing and additional excavation would likely damage the bracing. Because impacted soil was located primarily in the bedding soils beneath the former 4-inch stormwater line, another soil sample, AOC-92-NORTH-21-4.5, was collected from the bedding soils below the abandoned 4-inch stormwater line on the opposite side of the seismic bracing and footing (Figure 3). This sample was collected 21 feet north of the north sidewall of the AOC-92 excavation, from the south sidewall of a separate utility reroute excavation. The analytical results for the soil sample collected on the north side of the seismic bracing were below laboratory reporting limits for both TPH-G and benzene. Field screening and observation did not indicate any potentially impacted soils elsewhere in the utility reroute excavation north of the seismic bracing.

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4.0 CONCLUSIONS AND RECOMMENDATIONS

This report documents the removal of soil affected by TPH-G from the AOC-092 source area at the Boeing Renton facility. All work was conducted in accordance with the Work Plan (AMEC 2013) and the final CAP (AMEC 2012) for the Facility.

The soil excavation and confirmation soil sampling can be summarized as follows:

- The final AOC-092 source area excavation was substantially larger than projected in the CAP; the excavation extended south beneath the location of the Building 4-20 Addition that was demolished prior to soil excavation.
- A total of 676.6 tons of TPH-G-affected soil was removed from AOC-092 and transported to Waste Management's Alaska Street transfer station in Seattle, Washington, for disposal at Waste Management's Columbia Ridge Landfill in Arlington, Oregon.
- Seven bottom and 14 sidewall confirmation soil samples were collected to verify all TPH-G affected soil had been removed, to the extent practicable.
- A total of 13 soil confirmation sample analytical results were below cleanup levels for TPH-G and benzene; one sample, AOC-92-NW-2-4.0, located on the north sidewall adjacent to a seismic bracing and footing, exceeded the soil cleanup level for TPH-G. This sample contained TPH-G at a concentration of 3,600 mg/kg, and was collected from bedding soils beneath an abandoned 4-inch clay stormwater line. Bedding soils around the former 4-inch stormwater line appear to have acted as a preferential flow path for the gasoline release.
- Another bedding soil sample, AOC-92-NORTH-21-4.5, was collected from an excavation on the opposite side of the seismic bracing and footing from the north sidewall of the AOC-092 excavation. This sample was collected beneath the same 4-inch stormwater line as sample AOC-92-NW-2-4.0. The sample collected north of the seismic brace was non-detect for both TPH-G and benzene. Therefore, the extent of TPH-G affected soil remaining onsite appears to be limited to the bedding material around the former stormwater line in the area below the seismic brace foundation.
- 500 pounds of PermeOx® Plus was placed along the west and north sidewalls of the AOC-092 source area excavation in locations outside the area to be excavated for the maintenance building, which will overlap most of the AOC-092 excavation footprint.
- The CPOC has been relocated to well GW 227S, which is located north of the sidewall with residual TPH concentrations.

The extensive AOC-092 excavation was larger than originally anticipated, since Boeing could access TPH-G-affected soils that would normally have been inaccessible beneath active utilities and/or building foundations. In addition, larger volumes of soil were excavated as a conservative measure to ensure that soil removed for construction of the new building foundation would not be impacted by residual concentrations of benzene or TPH from AOC-92..

The AOC-092 source area has been effectively removed and enhanced bioremediation has been implemented. Boeing plans to implement the monitored attenuation program described in the EDR to confirm attainment of the cleanup standard for this AOC.

5.0 REFERENCES

AMEC Environment & Infrastructure, Inc. (AMEC), 2012, Draft Cleanup Action Plan, Boeing Renton Facility, Renton, Washington, September.

AMEC, 2013, AOC-092 Source Area Excavation Work Plan, Boeing Renton Facility, Renton, Washington, June.

Ecology – see Washington State Department of Ecology

Roy F. Weston (Weston), 1998, Remedial Investigation Work Plan, Boeing Renton Plant, Renton, Washington.

Weston, 2001, Remedial Investigation Report, Boeing Renton Plant, Renton, Washington, August.

Washington State Department of Ecology (Ecology), 2004, Implementation Memorandum #5, Collecting and Preparing Soil Samples for VOC Analysis, June 17.

Weston – see Roy F. Weston

TABLES

TABLE 1

AOC-092 EXCAVATION SAMPLES
CONFIRMATION SOIL CONCENTRATIONS[1]
AUGUST 2013

Boeing Renton Facility
Renton, Washington

Sample Location	Sample Depth (feet)	Sample Date	Benzene (µg/kg)	TPH-Gasoline (mg/kg)
AOC-92-B1-4.5	4.5	8/13/2013	21	29
AOC-92-B2-6.0	6.0	8/14/2013	17 U	6.7 U
AOC-92-B3-6.0	6.0	8/14/2013	21 U	8.4 U
AOC-92-B4-4.5	4.5	8/14/2013	23 U	11
AOC-92-B5-5.5	5.5	8/15/2013	20 U	8.1 U
AOC-92-B-6-5.0	5.0	8/26/2013	15 U	6.1 U
AOC-92-B-7-5.0	5.0	8/26/2013	23 U	9.1 U
AOC-92-NW-1-4.0	4.0	8/13/2013	17 U	6.6 U
AOC-92-NW-2-4.0	4.0	8/13/2013	14 U	3,600
AOC-92-WW-1-4.0	4.0	8/13/2013	14 U	12
AOC-92-WW-2-4.0	4.0	8/14/2013	15 U	6.1 U
AOC-92-WW-3-4.0	4.0	8/15/2013	17 U	6.7 U
AOC-92-WW-4-4.0	4.0	8/26/2013	12 U	5.0 U
AOC-92-SW-1-5.0	5.0	8/15/2013	14 U	5.6 U
AOC-92-SW-2-4.0	4.0	8/15/2013	16 U	13
AOC-92-EW-1-4.0	4.0	8/13/2013	17 U	47
AOC-92-EW-2-4.0	4.0	8/14/2013	17 U	6.7 U
AOC-92-EW-3-4.0	4.0	8/15/2013	14 U	5.8 U
AOC-92-EW-4-4.0	4.0	8/26/2013	21	31
AOC-92-EW-5-4.0	4.0	8/28/2013	16 U	6.3 U
AOC-92-NORTH-21-4.5	4.5	8/14/2013	19 U	7.4 U

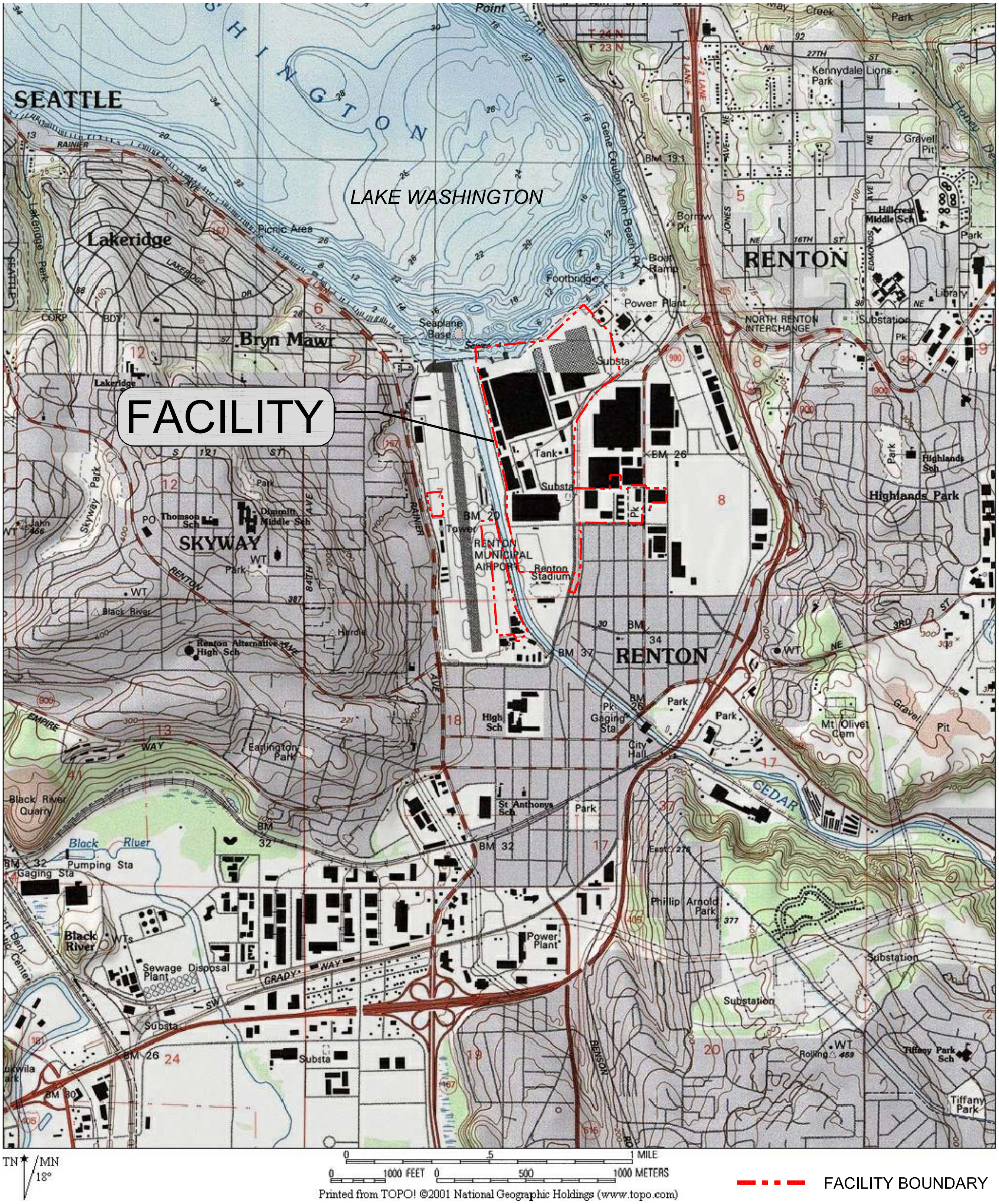
Notes

1. Data qualifiers are as follows:
   U = The analyte was not detected at the reporting limit indicated.

Abbreviations

µg/kg = micrograms per kilogram
mg/kg = milligrams per kilogram

FIGURES



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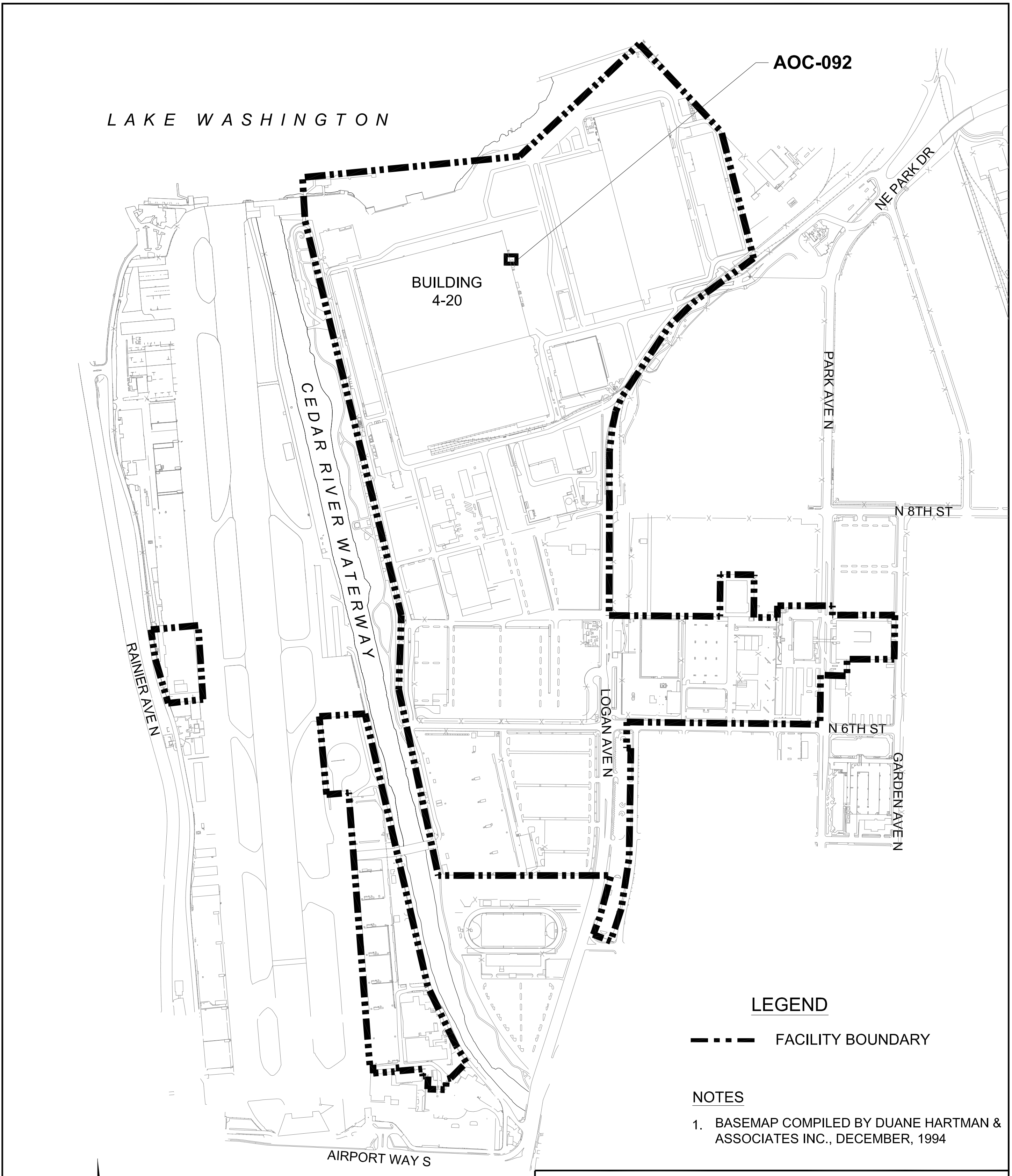
BOEING FACILITY LOCATION
Boeing Renton Facility
Renton, Washington

By: APS
Date: 09/30/13
Project No. 8888
Figure 1

Plot Date: 09/30/13 - 2:04pm, Plotted by: adam.stenberg
Drawing Path: S:\8888_2006\069_EDR\, Drawing Name: BoeingRentonSiteMap_090413.dwg



LEGEND

▬ · ▬ · ▬ FACILITY BOUNDARY

NOTES

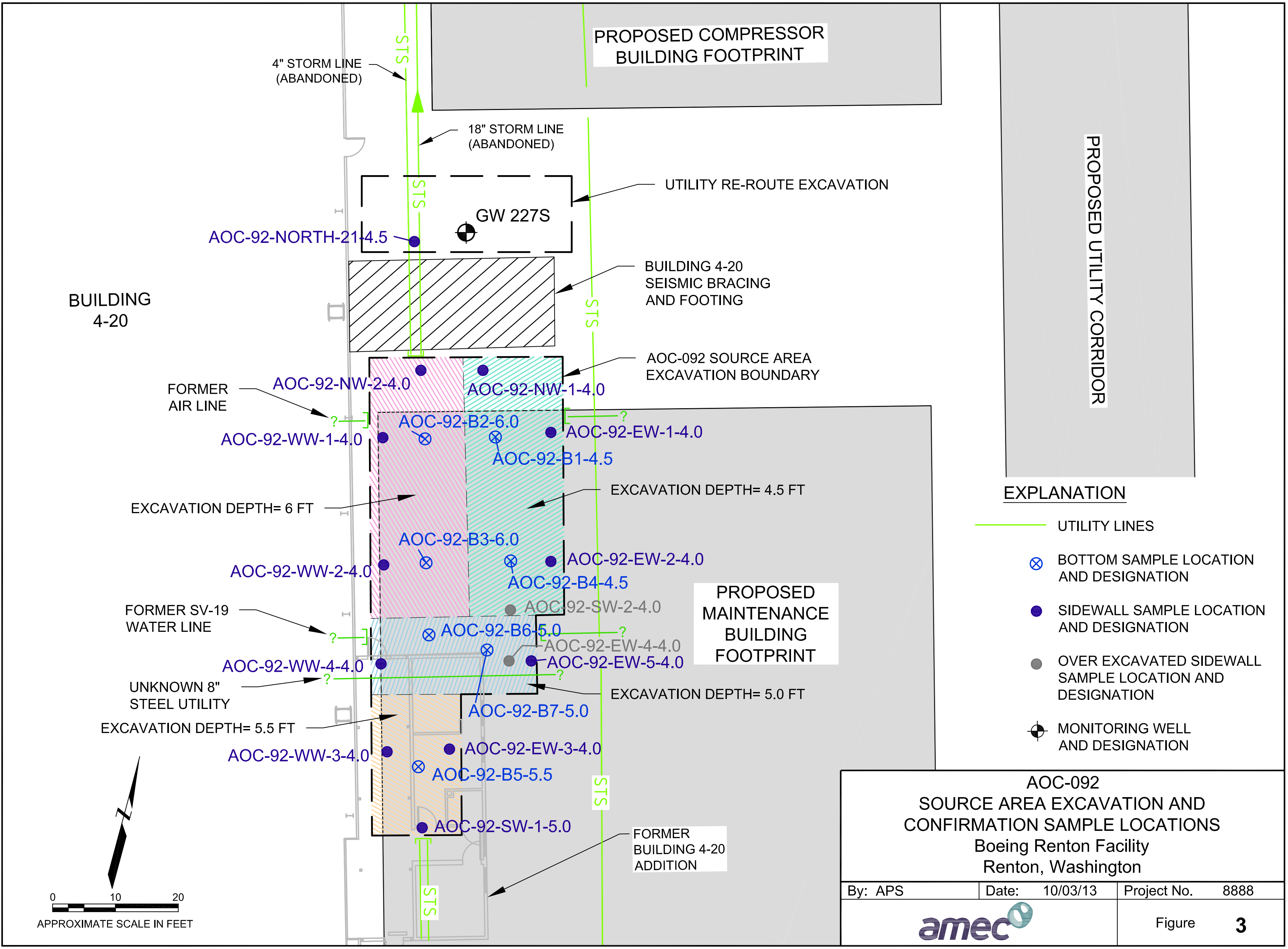
1. BASEMAP COMPILED BY DUANE HARTMAN & ASSOCIATES INC., DECEMBER, 1994

0 400 800
APPROXIMATE SCALE IN FEET

BOEING FACILITY LAYOUT
Boeing Renton Facility
Renton, Washington

By: APS	Date: 09/30/13	Project No. 8888
	amec	Figure 2

Plot Date: 09/30/13 - 2:55pm, Plotted by: adam.stenberg
Drawing Path: S:\8888_2006\069_EDR\, Drawing Name: BoeingRentonSiteMap_090413.dwg



Plot Date: 10/03/13 - 4:38pm, Plotted by: adam.stenberg
Drawing Path: S:\8888_2006\069_EDR\, Drawing Name: BoeingRenton_AOC-092_SiteMap_090613.dwg

AOC-092
SOURCE AREA EXCAVATION AND
CONFIRMATION SAMPLE LOCATIONS
Boeing Renton Facility
Renton, Washington

By: APS	Date: 10/03/13	Project No. 8888
amec		Figure 3

APPENDIX A

Soil Disposal Records

COLUMBIA RIDGE LANDFILL & RECYCLING CENTER
A WASTE MANAGEMENT COMPANY

18177 Cedar Springs Lane
Arlington, OR 97812
(541) 454-2030
(541) 454-3312 Fax

CUSTOMER INFORMATION:
The Boeing Company
P.O. Box 3707 Mail Stop 6Y-94
Seattle, WA. 98124
Attn: Fred Wallace
Ph: (206) 715-7981

ACCOUNT # 259-13

INVOICE #: **3964**
DATE: 8/15/13
PROFILE # 100583WA
LOCATION: Renton WA
WASTE TYPE: PCS
Boeing #: **X2648**
PO#: RXN00028-01
Alaska Street Transfer Facility

SUMMARY OF CHARGES

TOTAL TONS 418.65
TOTAL LOADS 13

DISPOSAL /TRANSPORTATION	$36.54/TON	$15,297.47
ODEQ FEE	$.30/TON	$125.46
TOTAL AMOUNT DUE		$15,423.07

SEND REMITTANCE TO:

Waste Management
Columbia Ridge Landfill
P.O. Box 541065
Los Angeles, CA. 90054-1065

AMOUNT DUE: $15,423.07
Payment due upon receipt

Please reference your account number and invoice number on your payment. Thankyou.

A Division of Oregon Waste Systems

Customer Summary Report

Criteria: 08/01/2013 12:00 AM to 08/14/2013 11:59 PM

Business Unit Name: AK St Reload and Recycle Facility - S07325 (USA)

Customer Name: BOEING (BOEING)

Profile: 100583WA

Ticket Date	Ticket ID	Cust Code	Manifest	Profile	Truck	Tons	Total
8/13/2013	65594	0000013	X2648	100583WA	H24T	33.6	$1,237.82
8/13/2013	65595	0000013	X2648	100583WA	H13T	27.22	$1,002.79
8/13/2013	65627	0000013	X2648	100583WA	H24T	34.44	$1,268.77
8/13/2013	65628	0000013	X2648	100583WA	H13T	34.01	$1,252.92
8/13/2013	65652	0000013	X2648	100583WA	H24T	32.81	$1,208.71
8/13/2013	65656	0000013	X2648	100583WA	H13T	32.07	$1,181.46
8/14/2013	65721	0000013	X2648	100583WA	H24T	31.02	$1,142.78
8/14/2013	65722	0000013	X2648	100583WA	H13T	28.04	$1,033.00
8/14/2013	65756	0000013	X2648	100583WA	H24T	33.72	$1,242.25
8/14/2013	65761	0000013	X2648	100583WA	H13T	32.26	$1,188.46
8/14/2013	65786	0000013	X2648	100583WA	H24T	34.02	$1,253.30
8/14/2013	65791	0000013	X2648	100583WA	H13T	31.84	$1,172.99
8/14/2013	65827	0000013	X2648	100583WA	H24T	33.6	$1,237.82
Customer Total	**13**					**418.65**	**$15,423.07**

COLUMBIA RIDGE LANDFILL & RECYCLING CENTER
A WASTE MANAGEMENT COMPANY

18177 Cedar Springs Lane
Arlington, OR 97812
(541) 454-2030
(541) 454-3312 Fax

CUSTOMER INFORMATION:
The Boeing Company
P.O. Box 3707 Mail Stop 6Y-94
Seattle, WA. 98124
Attn: Fred Wallace
Ph: (206) 715-7981

ACCOUNT # 259-13

INVOICE #: **3996**
DATE: 9/1/2013
PROFILE # 100583WA
LOCATION: Renton WA
WASTE TYPE: PCS
Boeing #: **X2648**
PO#: RXN00028-01
Alaska Street Transfer Facility

SUMMARY OF CHARGES

TOTAL TONS 257.95
TOTAL LOADS 11

DISPOSAL /TRANSPORTATION	$36.54/TON	$9,425.49
ODEQ FEE	$.30/TON	$77.24
TOTAL AMOUNT DUE		$9,502.87

SEND REMITTANCE TO:

Waste Management
Columbia Ridge Landfill
P.O. Box 541065
Los Angeles, CA. 90054-1065

AMOUNT DUE: $9,502.87
Payment due upon receipt

Please reference your account number and invoice number on your payment. Thankyou.

A Division of Oregon Waste Systems

Customer Summary Report

Criteria: 08/15/2013 12:00 AM to 08/31/2013 11:59 PM
Business Unit Name: AK St Reload and Recycle Facility - S07325 (USA)
Customer Name: BOEING (BOEING)
Profile: 100583WA

Ticket Date	Ticket ID	Cust Code	Generator	Manifest	Profile	Truck	Tons	Total
8/15/2013	65866	13	OR-Boeing Renton	X2648	100583WA	H13T	34.46	$1,269.50
8/15/2013	65901	13	OR-Boeing Renton	X2648	100583WA	H13T	33.24	$1,224.56
8/15/2013	65925	13	OR-Boeing Renton	X2648	100583WA	H13T	33.73	$1,242.61
8/26/2013	66583	13	OR-Boeing Renton	X2648	100583WA	H24T	32.39	$1,193.25
8/26/2013	66584	13	OR-Boeing Renton	X2648	100583WA	H20T	28.93	$1,065.78
8/26/2013	66609	13	OR-Boeing Renton	X2648	100583WA	H24	16.16	$595.33
8/26/2013	66614	13	OR-Boeing Renton	X2648	100583WA	H20	16.25	$598.66
8/26/2013	66635	13	OR-Boeing Renton	X2648	100583WA	H24	17.08	$629.22
8/26/2013	66637	13	OR-Boeing Renton	X2648	100583WA	H20	14.66	$540.07
8/26/2013	66652	13	OR-Boeing Renton	X2648	100583WA	H24T	17.62	$649.13
8/26/2013	66654	13	OR-Boeing Renton	X2648	100583WA	H20T	13.43	$494.76
Customer Total	11						257.95	$9,502.87

Customer Summary Report
Criteria: 08/15/2013 12:00 AM to 08/31/2013 11:59 PM
Business Unit Name: AK St Reload and Recycle Facility - S07325 (USA)
Customer Name: BOEING (BOEING)
Profile: 100583WA

Ticket Date	Ticket ID	Cust Code	Generator	Manifest	Profile	Truck	Tons	Total
8/15/2013	65866	13	OR-Boeing Renton	X2648	100583WA	H13T	34.46	$1,269.50
8/15/2013	65901	13	OR-Boeing Renton	X2648	100583WA	H13T	33.24	$1,224.56
8/15/2013	65925	13	OR-Boeing Renton	X2648	100583WA	H13T	33.73	$1,242.61
8/26/2013	66583	13	OR-Boeing Renton	X2648	100583WA	H24T	32.39	$1,193.25
8/26/2013	66584	13	OR-Boeing Renton	X2648	100583WA	H20T	28.93	$1,065.78
8/26/2013	66609	13	OR-Boeing Renton	X2648	100583WA	H24	16.16	$595.33
8/26/2013	66614	13	OR-Boeing Renton	X2648	100583WA	H20	16.25	$598.66
8/26/2013	66635	13	OR-Boeing Renton	X2648	100583WA	H24	17.08	$629.22
8/26/2013	66637	13	OR-Boeing Renton	X2648	100583WA	H20	14.66	$540.07
8/26/2013	66652	13	OR-Boeing Renton	X2648	100583WA	H24T	17.62	$649.13
8/26/2013	66654	13	OR-Boeing Renton	X2648	100583WA	H20T	13.43	$494.76
Customer Total	11						257.95	$9,502.87

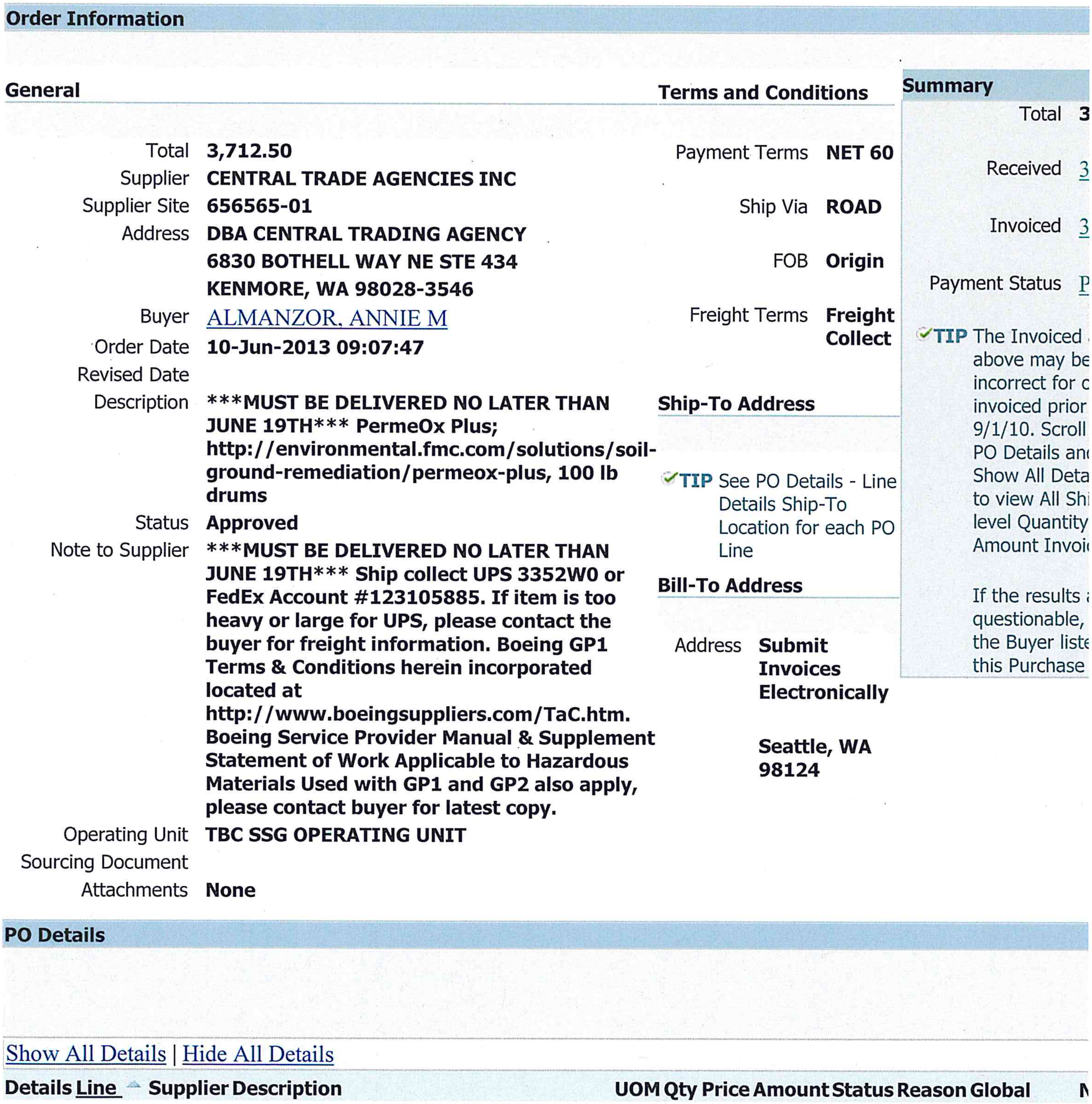
APPENDIX B

PermeOx® Plus Purchase Order

Moxley, Nathan

From:	Bach, Carl M [carl.m.bach@boeing.com]
Sent:	Monday, September 09, 2013 11:47 AM
To:	Wallace, Fred J; Moxley, Nathan
Cc:	Mcgaughey, Larry; Long, John
Subject:	RE: Perm-Ox and Soil Disposal Records for AOC-92

Correct. 500 lbs. Here is the order sheet:



Order Information

General

Total	**3,712.50**
Supplier	**CENTRAL TRADE AGENCIES INC**
Supplier Site	**656565-01**
Address	**DBA CENTRAL TRADING AGENCY** **6830 BOTHELL WAY NE STE 434** **KENMORE, WA 98028-3546**
Buyer	ALMANZOR, ANNIE M
Order Date	**10-Jun-2013 09:07:47**
Revised Date	
Description	*****MUST BE DELIVERED NO LATER THAN JUNE 19TH*** PermeOx Plus; http://environmental.fmc.com/solutions/soil-ground-remediation/permeox-plus, 100 lb drums**
Status	**Approved**
Note to Supplier	*****MUST BE DELIVERED NO LATER THAN JUNE 19TH*** Ship collect UPS 3352W0 or FedEx Account #123105885. If item is too heavy or large for UPS, please contact the buyer for freight information. Boeing GP1 Terms & Conditions herein incorporated located at http://www.boeingsuppliers.com/TaC.htm. Boeing Service Provider Manual & Supplement Statement of Work Applicable to Hazardous Materials Used with GP1 and GP2 also apply, please contact buyer for latest copy.**
Operating Unit	**TBC SSG OPERATING UNIT**
Sourcing Document	
Attachments	**None**

Terms and Conditions

Payment Terms	**NET 60**
Ship Via	**ROAD**
FOB	**Origin**
Freight Terms	**Freight Collect**

Ship-To Address

✓TIP See PO Details - Line Details Ship-To Location for each PO Line

Bill-To Address

Address	**Submit Invoices Electronically** **Seattle, WA 98124**

Summary

Total	**3**
Received	3
Invoiced	3
Payment Status	P

✓TIP The Invoiced above may be incorrect for c invoiced prior 9/1/10. Scroll PO Details and Show All Deta to view All Shi level Quantity Amount Invoi

If the results questionable, the Buyer liste this Purchase

PO Details

Details	Line	Supplier Description	UOM	Qty	Price	Amount	Status	Reason	Global	N

Item							Agreement S
⊞ Show 1	PermeOx Plus; http://environmental.fmc.com/solutions/soil-ground-remediation/permeox-plus, 100 lb drums	LB	500	7.425	3,712.50	Closed	

From: Wallace, Fred J
Sent: Friday, September 06, 2013 12:43 PM
To: Moxley, Nathan; Bach, Carl M
Cc: Mcgaughey, Larry; Long, John
Subject: RE: Perm-Ox and Soil Disposal Records for AOC-92

Nat,

We spread (5) drums of Perm – Ox. I think each drum weighed 100 lbs, but you should confirm with Carl on Monday when he returns from vacation.
Glacier excavated and shipped (677 tons) of soil to Alaska street. I can send you Waste Management's summary reports if you need them.

Boeing Remediation

fred.j.wallace@boeing.com
206.930.0461

APPENDIX C

Laboratory Reports and Data Validation

Memo

To: Larry McGaughey, Project Manager   Project: 0088880080.0300
From: Crystal Neirby   cc: Project File
Tel: (206) 342-1760
Fax: (206) 342-1761
Date: October 16, 2013

Subject: **Summary Data Quality Review**
2013 Boeing Renton Sampling Support
AOC-092 Excavation
ARI SDGs: XA71, XA82, XA98, XB22, XC25, and XC55

This memo presents the summary data quality review of 21 primary soil samples and four trip blank samples collected between August 13 and 28, 2013. The samples were submitted to Analytical Resources, Inc. (ARI), located in Tukwila, Washington, a laboratory accredited by the Washington State Department of Ecology (Ecology). The samples were analyzed for the following:

- Benzene by U.S. Environmental Protection Agency (EPA) Method 8021B Modified; and
- Total petroleum hydrocarbons as gasoline (TPH-G) by Ecology Method NWTPH-Gx.

The samples, the sample dates, and the associated laboratory sample delivery groups (SDGs) are listed below.

Sample ID	Date Sampled	SDG
AOC-92-B1-4.5	8/13/2013	XA71
AOC-92-NW-1-4.0	8/13/2013	XA71
AOC-92-NW-2-4.0	8/13/2013	XA71
AOC-92-WW-1-4.0	8/13/2013	XA71
AOC-92-EW-1-4.0	8/13/2013	XA71
AOC-92-NORTH-21-4.5	8/14/2013	XA82
AOC-92-B2-6.0	8/14/2013	XA82
Trip Blank	--	XA82
AOC-92-B3-6.0	8/14/2013	XA98
AOC-92-WW-2-4.0	8/14/2013	XA98
AOC-92-B4-4.5	8/14/2013	XA98
AOC-92-EW-2-4.0	8/14/2013	XA98
Trip Blank	--	XA98
AOC-92-SW-1-5.0	8/15/2013	XB22
AOC-92-WW-3-4.0	8/15/2013	XB22
AOC-92-B5-5.5	8/15/2013	XB22
AOC-EW-3-4.0	8/15/2013	XB22
AOC-92-SW-2-4.0	8/15/2013	XB22
Trip Blank	--	XB22
AOC-92-B6-5.0	8/26/2013	XC25
AOC-92-WW-4-4.0	8/26/2013	XC25

AMEC Environment & Infrastructure, Inc.
600 University Street, Suite 600
Seattle, Washington
USA 98101-4107
Tel (206) 342-1760
Fax (206) 342-1761
www.amec.com

Sample ID	Date Sampled	SDG
AOC-92-B7-5.0	8/26/2013	XC25
AOC-92-EW-4-4.0	8/26/2013	XC25
Trip Blank	--	XC25
AOC-92-EW-5-4.0	8/28/2013	XC55

Data were reviewed in accordance with the appropriate method procedures and criteria documented in the Quality Assurance Project Plan (QAPP) (AMEC, 2012). The control limits provided in the QAPP are advisory limits; therefore, the most current control limits provided by the laboratory were used to evaluate the quality control data. In cases where the laboratory did not track limits for an analyte, the limits in the QAPP were used.

Holding times, method/trip blanks, surrogate recoveries, laboratory control samples (LCS) and laboratory control sample duplicates (LCSD), matrix spike/matrix spike duplicates (MS/MSD), field duplicates, and reporting limits were reviewed where available to assess compliance with applicable methods. If qualification was required, data were qualified based on the definitions and use of qualifying flags outlined in EPA guidelines (EPA, 2008).

ARI received the samples each day that samples were collected. The temperatures of the coolers were recorded upon receipt and were below the maximum acceptable temperature of 6 degrees Celsius (°C), with the following exceptions:

- SDG XA71 was received at a temperature of 14.4ºC, within one hour of final sample collection.
- SDG XC55 was received at a temperature of 13.3 ºC, within a half hour of final sample collection.

The temperatures of the coolers did not equilibrate because of the brief amount of time the samples spent in transit to the laboratory. The sample results are not affected by the cooler temperatures and are not qualified.

The laboratory also noted “pea-sized” bubbles (2 to 4 millimeters) in the trip blank associated with SDGs XA82 and XA98. The laboratory proceeded with analysis using unaffected vials if available. Sample results are not affected and are not qualified.

ORGANIC ANALYSES

Samples were analyzed for benzene and TPH-G. Laboratory data were evaluated for the following parameters:

1. Preservation and Holding Times – Acceptable
2. Blanks – Acceptable except as noted:

   SDGs XA71 and XC55: a trip blank was not submitted with the samples associated with these SDGs, as required. The sample results are not affected and are not qualified.

3. Surrogates – Acceptable except as noted:

   SDG XA71: The surrogate bromobenzene, (one of two surrogates reported for both benzene and gasoline analyses) was not recovered in the initial analysis of sample AOC-92-NW-2-4.0 due to high analyte concentrations. The sample was diluted and reanalyzed with acceptable surrogate recoveries; therefore, sample results are not qualified.

4. LCS/LCSD – Acceptable
5. MS/MSD – Sample specific MS/MSD analyses were not performed with the samples submitted for this project.
6. Field Duplicates – Field duplicates were not collected with the samples submitted for this project.
7. Reporting Limits and laboratory flags – Acceptable except as noted:

   SDG XA71: The laboratory flagged the gasoline range hydrocarbon result in the initial analysis of sample AOC-92-NW-2-4.0 with an “ES” to indicate the result was greater than the calibration range of the instrument. The sample was diluted and reanalyzed. The gasoline range hydrocarbon result is reported from the reanalysis, and the benzene result is reported from the initial analysis

OVERALL ASSESSMENT OF DATA

The table below summarizes the data assessment. The completeness of SDGs XA71, XA82, XA98, XB22, XC25, and XC55 is 100 percent. Evaluation of the usefulness of these data is based on EPA guidance documents identified in the introduction to this report. Few problems were identified, and analytical performance was generally within specified limits. The data meet the project’s data quality objectives.

Sample ID	Qualified Analyte
AOC-92-B1-4.5	None
AOC-92-NW-1-4.0	None
AOC-92-NW-2-4.0	None
AOC-92-WW-1-4.0	None
AOC-92-EW-1-4.0	None
AOC-92-NORTH-21-4.5	None
AOC-92-B2-6.0	None
Trip Blank	None
AOC-92-B3-6.0	None
AOC-92-WW-2-4.0	None
AOC-92-B4-4.5	None
AOC-92-EW-2-4.0	None
Trip Blank	None
AOC-92-SW-1-5.0	None
AOC-92-WW-3-4.0	None

Sample ID	Qualified Analyte
AOC-92-B5-5.5	None
AOC-EW-3-4.0	None
AOC-92-SW-2-4.0	None
Trip Blank	None
AOC-92-B6-5.0	None
AOC-92-WW-4-4.0	None
AOC-92-B7-5.0	None
AOC-92-EW-4-4.0	None
Trip Blank	None
AOC-92-EW-5-4.0	None

REFERENCES

AMEC Environment & Infrastructure, Inc. (AMEC), 2012, Quality Assurance Project Plan, Boeing Renton Facility, Renton, Washington: Prepared for the Boeing Company, February.

U.S. Environmental Protection Agency (EPA), 2008, U.S. EPA Contract Laboratory Program National Functional Guidelines for Superfund Organic Methods Data Review: EPA 540-R-08-001, June.

Analytical Resources, Incorporated
Analytical Chemists and Consultants

August 14, 2013

Crystal Neirby
Amec
One Union Square
600 University Street, Suite 600
Seattle, WA 98101

RE: Project: Renton AOC-92
ARI Job: XA71

Dear Mr. Haddock:

Please find enclosed the original Chain-of-Custody (COC) record, sample receipt documentation, and analytical results for the project referenced above. Analytical Resources, Inc. (ARI) accepted five soil samples on August 13, 2013.

The samples were analyzed for NWTPH-Gx plus Benzene, as requested on the COC.

No anomalies were associated with these samples.

Quality control analysis results are included for your review. An electronic copy of this report and all associated raw data will be kept on file at ARI. If you have any questions or require additional information, please contact me at your convenience.

Sincerely,
ANALYTICAL RESOURCES, INC.

Kelly Bottem
Client Services Manager
(206) 695-6211
kellyb@arilabs.com
www.arilabs.com
Enclosures
cc: Carl Bach, The Boeing Company, carl.m.bach@Boeing.com

Chain of Custody Record & Laboratory Analysis Request

Analytical Resources, Incorporated
Analytical Chemists and Consultants
4611 South 134th Place, Suite 100
Tukwila, WA 98168
206-695-6200 206-695-6201 (fax)

ARI Assigned Number: XA71
Turn-around Requested: ~~ASAP~~ 24 hr TAT Kelly 8/14/13 per Boeing
ARI Client Company: Boeing
Phone:
Client Contact: Crystal Neirby (AMEC)
Client Project Name: Boeing Renton AOC-92
Client Project #:
Samplers: Nathan Moxley

Page: 1 of 1
Date: 8/13/13
Ice Present? Y
No. of Coolers: 1
Cooler Temps: 14.4

Sample ID	Date	Time	Matrix	No. Containers	TPH-G	Benzene							Notes/Comments
AOC-92-B1-4.5	8/13/13	1050	Soil	NM ~~2~~ 3	X	X							
AOC-92-NW-1-4.0	↓	1100	↓	↓	↓	↓							
AOC-92-NW-2-4.0		1110											*Hot Sample*
AOC-92-WW-1-4.0		1200											
AOC-92-EW-1-4.0		1215											

Comments/Special Instructions: Carl Bach = Boeing PM

Relinquished by:	Received by:	Relinquished by:	Received by:
(Signature)	(Signature)	(Signature)	(Signature)
Printed Name: Nathan Moxley	Printed Name: Jennifer Millsap	Printed Name:	Printed Name:
Company: AMEC	Company: ARI	Company:	Company:
Date & Time: 8/13/13 @ 1310	Date & Time: 8/13/13 @ 1310	Date & Time:	Date & Time:

Limits of Liability: *ARI will perform all requested services in accordance with appropriate methodology following ARI Standard Operating Procedures and the ARI Quality Assurance Program. This program meets standards for the industry. The total liability of ARI, its officers, agents, employees, or successors, arising out of or in connection with the requested services, shall not exceed the Invoiced amount for said services. The acceptance by the client of a proposal for services by ARI release ARI from any liability in excess thereof, not withstanding any provision to the contrary in any contract, purchase order or co-signed agreement between ARI and the Client.*

Sample Retention Policy: All samples submitted to ARI will be appropriately discarded no sooner than 90 days after receipt or 60 days after submission of hardcopy data, whichever is longer, unless alternate retention schedules have been established by work-order or contract.

Analytical Resources, Incorporated
Analytical Chemists and Consultants

Cooler Receipt Form

ARI Client Boeing

COC No(s) [✓ NA]

Assigned ARI Job No U XA71

Project Name Boeing Renton AOC-92

Delivered by: Fed-Ex UPS Courier [✓ Hand Delivered] Other:

Tracking No [✓ NA]

Preliminary Examination Phase:

Were intact, properly signed and dated custody seals attached to the outside of to cooler? YES [✓ NO]

Were custody papers included with the cooler? [✓ YES] NO

Were custody papers properly filled out (ink, signed, etc.) [✓ YES] NO

Temperature of Cooler(s) (°C) (recommended 2 0-6.0 °C for chemistry) 14.4

If cooler temperature is out of compliance fill out form 00070F Temp Gun ID# 1224/2224

Cooler Accepted by: JM Date: 8/13/13 Time: 1310

Complete custody forms and attach all shipping documents

Log-In Phase:

Was a temperature blank included in the cooler? YES [✓ NO]

What kind of packing material was used? Bubble Wrap [✓ Wet Ice] Gel Packs [✓ Baggies] Foam Block Paper Other:

Was sufficient ice used (if appropriate)? NA ~~YES~~ [✓ NO]

Were all bottles sealed in individual plastic bags? [✓ YES] NO

Did all bottles arrive in good condition (unbroken)? [✓ YES] NO

Were all bottle labels complete and legible? [✓ YES] NO

Did the number of containers listed on COC match with the number of containers received? [✓ YES] NO

Did all bottle labels and tags agree with custody papers? [✓ YES] NO

Were all bottles used correct for the requested analyses? [✓ YES] NO

Do any of the analyses (bottles) require preservation? (attach preservation sheet, excluding VOCs) [✓ NA] YES NO

Were all VOC vials free of air bubbles? [✓ NA] YES NO

Was sufficient amount of sample sent in each bottle? [✓ YES] NO

Date VOC Trip Blank was made at ARI [✓ NA]

Was Sample Split by ARI: [✓ NA] YES Date/Time Equipment: Split by:

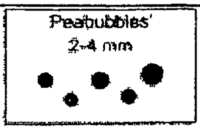
Samples Logged by: AV Date: 8/13/13 Time: 1425

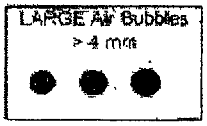
***** Notify Project Manager of discrepancies or concerns *****

Sample ID on Bottle	Sample ID on COC	Sample ID on Bottle	Sample ID on COC

Additional Notes, Discrepancies, & Resolutions:

By: Date:





Small → "sm"
Peabubbles → "pb"
Large → "lg"
Headspace → "hs"

Analytical Resources,
Incorporated
Analytical Chemists and
Consultants

Cooler Temperature Compliance Form

XA71

Cooler#: 1 **Temperature(°C):** 14.4

Sample ID	**Bottle Count**	**Bottle Type**
All Samples received		
above 6°C.		

Cooler#:__________ **Temperature(°C):**__________

Sample ID	**Bottle Count**	**Bottle Type**

Cooler#:__________ **Temperature(°C):**__________

Sample ID	**Bottle Count**	**Bottle Type**

Cooler#:__________ **Temperature(°C):**__________

Sample ID	**Bottle Count**	**Bottle Type**

Completed by: AV Date 8/13/13 Time: 1426

Sample ID Cross Reference Report

ANALYTICAL RESOURCES INCORPORATED

ARI Job No: XA71
Client: The Boeing Company
Project Event: N/A
Project Name: Boeing Renton AOC-92

	Sample ID	ARI Lab ID	ARI LIMS ID	Matrix	Sample Date/Time	VTSR
1.	AOC-92-B1-4.5	XA71A	13-16811	Soil	08/13/13 10:50	08/13/13 13:10
2.	AOC-92-NW-1-4.0	XA71B	13-16812	Soil	08/13/13 11:00	08/13/13 13:10
3.	AOC-92-NW-2-4.0	XA71C	13-16813	Soil	08/13/13 11:10	08/13/13 13:10
4.	AOC-92-WW-1-4.0	XA71D	13-16814	Soil	08/13/13 12:00	08/13/13 13:10
5.	AOC-92-EW-1-4.0	XA71E	13-16815	Soil	08/13/13 12:15	08/13/13 13:10

ORGANICS ANALYSIS DATA SHEET
BETX by Method SW8021BMod
TPHG by Method NWTPHG
Page 1 of 1

Sample ID: AOC-92-B1-4.5
SAMPLE

Lab Sample ID: XA71A
LIMS ID: 13-16811
Matrix: Soil
Data Release Authorized:
Reported: 08/14/13

QC Report No: XA71-The Boeing Company
Project: Boeing Renton AOC-92
Event: NA
Date Sampled: 08/13/13
Date Received: 08/13/13

Date Analyzed: 08/13/13 22:09
Instrument/Analyst: PID1/PKC

Purge Volume: 5.0 mL
Sample Amount: 92 mg-dry-wt
Percent Moisture: 13.3%

CAS Number	Analyte	RL	Result	GAS ID
71-43-2	**Benzene**	**14**	**21**	
	Gasoline Range Hydrocarbons	**5.4**	**29**	**GAS**

BETX Surrogate Recovery

Trifluorotoluene	90.7%
Bromobenzene	93.5%

Gasoline Surrogate Recovery

Trifluorotoluene	91.8%
Bromobenzene	96.4%

BETX values reported in µg/kg (ppb)
Gasoline values reported in mg/kg (ppm)

GAS: Indicates the presence of gasoline or weathered gasoline.
GRO: Positive result that does not match an identifiable gasoline pattern.

Quantitation on total peaks in the gasoline range from Toluene to Naphthalene.

Results corrected for soil moisture content per Section 11.10.5 of EPA Method 8000C.

ORGANICS ANALYSIS DATA SHEET
BETX by Method SW8021BMod
TPHG by Method NWTPHG
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Sample ID: AOC-92-NW-1-4.0
SAMPLE

Lab Sample ID: XA71B
LIMS ID: 13-16812
Matrix: Soil
Data Release Authorized:
Reported: 08/14/13

QC Report No: XA71-The Boeing Company
Project: Boeing Renton AOC-92
Event: NA
Date Sampled: 08/13/13
Date Received: 08/13/13

Date Analyzed: 08/13/13 22:38
Instrument/Analyst: PID1/PKC

Purge Volume: 5.0 mL
Sample Amount: 76 mg-dry-wt
Percent Moisture: 11.4%

CAS Number	**Analyte**	**RL**	**Result**	GAS ID
71-43-2	Benzene	17	< 17 U	
	Gasoline Range Hydrocarbons	6.6	< 6.6 U	---

BETX Surrogate Recovery

Trifluorotoluene	92.4%
Bromobenzene	95.1%

Gasoline Surrogate Recovery

Trifluorotoluene	94.4%
Bromobenzene	99.8%

BETX values reported in µg/kg (ppb)
Gasoline values reported in mg/kg (ppm)

GAS: Indicates the presence of gasoline or weathered gasoline.
GRO: Positive result that does not match an identifiable gasoline pattern.

Quantitation on total peaks in the gasoline range from Toluene to Naphthalene.

Results corrected for soil moisture content per Section 11.10.5 of EPA Method 8000C.

FORM I

ORGANICS ANALYSIS DATA SHEET
BETX by Method SW8021BMod
TPHG by Method NWTPHG
Page 1 of 1

Sample ID: AOC-92-NW-2-4.0
SAMPLE

Lab Sample ID: XA71C
LIMS ID: 13-16813
Matrix: Soil
Data Release Authorized:
Reported: 08/14/13

QC Report No: XA71-The Boeing Company
Project: Boeing Renton AOC-92
Event: NA
Date Sampled: 08/13/13
Date Received: 08/13/13

Date Analyzed: 08/14/13 00:34
Instrument/Analyst: PID1/PKC

Purge Volume: 5.0 mL
Sample Amount: 89 mg-dry-wt
Percent Moisture: 16.6%

CAS Number	**Analyte**	**RL**	**Result**	GAS ID
71-43-2	Benzene	14	< 14 U	
	Gasoline Range Hydrocarbons	**5.6**	**3,500 ES**	**GRO**

BETX Surrogate Recovery	
Trifluorotoluene	107%
Bromobenzene	NR

Gasoline Surrogate Recovery	
Trifluorotoluene	116%
Bromobenzene	NR

BETX values reported in µg/kg (ppb)
Gasoline values reported in mg/kg (ppm)

GAS: Indicates the presence of gasoline or weathered gasoline.
GRO: Positive result that does not match an identifiable gasoline pattern.

Quantitation on total peaks in the gasoline range from Toluene to Naphthalene.

Results corrected for soil moisture content per Section 11.10.5 of EPA Method 8000C.

ORGANICS ANALYSIS DATA SHEET
BETX by Method SW8021BMod
TPHG by Method NWTPHG
Page 1 of 1

Sample ID: AOC-92-NW-2-4.0
DILUTION

Lab Sample ID: XA71C
LIMS ID: 13-16813
Matrix: Soil
Data Release Authorized:
Reported: 08/14/13

QC Report No: XA71-The Boeing Company
Project: Boeing Renton AOC-92
Event: NA
Date Sampled: 08/13/13
Date Received: 08/13/13

Date Analyzed: 08/13/13 23:07
Instrument/Analyst: PID1/PKC

Purge Volume: 5.0 mL
Sample Amount: 4.4 mg-dry-wt
Percent Moisture: 16.6%

CAS Number	**Analyte**	**RL**	**Result**	GAS ID
71-43-2	Benzene	280	< 280 U	
	Gasoline Range Hydrocarbons	**110**	**3,600**	**GRO**

BETX Surrogate Recovery

Trifluorotoluene	96.2%
Bromobenzene	103%

Gasoline Surrogate Recovery

Trifluorotoluene	97.8%
Bromobenzene	109%

BETX values reported in µg/kg (ppb)
Gasoline values reported in mg/kg (ppm)

GAS: Indicates the presence of gasoline or weathered gasoline.
GRO: Positive result that does not match an identifiable gasoline pattern.

Quantitation on total peaks in the gasoline range from Toluene to Naphthalene.

Results corrected for soil moisture content per Section 11.10.5 of EPA Method 8000C.

**ANALYTICAL
RESOURCES
INCORPORATED**

ORGANICS ANALYSIS DATA SHEET
BETX by Method SW8021BMod
TPHG by Method NWTPHG
Page 1 of 1

Sample ID: AOC-92-WW-1-4.0
SAMPLE

Lab Sample ID: XA71D
LIMS ID: 13-16814
Matrix: Soil
Data Release Authorized:
Reported: 08/14/13

QC Report No: XA71-The Boeing Company
Project: Boeing Renton AOC-92
Event: NA
Date Sampled: 08/13/13
Date Received: 08/13/13

Date Analyzed: 08/13/13 23:36
Instrument/Analyst: PID1/PKC

Purge Volume: 5.0 mL
Sample Amount: 92 mg-dry-wt
Percent Moisture: 22.1%

CAS Number	**Analyte**	**RL**	**Result**	
71-43-2	Benzene	14	< 14 U	
				GAS ID
	Gasoline Range Hydrocarbons	**5.4**	**12**	**GRO**

BETX Surrogate Recovery

Trifluorotoluene	85.3%
Bromobenzene	88.2%

Gasoline Surrogate Recovery

Trifluorotoluene	87.0%
Bromobenzene	93.6%

BETX values reported in µg/kg (ppb)
Gasoline values reported in mg/kg (ppm)

GAS: Indicates the presence of gasoline or weathered gasoline.
GRO: Positive result that does not match an identifiable gasoline pattern.

Quantitation on total peaks in the gasoline range from Toluene to Naphthalene.

Results corrected for soil moisture content per Section 11.10.5 of EPA Method 8000C.

ORGANICS ANALYSIS DATA SHEET
BETX by Method SW8021BMod
TPHG by Method NWTPHG
Page 1 of 1

Sample ID: AOC-92-EW-1-4.0
SAMPLE

Lab Sample ID: XA71E
LIMS ID: 13-16815
Matrix: Soil
Data Release Authorized:
Reported: 08/14/13

QC Report No: XA71-The Boeing Company
Project: Boeing Renton AOC-92
Event: NA
Date Sampled: 08/13/13
Date Received: 08/13/13

Date Analyzed: 08/14/13 00:05
Instrument/Analyst: PID1/PKC

Purge Volume: 5.0 mL
Sample Amount: 74 mg-dry-wt
Percent Moisture: 21.0%

CAS Number	Analyte	RL	Result	GAS ID
71-43-2	Benzene	17	< 17 U	
	Gasoline Range Hydrocarbons	**6.7**	**47**	**GRO**

BETX Surrogate Recovery

Trifluorotoluene	87.8%
Bromobenzene	93.3%

Gasoline Surrogate Recovery

Trifluorotoluene	90.0%
Bromobenzene	98.8%

BETX values reported in µg/kg (ppb)
Gasoline values reported in mg/kg (ppm)

GAS: Indicates the presence of gasoline or weathered gasoline.
GRO: Positive result that does not match an identifiable gasoline pattern.

Quantitation on total peaks in the gasoline range from Toluene to Naphthalene.

Results corrected for soil moisture content per Section 11.10.5 of EPA Method 8000C.

ORGANICS ANALYSIS DATA SHEET
BETX by Method SW8021BMod
TPHG by Method NWTPHG
Page 1 of 1

Sample ID: MB-081313
METHOD BLANK

Lab Sample ID: MB-081313
LIMS ID: 13-16811
Matrix: Soil
Data Release Authorized:
Reported: 08/14/13

QC Report No: XA71-The Boeing Company
Project: Boeing Renton AOC-92
Event: NA
Date Sampled: NA
Date Received: NA

Date Analyzed: 08/13/13 12:15
Instrument/Analyst: PID1/PKC

Purge Volume: 5.0 mL
Sample Amount: 100 mg-dry-wt

CAS Number	Analyte	RL	Result	GAS ID
71-43-2	Benzene	12	< 12 U	
	Gasoline Range Hydrocarbons	5.0	< 5.0 U	---

BETX Surrogate Recovery

Trifluorotoluene	95.8%
Bromobenzene	92.4%

Gasoline Surrogate Recovery

Trifluorotoluene	97.0%
Bromobenzene	94.9%

BETX values reported in µg/kg (ppb)
Gasoline values reported in mg/kg (ppm)

GAS: Indicates the presence of gasoline or weathered gasoline.
GRO: Positive result that does not match an identifiable gasoline pattern.

Quantitation on total peaks in the gasoline range from Toluene to Naphthalene.

BETX SOIL SURROGATE RECOVERY SUMMARY

ARI Job: XA71
Matrix: Soil

QC Report No: XA71-The Boeing Company
Project: Boeing Renton AOC-92
Event: NA

Client ID	TFT	BBZ	TOT OUT
MB-081313	95.8%	92.4%	0
LCS-081313	110%	99.3%	0
LCSD-081313	109%	101%	0
AOC-92-B1-4.5	90.7%	93.5%	0
AOC-92-NW-1-4.0	92.4%	95.1%	0
AOC-92-NW-2-4.0	107%	NR	0
AOC-92-NW-2-4.0 DL	96.2%	103%	0
AOC-92-WW-1-4.0	85.3%	88.2%	0
AOC-92-EW-1-4.0	87.8%	93.3%	0

	LCS/MB LIMITS	QC LIMITS
(TFT) = Trifluorotoluene	(80-120)	(69-126)
(BBZ) = Bromobenzene	(80-120)	(49-143)

Log Number Range: 13-16811 to 13-16815

FORM II BETX

TPHG SOIL SURROGATE RECOVERY SUMMARY

ARI Job: XA71
Matrix: Soil

QC Report No: XA71-The Boeing Company
Project: Boeing Renton AOC-92
Event: NA

Client ID	BFB	TFT	BBZ	TOT OUT
MB-081313	NA	97.0%	94.9%	0
LCS-081313	NA	113%	99.6%	0
LCSD-081313	NA	114%	105%	0
AOC-92-B1-4.5	NA	91.8%	96.4%	0
AOC-92-NW-1-4.0	NA	94.4%	99.8%	0
AOC-92-NW-2-4.0	NA	116%	NR	0
AOC-92-NW-2-4.0 DL	NA	97.8%	109	0
AOC-92-WW-1-4.0	NA	87.0%	93.6%	0
AOC-92-EW-1-4.0	NA	90.0%	98.8%	0

	LCS/MB LIMITS	QC LIMITS
(TFT) = Trifluorotoluene	(80-120)	(65-128)
(BBZ) = Bromobenzene	(80-120)	(52-149)

Log Number Range: 13-16811 to 13-16815

FORM II TPHG

ORGANICS ANALYSIS DATA SHEET
BETX by Method SW8021BMod
Page 1 of 1

Sample ID: LCS-081313
LAB CONTROL SAMPLE

Lab Sample ID: LCS-081313
LIMS ID: 13-16811
Matrix: Soil
Data Release Authorized:
Reported: 08/14/13

QC Report No: XA71-The Boeing Company
Project: Boeing Renton AOC-92
Event: NA
Date Sampled: NA
Date Received: NA

Date Analyzed LCS: 08/13/13 11:16
LCSD: 08/13/13 11:45
Instrument/Analyst LCS: PID1/PKC
LCSD: PID1/PKC

Purge Volume: 5.0 mL

Sample Amount LCS: 100 mg-dry-wt
LCSD: 100 mg-dry-wt

Analyte	**LCS**	**Spike Added-LCS**	**LCS Recovery**	**LCSD**	**Spike Added-LCSD**	**LCSD Recovery**	**RPD**
Benzene	93.5	105	89.0%	92.0	105	87.6%	1.6%

Reported in µg/kg (ppb)

RPD calculated using sample concentrations per SW846.

BETX Surrogate Recovery

	LCS	**LCSD**
Trifluorotoluene	110%	109%
Bromobenzene	99.3%	101%

ANALYTICAL
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ORGANICS ANALYSIS DATA SHEET
TPHG by Method NWTPHG
Page 1 of 1

Sample ID: LCS-081313
LAB CONTROL SAMPLE

Lab Sample ID: LCS-081313
LIMS ID: 13-16811
Matrix: Soil
Data Release Authorized:
Reported: 08/14/13

QC Report No: XA71-The Boeing Company
Project: Boeing Renton AOC-92
Event: NA
Date Sampled: NA
Date Received: NA

Date Analyzed LCS: 08/13/13 11:16
LCSD: 08/13/13 11:45
Instrument/Analyst LCS: PID1/PKC
LCSD: PID1/PKC

Purge Volume: 5.0 mL

Sample Amount LCS: 100 mg-dry-wt
LCSD: 100 mg-dry-wt

Analyte	**LCS**	**Spike Added-LCS**	**LCS Recovery**	**LCSD**	**Spike Added-LCSD**	**LCSD Recovery**	**RPD**
Gasoline Range Hydrocarbons	120	125	96.0%	123	125	98.4%	2.5%

Reported in mg/kg (ppm)

RPD calculated using sample concentrations per SW846.

TPHG Surrogate Recovery

	LCS	**LCSD**
Trifluorotoluene	113%	114%
Bromobenzene	99.6%	105%

FORM III

Analytical Resources, Incorporated
Analytical Chemists and Consultants

August 15, 2013

Crystal Neirby
Amec
One Union Square
600 University Street, Suite 600
Seattle, WA 98101

RE: Project: Renton AOC-92
ARI Job: XA82

Dear Mr. Haddock:

Please find enclosed the original Chain-of-Custody (COC) record, sample receipt documentation, and analytical results for the project referenced above. Analytical Resources, Inc. (ARI) accepted two soil samples and a trip blank on August 14, 2013.

The samples were analyzed for NWTPH-Gx plus Benzene, as requested on the COC.

No anomalies were associated with these samples.

Quality control analysis results are included for your review. An electronic copy of this report and all associated raw data will be kept on file at ARI. If you have any questions or require additional information, please contact me at your convenience.

Sincerely,
ANALYTICAL RESOURCES, INC.

Kelly Bottem
Client Services Manager
(206) 695-6211
kellyb@arilabs.com
www.arilabs.com
Enclosures
cc: Carl Bach, The Boeing Company, carl.m.bach@Boeing.com

Chain of Custody Record & Laboratory Analysis Request

Analytical Resources, Incorporated
Analytical Chemists and Consultants
4611 South 134th Place, Suite 100
Tukwila, WA 98168
206-695-6200 206-695-6201 (fax)

ARI Assigned Number: XA82	Turn-around Requested: ASAP	Page: 1	of 1
ARI Client Company: Boeing	Phone:	Date: 8/14/13	Ice Present? Y
Client Contact: Crystal Neirby (AMEC), Fred Wallace Carl Bach (Boeing)		No. of Coolers: 1	Cooler Temps: 3.3
Client Project Name: AOC-92, Boeing Renton			
Client Project #:	Samplers: Nathan Moxley		

Sample ID	Date	Time	Matrix	No Containers	TPH-G	Benzene							Notes/Comments
AOC-92-north-21-4.5	8/14/13	0655	Soil	3	X	X							
AOC-92-B2-6.0	8/14/13	0910	Soil	3	X	X							
trip blanks			Water	2	X	X							

Analysis Requested

Comments/Special Instructions	Relinquished by:	Received by:	Relinquished by:	Received by:
Please let Fred Wallace know as soon as results are available	(Signature)	(Signature)	(Signature)	(Signature)
	Printed Name: Nathan Moxley	Printed Name: A. Volgardsen	Printed Name:	Printed Name:
	Company: AMEC	Company: ARI	Company:	Company:
	Date & Time: 8/14/13 @ 1020	Date & Time: 8/14/13 1020	Date & Time:	Date & Time:

Limits of Liability: *ARI will perform all requested services in accordance with appropriate methodology following ARI Standard Operating Procedures and the ARI Quality Assurance Program. This program meets standards for the industry. The total liability of ARI, its officers, agents, employees, or successors, arising out of or in connection with the requested services, shall not exceed the Invoiced amount for said services. The acceptance by the client of a proposal for services by ARI release ARI from any liability in excess thereof, not withstanding any provision to the contrary in any contract, purchase order or co-signed agreement between ARI and the Client.*

Sample Retention Policy: All samples submitted to ARI will be appropriately discarded no sooner than 90 days after receipt or 60 days after submission of hardcopy data, whichever is longer, unless alternate retention schedules have been established by work-order or contract.

Analytical Resources, Incorporated
Analytical Chemists and Consultants

Cooler Receipt Form

ARI Client: Boeing
COC No(s): [✓ NA]
Assigned ARI Job No: XA82

Project Name: Boeing Renton ADC-92
Delivered by: Fed-Ex ~~UPS~~ Courier [✓ Hand Delivered] Other ______
Tracking No: [✓ NA]

Preliminary Examination Phase:

Were intact, properly signed and dated custody seals attached to the outside of to cooler? YES [✓ NO]
Were custody papers included with the cooler? [✓ YES] NO
Were custody papers properly filled out (ink, signed, etc.) [✓ YES] NO
Temperature of Cooler(s) (°C) (recommended 2 0-6 0 °C for chemistry) 3.3
If cooler temperature is out of compliance fill out form 00070F
Temp Gun ID#: 122412224
Cooler Accepted by: AV Date: 8/14/13 Time: 1020

Complete custody forms and attach all shipping documents

Log-In Phase:

Was a temperature blank included in the cooler? YES [✓ NO]
What kind of packing material was used? Bubble Wrap [✓ Wet Ice] Gel Packs [✓ Baggies] Foam Block Paper Other: ______
Was sufficient ice used (if appropriate)? NA [✓ YES] NO
Were all bottles sealed in individual plastic bags? [✓ YES] NO
Did all bottles arrive in good condition (unbroken)? [✓ YES] NO
Were all bottle labels complete and legible? [✓ YES] NO
Did the number of containers listed on COC match with the number of containers received? [✓ YES] NO
Did all bottle labels and tags agree with custody papers? [✓ YES] NO
Were all bottles used correct for the requested analyses? [✓ YES] NO
Do any of the analyses (bottles) require preservation? (attach preservation sheet, excluding VOCs) [✓ NA] YES NO
Were all VOC vials free of air bubbles? NA YES [✓ NO]
Was sufficient amount of sample sent in each bottle? [✓ YES] NO
Date VOC Trip Blank was made at ARI NA 8/2/13
Was Sample Split by ARI: [✓ NA] YES Date/Time ______ Equipment ______ Split by: ______

Samples Logged by: AV Date: 8/14/13 Time: 1021

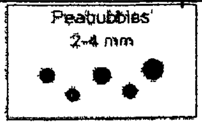
***** Notify Project Manager of discrepancies or concerns *****

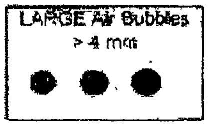
Sample ID on Bottle	Sample ID on COC	Sample ID on Bottle	Sample ID on COC

Additional Notes, Discrepancies, & Resolutions:

TB = 2pb

By: AV Date: 8/14/13





Small → "sm"
Peabubbles → "pb"
Large → "lg"
Headspace → "hs"

Sample ID Cross Reference Report

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ARI Job No: XA82
Client: The Boeing Company
Project Event: N/A
Project Name: Boeing Renton, AOC-92

	Sample ID	ARI Lab ID	ARI LIMS ID	Matrix	Sample Date/Time	VTSR
1.	AOC-92-NORTH-21-4.5	XA82A	13-16830	Soil	08/14/13 06:55	08/14/13 10:20
2.	AOC-92-B2-6.0	XA82B	13-16831	Soil	08/14/13 09:10	08/14/13 10:20
3.	Trip Blanks	XA82C	13-16832	Water	08/14/13	08/14/13 10:20

Printed 08/14/13 Page 1 of 1

ORGANICS ANALYSIS DATA SHEET
BETX by Method SW8021BMod
TPHG by Method NWTPHG
Page 1 of 1

Sample ID: AOC-92-NORTH-21-4.5
SAMPLE

Lab Sample ID: XA82A
LIMS ID: 13-16830
Matrix: Soil
Data Release Authorized:
Reported: 08/15/13

QC Report No: XA82-The Boeing Company
Project: Boeing Renton, AOC-92
Event: NA
Date Sampled: 08/14/13
Date Received: 08/14/13

Date Analyzed: 08/14/13 13:04
Instrument/Analyst: PID1/PKC

Purge Volume: 5.0 mL
Sample Amount: 67 mg-dry-wt
Percent Moisture: 23.6%

CAS Number	Analyte	RL	Result	GAS ID
71-43-2	Benzene	19	< 19 U	
	Gasoline Range Hydrocarbons	7.4	< 7.4 U	---

BETX Surrogate Recovery

Trifluorotoluene	93.0%
Bromobenzene	90.7%

Gasoline Surrogate Recovery

Trifluorotoluene	94.6%
Bromobenzene	93.7%

BETX values reported in µg/kg (ppb)
Gasoline values reported in mg/kg (ppm)

GAS: Indicates the presence of gasoline or weathered gasoline.
GRO: Positive result that does not match an identifiable gasoline pattern.

Quantitation on total peaks in the gasoline range from Toluene to Naphthalene.

Results corrected for soil moisture content per Section 11.10.5 of EPA Method 8000C.

ORGANICS ANALYSIS DATA SHEET
BETX by Method SW8021BMod
TPHG by Method NWTPHG
Page 1 of 1

Sample ID: AOC-92-B2-6.0
SAMPLE

Lab Sample ID: XA82B
LIMS ID: 13-16831
Matrix: Soil
Data Release Authorized:
Reported: 08/15/13

QC Report No: XA82-The Boeing Company
Project: Boeing Renton, AOC-92
Event: NA
Date Sampled: 08/14/13
Date Received: 08/14/13

Date Analyzed: 08/14/13 13:33
Instrument/Analyst: PID1/PKC

Purge Volume: 5.0 mL
Sample Amount: 74 mg-dry-wt
Percent Moisture: 22.8%

CAS Number	Analyte	RL	Result	GAS ID
71-43-2	Benzene	17	< 17 U	
	Gasoline Range Hydrocarbons	6.7	< 6.7 U	---

BETX Surrogate Recovery

Trifluorotoluene	96.8%
Bromobenzene	95.9%

Gasoline Surrogate Recovery

Trifluorotoluene	98.1%
Bromobenzene	100%

BETX values reported in µg/kg (ppb)
Gasoline values reported in mg/kg (ppm)

GAS: Indicates the presence of gasoline or weathered gasoline.
GRO: Positive result that does not match an identifiable gasoline pattern.

Quantitation on total peaks in the gasoline range from Toluene to Naphthalene.

Results corrected for soil moisture content per Section 11.10.5 of EPA Method 8000C.

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ORGANICS ANALYSIS DATA SHEET
BETX by Method SW8021BMod
TPHG by Method NWTPHG
Page 1 of 1

Sample ID: Trip Blanks
SAMPLE

Lab Sample ID: XA82C
LIMS ID: 13-16832
Matrix: Water
Data Release Authorized:
Reported: 08/15/13

QC Report No: XA82-The Boeing Company
Project: Boeing Renton, AOC-92
Event: NA
Date Sampled: 08/14/13
Date Received: 08/14/13

Date Analyzed: 08/14/13 12:34
Instrument/Analyst: PID1/PKC

Purge Volume: 5.0 mL
Dilution Factor: 1.00

CAS Number	Analyte	RL	Result	GAS ID
71-43-2	Benzene	0.25	< 0.25 U	
	Gasoline Range Hydrocarbons	0.10	< 0.10 U	---

BETX Surrogate Recovery	
Trifluorotoluene	98.8%
Bromobenzene	95.6%

Gasoline Surrogate Recovery	
Trifluorotoluene	99.6%
Bromobenzene	95.1%

BETX values reported in µg/L (ppb)
Gasoline values reported in mg/L (ppm)

GAS: Indicates the presence of gasoline or weathered gasoline.
GRO: Positive result that does not match an identifiable gasoline pattern.

Quantitation on total peaks in the gasoline range from Toluene to Naphthalene.

ORGANICS ANALYSIS DATA SHEET
BETX by Method SW8021BMod
TPHG by Method NWTPHG
Page 1 of 1

Sample ID: MB-081413
METHOD BLANK

Lab Sample ID: MB-081413
LIMS ID: 13-16830
Matrix: Soil
Data Release Authorized:
Reported: 08/15/13

QC Report No: XA82-The Boeing Company
Project: Boeing Renton, AOC-92
Event: NA
Date Sampled: NA
Date Received: NA

Date Analyzed: 08/14/13 11:44
Instrument/Analyst: PID1/PKC

Purge Volume: 5.0 mL
Sample Amount: 100 mg-dry-wt

CAS Number	Analyte	RL	Result	GAS ID
71-43-2	Benzene	12	< 12 U	
	Gasoline Range Hydrocarbons	5.0	< 5.0 U	---

BETX Surrogate Recovery

Trifluorotoluene	95.2%
Bromobenzene	93.3%

Gasoline Surrogate Recovery

Trifluorotoluene	96.2%
Bromobenzene	96.8%

BETX values reported in µg/kg (ppb)
Gasoline values reported in mg/kg (ppm)

GAS: Indicates the presence of gasoline or weathered gasoline.
GRO: Positive result that does not match an identifiable gasoline pattern.

Quantitation on total peaks in the gasoline range from Toluene to Naphthalene.

BETX SOIL SURROGATE RECOVERY SUMMARY

ARI Job: XA82
Matrix: Soil

QC Report No: XA82-The Boeing Company
Project: Boeing Renton, AOC-92
Event: NA

Client ID	TFT	BBZ	TOT OUT
MB-081413	95.2%	93.3%	0
LCS-081413	107%	99.5%	0
LCSD-081413	107%	100%	0
AOC-92-NORTH-21-4.5	93.0%	90.7%	0
AOC-92-B2-6.0	96.8%	95.9%	0

	LCS/MB LIMITS	QC LIMITS
(TFT) = Trifluorotoluene	(80-120)	(69-126)
(BBZ) = Bromobenzene	(80-120)	(49-143)

Log Number Range: 13-16830 to 13-16831

FORM II BETX

TPHG SOIL SURROGATE RECOVERY SUMMARY

ARI Job: XA82
Matrix: Soil

QC Report No: XA82-The Boeing Company
Project: Boeing Renton, AOC-92
Event: NA

Client ID	BFB	TFT	BBZ	TOT OUT
MB-081413	NA	96.2%	96.8%	0
LCS-081413	NA	113%	101%	0
LCSD-081413	NA	113%	107%	0
AOC-92-NORTH-21-4.5	NA	94.6%	93.7%	0
AOC-92-B2-6.0	NA	98.1%	100%	0

	LCS/MB LIMITS	QC LIMITS
(TFT) = Trifluorotoluene	(80-120)	(65-128)
(BBZ) = Bromobenzene	(80-120)	(52-149)

Log Number Range: 13-16830 to 13-16831

FORM II TPHG

TPHG WATER SURROGATE RECOVERY SUMMARY

ARI Job: XA82
Matrix: Water

QC Report No: XA82-The Boeing Company
Project: Boeing Renton, AOC-92
Event: NA

Client ID	TFT	BBZ	TOT OUT
Trip Blanks	99.6%	95.1%	0

	LCS/MB LIMITS	QC LIMITS
(TFT) = Trifluorotoluene	(80-120)	(80-120)
(BBZ) = Bromobenzene	(80-120)	(80-120)

Log Number Range: 13-16832 to 13-16832

FORM II TPHG

BETX WATER SURROGATE RECOVERY SUMMARY

ARI Job: XA82
Matrix: Water

QC Report No: XA82-The Boeing Company
Project: Boeing Renton, AOC-92
Event: NA

Client ID	TFT	BBZ	TOT OUT
Trip Blanks	98.8%	95.6%	0

		LCS/MB LIMITS	QC LIMITS
(TFT) = Trifluorotoluene	(5 mL PV)	(80-120)	(80-120)
(TFT) = Trifluorotoluene	(15 mL PV)	(79-120)	(80-120)
(BBZ) = Bromobenzene	(5 mL PV)	(80-120)	(77-120)
(BBZ) = Bromobenzene	(15 mL PV)	(79-120)	(80-120)

Log Number Range: 13-16832 to 13-16832

FORM II BETX

ORGANICS ANALYSIS DATA SHEET
BETX by Method SW8021BMod
Page 1 of 1

Sample ID: LCS-081413
LAB CONTROL SAMPLE

Lab Sample ID: LCS-081413
LIMS ID: 13-16830
Matrix: Soil
Data Release Authorized:
Reported: 08/15/13

QC Report No: XA82-The Boeing Company
Project: Boeing Renton, AOC-92
Event: NA
Date Sampled: NA
Date Received: NA

Date Analyzed LCS: 08/14/13 10:46
LCSD: 08/14/13 11:15
Instrument/Analyst LCS: PID1/PKC
LCSD: PID1/PKC

Purge Volume: 5.0 mL

Sample Amount LCS: 100 mg-dry-wt
LCSD: 100 mg-dry-wt

Analyte	**LCS**	**Spike Added-LCS**	**LCS Recovery**	**LCSD**	**Spike Added-LCSD**	**LCSD Recovery**	**RPD**
Benzene	89.0	105	84.8%	90.5	105	86.2%	1.7%

Reported in µg/kg (ppb)

RPD calculated using sample concentrations per SW846.

BETX Surrogate Recovery

	LCS	**LCSD**
Trifluorotoluene	107%	107%
Bromobenzene	99.5%	100%

ORGANICS ANALYSIS DATA SHEET
TPHG by Method NWTPHG
Page 1 of 1

Sample ID: LCS-081413
LAB CONTROL SAMPLE

Lab Sample ID: LCS-081413
LIMS ID: 13-16830
Matrix: Soil
Data Release Authorized:
Reported: 08/15/13

QC Report No: XA82-The Boeing Company
Project: Boeing Renton, AOC-92
Event: NA
Date Sampled: NA
Date Received: NA

Date Analyzed LCS: 08/14/13 10:46
LCSD: 08/14/13 11:15
Instrument/Analyst LCS: PID1/PKC
LCSD: PID1/PKC

Purge Volume: 5.0 mL

Sample Amount LCS: 100 mg-dry-wt
LCSD: 100 mg-dry-wt

Analyte	LCS	Spike Added-LCS	LCS Recovery	LCSD	Spike Added-LCSD	LCSD Recovery	RPD
Gasoline Range Hydrocarbons	117	125	93.6%	124	125	99.2%	5.8%

Reported in mg/kg (ppm)

RPD calculated using sample concentrations per SW846.

TPHG Surrogate Recovery

	LCS	LCSD
Trifluorotoluene	113%	113%
Bromobenzene	101%	107%

FORM III

Analytical Resources, Incorporated
Analytical Chemists and Consultants

August 15, 2013

Crystal Neirby
Amec
One Union Square
600 University Street, Suite 600
Seattle, WA 98101

RE: Project: Renton AOC-92
ARI Job: XA98

Dear Mr. Haddock:

Please find enclosed the original Chain-of-Custody (COC) record, sample receipt documentation, and analytical results for the project referenced above. Analytical Resources, Inc. (ARI) accepted four soil samples and a trip blank on August 14, 2013.

The samples were analyzed for NWTPH-Gx plus Benzene, as requested on the COC.

No anomalies were associated with these samples.

Quality control analysis results are included for your review. An electronic copy of this report and all associated raw data will be kept on file at ARI. If you have any questions or require additional information, please contact me at your convenience.

Sincerely,
ANALYTICAL RESOURCES, INC.

Kelly Bottem
Client Services Manager
(206) 695-6211
kellyb@arilabs.com
www.arilabs.com
Enclosures
cc: Carl Bach, The Boeing Company, carl.m.bach@Boeing.com

Chain of Custody Record & Laboratory Analysis Request

Analytical Resources, Incorporated
Analytical Chemists and Consultants
4611 South 134th Place, Suite 100
Tukwila, WA 98168
206-695-6200 206-695-6201 (fax)

ARI Assigned Number: XA98
Turn-around Requested: Rush
Page: i of 1
ARI Client Company: Boeing
Phone:
Date: 8/14/13
Ice Present? Y
Client Contact: Crystal Neirby (AMEC) Fred Wallace, Carl Bach > Boeing
No. of Coolers: 1
Cooler Temps: 1.4
Client Project Name: AOC-92, Boeing Renton
Client Project #:
Samplers: Nathan Moxley

Sample ID	Date	Time	Matrix	No Containers	Analysis Requested: TPH-G	Benzene							Notes/Comments
AOC-92-B3-6.0	8/14/13	1115	Soil	3	X	X							
AOC-92-WW-2-4.0	↓	1125	↓	↓	↓	↓							
AOC-92-B4-4.5		1445											
AOC-92-EW-2-4.0		1455											
trip blanks													

Comments/Special Instructions

Relinquished by: (Signature)	Received by: (Signature)	Relinquished by: (Signature)	Received by: (Signature)
Printed Name: Nathan Moxley	Printed Name: Jennifer Millsop	Printed Name:	Printed Name:
Company: AMEC	Company: ARI	Company:	Company:
Date & Time: 8/14/13 @ 1550	Date & Time: 8/14/13 1550	Date & Time:	Date & Time:

Limits of Liability: *ARI will perform all requested services in accordance with appropriate methodology following ARI Standard Operating Procedures and the ARI Quality Assurance Program. This program meets standards for the industry. The total liability of ARI, its officers, agents, employees, or successors, arising out of or in connection with the requested services, shall not exceed the Invoiced amount for said services. The acceptance by the client of a proposal for services by ARI release ARI from any liability in excess thereof, not withstanding any provision to the contrary in any contract, purchase order or co-signed agreement between ARI and the Client.*

Sample Retention Policy: All samples submitted to ARI will be appropriately discarded no sooner than 90 days after receipt or 60 days after submission of hardcopy data, whichever is longer, unless alternate retention schedules have been established by work-order or contract.

Analytical Resources, Incorporated
Analytical Chemists and Consultants

Cooler Receipt Form

ARI Client: Boeing

COC No(s): ______ [✓ NA]

Assigned ARI Job No: XA98

Project Name: AOC-92, Boeing Renton

Delivered by: Fed-Ex UPS Courier [✓ Hand Delivered] Other: ______

Tracking No: ______ [✓ NA]

Preliminary Examination Phase:

Were intact, properly signed and dated custody seals attached to the outside of to cooler? YES [✓ NO]

Were custody papers included with the cooler? [✓ YES] NO

Were custody papers properly filled out (ink, signed, etc.) [✓ YES] NO

Temperature of Cooler(s) (°C) (recommended 2 0-6 0 °C for chemistry) 1.4 ___ ___ ___

If cooler temperature is out of compliance fill out form 00070F

Temp Gun ID#: 1224/2224

Cooler Accepted by: JM Date: 8/14/13 Time: 1550

Complete custody forms and attach all shipping documents

Log-In Phase:

Was a temperature blank included in the cooler? YES [✓ NO]

What kind of packing material was used? Bubble Wrap [✓ Wet Ice] Gel Packs Baggies Foam Block Paper Other: ______

Was sufficient ice used (if appropriate)? NA [✓ YES] NO

Were all bottles sealed in individual plastic bags? YES [✓ NO]

Did all bottles arrive in good condition (unbroken)? [✓ YES] NO

Were all bottle labels complete and legible? [✓ YES] NO

Did the number of containers listed on COC match with the number of containers received? [✓ YES] NO

Did all bottle labels and tags agree with custody papers? [✓ YES] NO

Were all bottles used correct for the requested analyses? [✓ YES] NO

Do any of the analyses (bottles) require preservation? (attach preservation sheet, excluding VOCs) [✓ NA] YES NO

Were all VOC vials free of air bubbles? [✓ NA] YES NO

Was sufficient amount of sample sent in each bottle? [✓ YES] NO

Date VOC Trip Blank was made at ARI [✓ NA] 8/2/13

Was Sample Split by ARI: [✓ NA] YES Date/Time: ______ Equipment: ______ Split by: ______

Samples Logged by: JM Date: 8/14/13 Time: 1557

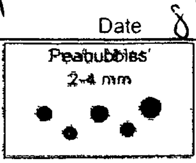
*** Notify Project Manager of discrepancies or concerns ***

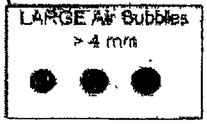
Sample ID on Bottle	Sample ID on COC	Sample ID on Bottle	Sample ID on COC

Additional Notes, Discrepancies, & Resolutions:

trip blanks = pb in 2 of 2

By: JM Date: 8/14/13





Small → "sm"
Peabubbles → "pb"
Large → "lg"
Headspace → "hs"

Sample ID Cross Reference Report

ANALYTICAL RESOURCES INCORPORATED

ARI Job No: XA98
Client: The Boeing Company
Project Event: N/A
Project Name: AOC-92, Boeing Renton

	Sample ID	ARI Lab ID	ARI LIMS ID	Matrix	Sample Date/Time	VTSR
1.	AOC-92-B3-6.0	XA98A	13-16931	Soil	08/14/13 11:15	08/14/13 15:50
2.	AOC-92-WW-2-4.0	XA98B	13-16932	Soil	08/14/13 11:25	08/14/13 15:50
3.	AOC-92-B4-4.5	XA98C	13-16933	Soil	08/14/13 14:45	08/14/13 15:50
4.	AOC-92-EW-2-4.0	XA98D	13-16934	Soil	08/14/13 14:55	08/14/13 15:50
5.	Trip Blanks	XA98E	13-16935	Water	08/14/13	08/14/13 15:50

Printed 08/14/13 Page 1 of 1

ANALYTICAL
RESOURCES
INCORPORATED

ORGANICS ANALYSIS DATA SHEET
BETX by Method SW8021BMod
TPHG by Method NWTPHG
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Sample ID: AOC-92-B3-6.0
SAMPLE

Lab Sample ID: XA98A
LIMS ID: 13-16931
Matrix: Soil
Data Release Authorized:
Reported: 08/15/13

QC Report No: XA98-The Boeing Company
Project: AOC-92, Boeing Renton
Event: NA
Date Sampled: 08/14/13
Date Received: 08/14/13

Date Analyzed: 08/14/13 20:36
Instrument/Analyst: PID1/PKC

Purge Volume: 5.0 mL
Sample Amount: 60 mg-dry-wt
Percent Moisture: 31.4%

CAS Number	Analyte	RL	Result	GAS ID
71-43-2	Benzene	21	< 21 U	
	Gasoline Range Hydrocarbons	8.4	< 8.4 U	---

BETX Surrogate Recovery	
Trifluorotoluene	90.5%
Bromobenzene	93.2%

Gasoline Surrogate Recovery	
Trifluorotoluene	92.5%
Bromobenzene	97.0%

BETX values reported in µg/kg (ppb)
Gasoline values reported in mg/kg (ppm)

GAS: Indicates the presence of gasoline or weathered gasoline.
GRO: Positive result that does not match an identifiable gasoline pattern.

Quantitation on total peaks in the gasoline range from Toluene to Naphthalene.

Results corrected for soil moisture content per Section 11.10.5 of EPA Method 8000C.

FORM I

ANALYTICAL
RESOURCES
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ORGANICS ANALYSIS DATA SHEET
BETX by Method SW8021BMod
TPHG by Method NWTPHG
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Sample ID: AOC-92-WW-2-4.0
SAMPLE

Lab Sample ID: XA98B
LIMS ID: 13-16932
Matrix: Soil
Data Release Authorized:
Reported: 08/15/13

QC Report No: XA98-The Boeing Company
Project: AOC-92, Boeing Renton
Event: NA
Date Sampled: 08/14/13
Date Received: 08/14/13

Date Analyzed: 08/14/13 21:05
Instrument/Analyst: PID1/PKC

Purge Volume: 5.0 mL
Sample Amount: 82 mg-dry-wt
Percent Moisture: 24.9%

CAS Number	**Analyte**	**RL**	**Result**	GAS ID
71-43-2	Benzene	15	< 15 U	
	Gasoline Range Hydrocarbons	6.1	< 6.1 U	---

BETX Surrogate Recovery

Trifluorotoluene	91.9%
Bromobenzene	94.7%

Gasoline Surrogate Recovery

Trifluorotoluene	94.3%
Bromobenzene	98.6%

BETX values reported in µg/kg (ppb)
Gasoline values reported in mg/kg (ppm)

GAS: Indicates the presence of gasoline or weathered gasoline.
GRO: Positive result that does not match an identifiable gasoline pattern.

Quantitation on total peaks in the gasoline range from Toluene to Naphthalene.

Results corrected for soil moisture content per Section 11.10.5 of EPA Method 8000C.

FORM I

ORGANICS ANALYSIS DATA SHEET
BETX by Method SW8021BMod
TPHG by Method NWTPHG
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Sample ID: AOC-92-B4-4.5
SAMPLE

Lab Sample ID: XA98C
LIMS ID: 13-16933
Matrix: Soil
Data Release Authorized:
Reported: 08/15/13

QC Report No: XA98-The Boeing Company
Project: AOC-92, Boeing Renton
Event: NA
Date Sampled: 08/14/13
Date Received: 08/14/13

Date Analyzed: 08/14/13 21:35
Instrument/Analyst: PID1/PKC

Purge Volume: 5.0 mL
Sample Amount: 55 mg-dry-wt
Percent Moisture: 36.0%

CAS Number	Analyte	RL	Result	GAS ID
71-43-2	Benzene	23	< 23 U	
	Gasoline Range Hydrocarbons	**9.1**	**11**	**GRO**

BETX Surrogate Recovery	
Trifluorotoluene	85.4%
Bromobenzene	90.0%

Gasoline Surrogate Recovery	
Trifluorotoluene	87.6%
Bromobenzene	93.6%

BETX values reported in µg/kg (ppb)
Gasoline values reported in mg/kg (ppm)

GAS: Indicates the presence of gasoline or weathered gasoline.
GRO: Positive result that does not match an identifiable gasoline pattern.

Quantitation on total peaks in the gasoline range from Toluene to Naphthalene.

Results corrected for soil moisture content per Section 11.10.5 of EPA Method 8000C.

FORM I

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
BETX by Method SW8021BMod
TPHG by Method NWTPHG
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Sample ID: AOC-92-EW-2-4.0
SAMPLE

Lab Sample ID: XA98D
LIMS ID: 13-16934
Matrix: Soil
Data Release Authorized:
Reported: 08/15/13

QC Report No: XA98-The Boeing Company
Project: AOC-92, Boeing Renton
Event: NA
Date Sampled: 08/14/13
Date Received: 08/14/13

Date Analyzed: 08/14/13 22:04
Instrument/Analyst: PID1/PKC

Purge Volume: 5.0 mL
Sample Amount: 74 mg-dry-wt
Percent Moisture: 19.3%

CAS Number	**Analyte**	**RL**	**Result**	GAS ID
71-43-2	Benzene	17	< 17 U	
	Gasoline Range Hydrocarbons	6.7	< 6.7 U	---

BETX Surrogate Recovery

Trifluorotoluene	85.7%
Bromobenzene	89.9%

Gasoline Surrogate Recovery

Trifluorotoluene	88.1%
Bromobenzene	94.4%

BETX values reported in µg/kg (ppb)
Gasoline values reported in mg/kg (ppm)

GAS: Indicates the presence of gasoline or weathered gasoline.
GRO: Positive result that does not match an identifiable gasoline pattern.

Quantitation on total peaks in the gasoline range from Toluene to Naphthalene.

Results corrected for soil moisture content per Section 11.10.5 of EPA Method 8000C.

FORM I

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ORGANICS ANALYSIS DATA SHEET
BETX by Method SW8021BMod
TPHG by Method NWTPHG
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Sample ID: Trip Blanks
SAMPLE

Lab Sample ID: XA98E
LIMS ID: 13-16935
Matrix: Water
Data Release Authorized:
Reported: 08/15/13

QC Report No: XA98-The Boeing Company
Project: AOC-92, Boeing Renton
Event: NA
Date Sampled: 08/14/13
Date Received: 08/14/13

Date Analyzed: 08/14/13 18:10
Instrument/Analyst: PID1/PKC

Purge Volume: 5.0 mL
Dilution Factor: 1.00

CAS Number	**Analyte**	**RL**	**Result**	GAS ID
71-43-2	Benzene	0.25	< 0.25 U	
	Gasoline Range Hydrocarbons	0.10	< 0.10 U	---

BETX Surrogate Recovery

Trifluorotoluene	95.9%
Bromobenzene	94.9%

Gasoline Surrogate Recovery

Trifluorotoluene	97.2%
Bromobenzene	98.0%

BETX values reported in µg/L (ppb)
Gasoline values reported in mg/L (ppm)

GAS: Indicates the presence of gasoline or weathered gasoline.
GRO: Positive result that does not match an identifiable gasoline pattern.

Quantitation on total peaks in the gasoline range from Toluene to Naphthalene.

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
BETX by Method SW8021BMod
TPHG by Method NWTPHG
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Sample ID: MB-081413
METHOD BLANK

Lab Sample ID: MB-081413
LIMS ID: 13-16931
Matrix: Soil
Data Release Authorized:
Reported: 08/15/13

QC Report No: XA98-The Boeing Company
Project: AOC-92, Boeing Renton
Event: NA
Date Sampled: NA
Date Received: NA

Date Analyzed: 08/14/13 11:44
Instrument/Analyst: PID1/PKC

Purge Volume: 5.0 mL
Sample Amount: 100 mg-dry-wt

CAS Number	Analyte	RL	Result	GAS ID
71-43-2	Benzene	12	< 12 U	
	Gasoline Range Hydrocarbons	5.0	< 5.0 U	---

BETX Surrogate Recovery

Trifluorotoluene	95.2%
Bromobenzene	93.3%

Gasoline Surrogate Recovery

Trifluorotoluene	96.2%
Bromobenzene	96.8%

BETX values reported in µg/kg (ppb)
Gasoline values reported in mg/kg (ppm)

GAS: Indicates the presence of gasoline or weathered gasoline.
GRO: Positive result that does not match an identifiable gasoline pattern.

Quantitation on total peaks in the gasoline range from Toluene to Naphthalene.

BETX SOIL SURROGATE RECOVERY SUMMARY

ARI Job: XA98
Matrix: Soil

QC Report No: XA98-The Boeing Company
Project: AOC-92, Boeing Renton
Event: NA

Client ID	TFT	BBZ	TOT OUT
MB-081413	95.2%	93.3%	0
LCS-081413	107%	99.5%	0
LCSD-081413	107%	100%	0
AOC-92-B3-6.0	90.5%	93.2%	0
AOC-92-WW-2-4.0	91.9%	94.7%	0
AOC-92-B4-4.5	85.4%	90.0%	0
AOC-92-EW-2-4.0	85.7%	89.9%	0

	LCS/MB LIMITS	QC LIMITS
(TFT) = Trifluorotoluene	(80-120)	(69-126)
(BBZ) = Bromobenzene	(80-120)	(49-143)

Log Number Range: 13-16931 to 13-16934

TPHG SOIL SURROGATE RECOVERY SUMMARY

ARI Job: XA98
Matrix: Soil

QC Report No: XA98-The Boeing Company
Project: AOC-92, Boeing Renton
Event: NA

Client ID	BFB	TFT	BBZ	TOT OUT
MB-081413	NA	96.2%	96.8%	0
LCS-081413	NA	113%	101%	0
LCSD-081413	NA	113%	107%	0
AOC-92-B3-6.0	NA	92.5%	97.0%	0
AOC-92-WW-2-4.0	NA	94.3%	98.6%	0
AOC-92-B4-4.5	NA	87.6%	93.6%	0
AOC-92-EW-2-4.0	NA	88.1%	94.4%	0

	LCS/MB LIMITS	QC LIMITS
(TFT) = Trifluorotoluene	(80-120)	(65-128)
(BBZ) = Bromobenzene	(80-120)	(52-149)

Log Number Range: 13-16931 to 13-16934

FORM II TPHG

TPHG WATER SURROGATE RECOVERY SUMMARY

ARI Job: XA98
Matrix: Water

QC Report No: XA98-The Boeing Company
Project: AOC-92, Boeing Renton
Event: NA

Client ID	TFT	BBZ	TOT OUT
Trip Blanks	97.2%	98.0%	0

	LCS/MB LIMITS	QC LIMITS
(TFT) = Trifluorotoluene	(80-120)	(80-120)
(BBZ) = Bromobenzene	(80-120)	(80-120)

Log Number Range: 13-16935 to 13-16935

FORM II TPHG

BETX WATER SURROGATE RECOVERY SUMMARY

ARI Job: XA98
Matrix: Water

QC Report No: XA98-The Boeing Company
Project: AOC-92, Boeing Renton
Event: NA

Client ID	TFT	BBZ	TOT OUT
Trip Blanks	95.9%	94.9%	0

		LCS/MB LIMITS	QC LIMITS
(TFT) = Trifluorotoluene	(5 mL PV)	(80-120)	(80-120)
(TFT) = Trifluorotoluene	(15 mL PV)	(79-120)	(80-120)
(BBZ) = Bromobenzene	(5 mL PV)	(80-120)	(77-120)
(BBZ) = Bromobenzene	(15 mL PV)	(79-120)	(80-120)

Log Number Range: 13-16935 to 13-16935

FORM II BETX

ORGANICS ANALYSIS DATA SHEET
BETX by Method SW8021BMod
Page 1 of 1

Sample ID: LCS-081413
LAB CONTROL SAMPLE

Lab Sample ID: LCS-081413
LIMS ID: 13-16931
Matrix: Soil
Data Release Authorized:
Reported: 08/15/13

QC Report No: XA98-The Boeing Company
Project: AOC-92, Boeing Renton
Event: NA
Date Sampled: NA
Date Received: NA

Date Analyzed LCS: 08/14/13 10:46
LCSD: 08/14/13 11:15
Instrument/Analyst LCS: PID1/PKC
LCSD: PID1/PKC

Purge Volume: 5.0 mL

Sample Amount LCS: 100 mg-dry-wt
LCSD: 100 mg-dry-wt

Analyte	**LCS**	**Spike Added-LCS**	**LCS Recovery**	**LCSD**	**Spike Added-LCSD**	**LCSD Recovery**	**RPD**
Benzene	89.0	105	84.8%	90.5	105	86.2%	1.7%

Reported in µg/kg (ppb)

RPD calculated using sample concentrations per SW846.

BETX Surrogate Recovery

	LCS	**LCSD**
Trifluorotoluene	107%	107%
Bromobenzene	99.5%	100%

FORM III

ANALYTICAL
RESOURCES
INCORPORATED

ORGANICS ANALYSIS DATA SHEET
TPHG by Method NWTPHG
Page 1 of 1

Sample ID: LCS-081413
LAB CONTROL SAMPLE

Lab Sample ID: LCS-081413
LIMS ID: 13-16931
Matrix: Soil
Data Release Authorized:
Reported: 08/15/13

QC Report No: XA98-The Boeing Company
Project: AOC-92, Boeing Renton
Event: NA
Date Sampled: NA
Date Received: NA

Date Analyzed LCS: 08/14/13 10:46
LCSD: 08/14/13 11:15
Instrument/Analyst LCS: PID1/PKC
LCSD: PID1/PKC

Purge Volume: 5.0 mL

Sample Amount LCS: 100 mg-dry-wt
LCSD: 100 mg-dry-wt

Analyte	**LCS**	**Spike Added-LCS**	**LCS Recovery**	**LCSD**	**Spike Added-LCSD**	**LCSD Recovery**	**RPD**
Gasoline Range Hydrocarbons	117	125	93.6%	124	125	99.2%	5.8%

Reported in mg/kg (ppm)

RPD calculated using sample concentrations per SW846.

TPHG Surrogate Recovery

	LCS	**LCSD**
Trifluorotoluene	113%	113%
Bromobenzene	101%	107%

FORM III

Analytical Resources, Incorporated
Analytical Chemists and Consultants

August 20, 2013

Crystal Neirby
Amec
One Union Square
600 University Street, Suite 600
Seattle, WA 98101

RE: Project: Renton AOC-92
ARI Job: XB22

Dear Crystal:

Please find enclosed the original Chain-of-Custody (COC) record, sample receipt documentation, and analytical results for the project referenced above. Analytical Resources, Inc. (ARI) accepted five soil samples and a trip blank on August 15, 2013.

The samples were analyzed for NWTPH-Gx plus Benzene, as requested on the COC.

No anomalies were associated with these samples.

Quality control analysis results are included for your review. An electronic copy of this report and all associated raw data will be kept on file at ARI. If you have any questions or require additional information, please contact me at your convenience.

Sincerely,
ANALYTICAL RESOURCES, INC.

Kelly Bottem
Client Services Manager
(206) 695-6211
kellyb@arilabs.com
www.arilabs.com
Enclosures
cc: Carl Bach, The Boeing Company, carl.m.bach@Boeing.com

Chain of Custody Record & Laboratory Analysis Request

Analytical Resources, Incorporated
Analytical Chemists and Consultants
4611 South 134th Place, Suite 100
Tukwila, WA 98168
206-695-6200 206-695-6201 (fax)

ARI Assigned Number: XB22
Turn-around Requested: 1 week
ARI Client Company: Boeing
Phone:
Client Contact: Crystal Neirby (AMEC) Fred Wallace Carl Bach > Boeing
Client Project Name: AOC-92
Client Project #:
Samplers: Nathan Moxley

Page: 1 of 1
Date: 8/15/13
Ice Present? Y
No. of Coolers: 1
Cooler Temps: 2.6

Sample ID	Date	Time	Matrix	No. Containers	Analysis Requested: TPH-G	Benzene							Notes/Comments
AOC-92-SW-1-5.0	8/15/13	0820	Soil	3	X	X							
AOC-92-WW-3-4.0	↓	1010	↓	↓	↓	↓							
AOC-92-BS-5.5	↓	1020	↓	↓	↓	↓							
AOC-92-EW-3-4.0	↓	1030	↓	↓	↓	↓							
AOC-92-SW-2-4.0	↓	1040	↓	↓	↓	↓							
trip blanks					X	X							

Comments/Special Instructions

	Relinquished by:	Received by:	Relinquished by:	Received by:
(Signature)				
Printed Name	Nathan Moxley	A. Volgardsen		
Company	AMEC	ARI		
Date & Time	8/15/13 1230 ~~1150~~ NM	8/15/13 1230		

Limits of Liability: *ARI will perform all requested services in accordance with appropriate methodology following ARI Standard Operating Procedures and the ARI Quality Assurance Program. This program meets standards for the industry. The total liability of ARI, its officers, agents, employees, or successors, arising out of or in connection with the requested services, shall not exceed the invoiced amount for said services. The acceptance by the client of a proposal for services by ARI release ARI from any liability in excess thereof, not withstanding any provision to the contrary in any contract, purchase order or co-signed agreement between ARI and the Client.*

Sample Retention Policy: All samples submitted to ARI will be appropriately discarded no sooner than 90 days after receipt or 60 days after submission of hardcopy data, whichever is longer, unless alternate retention schedules have been established by work-order or contract.

Analytical Resources, Incorporated
Analytical Chemists and Consultants

Cooler Receipt Form

ARI Client: Boeing
COC No(s) ______ [✓ NA]
Assigned ARI Job No ~~XB25~~ XB22

Project Name: Boeing Renton, AOC-92
Delivered by: Fed-Ex UPS Courier [✓ Hand Delivered] Other: ______
Tracking No: ______ [✓ NA]

Preliminary Examination Phase:

Were intact, properly signed and dated custody seals attached to the outside of to cooler? YES [✓ NO]
Were custody papers included with the cooler? [✓ YES] NO
Were custody papers properly filled out (ink, signed, etc.) [✓ YES] NO
Temperature of Cooler(s) (°C) (recommended 2 0-6 0 °C for chemistry) 26
If cooler temperature is out of compliance fill out form 00070F
Temp Gun ID# 12241224
Cooler Accepted by: AV Date: 8/15/13 Time: 1230

Complete custody forms and attach all shipping documents

Log-In Phase:

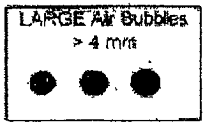
Was a temperature blank included in the cooler? YES [✓ NO]
What kind of packing material was used? Bubble Wrap [✓ Wet Ice] Gel Packs Baggies Foam Block Paper Other: ______
Was sufficient ice used (if appropriate)? NA [✓ YES] NO
Were all bottles sealed in individual plastic bags? YES [✓ NO]
Did all bottles arrive in good condition (unbroken)? [✓ YES] NO
Were all bottle labels complete and legible? [✓ YES] NO
Did the number of containers listed on COC match with the number of containers received? [✓ YES] NO
Did all bottle labels and tags agree with custody papers? [✓ YES] NO
Were all bottles used correct for the requested analyses? [✓ YES] NO
Do any of the analyses (bottles) require preservation? (attach preservation sheet, excluding VOCs) [✓ NA] YES NO
Were all VOC vials free of air bubbles? NA [✓ YES] NO
Was sufficient amount of sample sent in each bottle? [✓ YES] NO
Date VOC Trip Blank was made at ARI NA 8/14/13
Was Sample Split by ARI: [✓ NA] YES Date/Time ______ Equipment ______ Split by: ______
Samples Logged by: JM Date: 8/15/13 Time: 1500

***** Notify Project Manager of discrepancies or concerns *****

Sample ID on Bottle	Sample ID on COC	Sample ID on Bottle	Sample ID on COC

Additional Notes, Discrepancies, & Resolutions:

By: Date:



Small → "sm"
Peabubbles → "pb"
Large → "lg"
Headspace → "hs"

Sample ID Cross Reference Report

ANALYTICAL RESOURCES INCORPORATED

ARI Job No: XB22
Client: The Boeing Company
Project Event: N/A
Project Name: AOC-92

	Sample ID	ARI Lab ID	ARI LIMS ID	Matrix	Sample Date/Time	VTSR
1.	AOC-92-SW-1-5.0	XB22A	13-17039	Soil	08/15/13 08:20	08/15/13 12:30
2.	AOC-92-WW-3-4.0	XB22B	13-17040	Soil	08/15/13 10:10	08/15/13 12:30
3.	AOC-92-B5-5.5	XB22C	13-17041	Soil	08/15/13 10:20	08/15/13 12:30
4.	AOC-92-EW-3-4.0	XB22D	13-17042	Soil	08/15/13 10:30	08/15/13 12:30
5.	AOC-92-SW-2-4.0	XB22E	13-17043	Soil	08/15/13 10:40	08/15/13 12:30
6.	Trip Blanks	XB22F	13-17044	Water	08/15/13	08/15/13 12:30

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ORGANICS ANALYSIS DATA SHEET
BETX by Method SW8021BMod
TPHG by Method NWTPHG
Page 1 of 1

Sample ID: AOC-92-SW-1-5.0
SAMPLE

Lab Sample ID: XB22A
LIMS ID: 13-17039
Matrix: Soil
Data Release Authorized:
Reported: 08/20/13

QC Report No: XB22-The Boeing Company
Project: AOC-92
Event: NA
Date Sampled: 08/15/13
Date Received: 08/15/13

Date Analyzed: 08/19/13 15:46
Instrument/Analyst: PID1/PKC

Purge Volume: 5.0 mL
Sample Amount: 88 mg-dry-wt
Percent Moisture: 18.8%

CAS Number	Analyte	RL	Result	GAS ID
71-43-2	Benzene	14	< 14 U	
	Gasoline Range Hydrocarbons	5.6	< 5.6 U	---

BETX Surrogate Recovery	
Trifluorotoluene	96.8%
Bromobenzene	98.2%

Gasoline Surrogate Recovery	
Trifluorotoluene	97.3%
Bromobenzene	103%

BETX values reported in µg/kg (ppb)
Gasoline values reported in mg/kg (ppm)

GAS: Indicates the presence of gasoline or weathered gasoline.
GRO: Positive result that does not match an identifiable gasoline pattern.

Quantitation on total peaks in the gasoline range from Toluene to Naphthalene.

Results corrected for soil moisture content per Section 11.10.5 of EPA Method 8000C.

ORGANICS ANALYSIS DATA SHEET
BETX by Method SW8021BMod
TPHG by Method NWTPHG
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Sample ID: AOC-92-WW-3-4.0
SAMPLE

Lab Sample ID: XB22B
LIMS ID: 13-17040
Matrix: Soil
Data Release Authorized:
Reported: 08/20/13

QC Report No: XB22-The Boeing Company
Project: AOC-92
Event: NA
Date Sampled: 08/15/13
Date Received: 08/15/13

Date Analyzed: 08/19/13 17:14
Instrument/Analyst: PID1/PKC

Purge Volume: 5.0 mL
Sample Amount: 74 mg-dry-wt
Percent Moisture: 19.2%

CAS Number	Analyte	RL	Result	GAS ID
71-43-2	Benzene	17	< 17 U	
	Gasoline Range Hydrocarbons	6.7	< 6.7 U	---

BETX Surrogate Recovery	
Trifluorotoluene	86.5%
Bromobenzene	87.0%

Gasoline Surrogate Recovery	
Trifluorotoluene	87.5%
Bromobenzene	90.6%

BETX values reported in µg/kg (ppb)
Gasoline values reported in mg/kg (ppm)

GAS: Indicates the presence of gasoline or weathered gasoline.
GRO: Positive result that does not match an identifiable gasoline pattern.

Quantitation on total peaks in the gasoline range from Toluene to Naphthalene.

Results corrected for soil moisture content per Section 11.10.5 of EPA Method 8000C.

ANALYTICAL
RESOURCES
INCORPORATED

ORGANICS ANALYSIS DATA SHEET
BETX by Method SW8021BMod
TPHG by Method NWTPHG
Page 1 of 1

Sample ID: AOC-92-B5-5.5
SAMPLE

Lab Sample ID: XB22C
LIMS ID: 13-17041
Matrix: Soil
Data Release Authorized:
Reported: 08/20/13

QC Report No: XB22-The Boeing Company
Project: AOC-92
Event: NA
Date Sampled: 08/15/13
Date Received: 08/15/13

Date Analyzed: 08/19/13 17:43
Instrument/Analyst: PID1/PKC

Purge Volume: 5.0 mL
Sample Amount: 62 mg-dry-wt
Percent Moisture: 29.1%

CAS Number	**Analyte**	**RL**	**Result**	GAS ID
71-43-2	Benzene	20	< 20 U	
	Gasoline Range Hydrocarbons	8.1	< 8.1 U	---

BETX Surrogate Recovery	
Trifluorotoluene	88.1%
Bromobenzene	89.2%

Gasoline Surrogate Recovery	
Trifluorotoluene	89.1%
Bromobenzene	93.5%

BETX values reported in µg/kg (ppb)
Gasoline values reported in mg/kg (ppm)

GAS: Indicates the presence of gasoline or weathered gasoline.
GRO: Positive result that does not match an identifiable gasoline pattern.

Quantitation on total peaks in the gasoline range from Toluene to Naphthalene.

Results corrected for soil moisture content per Section 11.10.5 of EPA Method 8000C.

ORGANICS ANALYSIS DATA SHEET
BETX by Method SW8021BMod
TPHG by Method NWTPHG
Page 1 of 1

Sample ID: AOC-92-EW-3-4.0
SAMPLE

Lab Sample ID: XB22D
LIMS ID: 13-17042
Matrix: Soil
Data Release Authorized:
Reported: 08/20/13

QC Report No: XB22-The Boeing Company
Project: AOC-92
Event: NA
Date Sampled: 08/15/13
Date Received: 08/15/13

Date Analyzed: 08/19/13 18:12
Instrument/Analyst: PID1/PKC

Purge Volume: 5.0 mL
Sample Amount: 87 mg-dry-wt
Percent Moisture: 20.1%

CAS Number	Analyte	RL	Result	GAS ID
71-43-2	Benzene	14	< 14 U	
	Gasoline Range Hydrocarbons	5.8	< 5.8 U	---

BETX Surrogate Recovery

Trifluorotoluene	89.0%
Bromobenzene	90.6%

Gasoline Surrogate Recovery

Trifluorotoluene	89.6%
Bromobenzene	94.5%

BETX values reported in µg/kg (ppb)
Gasoline values reported in mg/kg (ppm)

GAS: Indicates the presence of gasoline or weathered gasoline.
GRO: Positive result that does not match an identifiable gasoline pattern.

Quantitation on total peaks in the gasoline range from Toluene to Naphthalene.

Results corrected for soil moisture content per Section 11.10.5 of EPA Method 8000C.

ORGANICS ANALYSIS DATA SHEET
BETX by Method SW8021BMod
TPHG by Method NWTPHG
Page 1 of 1

Sample ID: AOC-92-SW-2-4.0
SAMPLE

Lab Sample ID: XB22E
LIMS ID: 13-17043
Matrix: Soil
Data Release Authorized:
Reported: 08/20/13

QC Report No: XB22-The Boeing Company
Project: AOC-92
Event: NA
Date Sampled: 08/15/13
Date Received: 08/15/13

Date Analyzed: 08/19/13 18:41
Instrument/Analyst: PID1/PKC

Purge Volume: 5.0 mL
Sample Amount: 76 mg-dry-wt
Percent Moisture: 17.4%

CAS Number	**Analyte**	**RL**	**Result**	
71-43-2	Benzene	16	< 16 U	
	Gasoline Range Hydrocarbons	**6.6**	**13**	GAS ID **GAS**

BETX Surrogate Recovery

Trifluorotoluene	92.0%
Bromobenzene	92.1%

Gasoline Surrogate Recovery

Trifluorotoluene	91.9%
Bromobenzene	95.4%

BETX values reported in µg/kg (ppb)
Gasoline values reported in mg/kg (ppm)

GAS: Indicates the presence of gasoline or weathered gasoline.
GRO: Positive result that does not match an identifiable gasoline pattern.

Quantitation on total peaks in the gasoline range from Toluene to Naphthalene.

Results corrected for soil moisture content per Section 11.10.5 of EPA Method 8000C.

ORGANICS ANALYSIS DATA SHEET
BETX by Method SW8021BMod
TPHG by Method NWTPHG
Page 1 of 1

Sample ID: Trip Blanks
SAMPLE

Lab Sample ID: XB22F
LIMS ID: 13-17044
Matrix: Water
Data Release Authorized:
Reported: 08/20/13

QC Report No: XB22-The Boeing Company
Project: AOC-92
Event: NA
Date Sampled: 08/15/13
Date Received: 08/15/13

Date Analyzed: 08/19/13 13:20
Instrument/Analyst: PID1/PKC

Purge Volume: 5.0 mL
Dilution Factor: 1.00

CAS Number	Analyte	RL	Result	GAS ID
71-43-2	Benzene	0.25	< 0.25 U	
	Gasoline Range Hydrocarbons	0.10	< 0.10 U	---

BETX Surrogate Recovery

Trifluorotoluene	98.3%
Bromobenzene	97.8%

Gasoline Surrogate Recovery

Trifluorotoluene	99.0%
Bromobenzene	99.1%

BETX values reported in µg/L (ppb)
Gasoline values reported in mg/L (ppm)

GAS: Indicates the presence of gasoline or weathered gasoline.
GRO: Positive result that does not match an identifiable gasoline pattern.

Quantitation on total peaks in the gasoline range from Toluene to Naphthalene.

FORM I

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
BETX by Method SW8021BMod
TPHG by Method NWTPHG
Page 1 of 1

Sample ID: MB-081913
METHOD BLANK

Lab Sample ID: MB-081913
LIMS ID: 13-17039
Matrix: Soil
Data Release Authorized:
Reported: 08/20/13

QC Report No: XB22-The Boeing Company
Project: AOC-92
Event: NA
Date Sampled: NA
Date Received: NA

Date Analyzed: 08/19/13 12:51
Instrument/Analyst: PID1/PKC

Purge Volume: 5.0 mL
Sample Amount: 100 mg-dry-wt

CAS Number	Analyte	RL	Result	GAS ID
71-43-2	Benzene	12	< 12 U	
	Gasoline Range Hydrocarbons	5.0	< 5.0 U	---

BETX Surrogate Recovery

Trifluorotoluene	103%
Bromobenzene	100%

Gasoline Surrogate Recovery

Trifluorotoluene	102%
Bromobenzene	97.5%

BETX values reported in µg/kg (ppb)
Gasoline values reported in mg/kg (ppm)

GAS: Indicates the presence of gasoline or weathered gasoline.
GRO: Positive result that does not match an identifiable gasoline pattern.

Quantitation on total peaks in the gasoline range from Toluene to Naphthalene.

FORM I

TPHG SOIL SURROGATE RECOVERY SUMMARY

ARI Job: XB22
Matrix: Soil

QC Report No: XB22-The Boeing Company
Project: AOC-92
Event: NA

Client ID	BFB	TFT	BBZ	TOT OUT
MB-081913	NA	102%	97.5%	0
LCS-081913	NA	104%	91.4%	0
LCSD-081913	NA	115%	106%	0
AOC-92-SW-1-5.0	NA	97.3%	103%	0
AOC-92-WW-3-4.0	NA	87.5%	90.6%	0
AOC-92-B5-5.5	NA	89.1%	93.5%	0
AOC-92-EW-3-4.0	NA	89.6%	94.5%	0
AOC-92-SW-2-4.0	NA	91.9%	95.4%	0

	LCS/MB LIMITS	QC LIMITS
(TFT) = Trifluorotoluene	(80-120)	(65-128)
(BBZ) = Bromobenzene	(80-120)	(52-149)

Log Number Range: 13-17039 to 13-17043

FORM II TPHG

BETX SOIL SURROGATE RECOVERY SUMMARY

ARI Job: XB22
Matrix: Soil

QC Report No: XB22-The Boeing Company
Project: AOC-92
Event: NA

Client ID	TFT	BBZ	TOT OUT
MB-081913	103%	100%	0
LCS-081913	99.4%	91.0%	0
LCSD-081913	110%	103%	0
AOC-92-SW-1-5.0	96.8%	98.2%	0
AOC-92-WW-3-4.0	86.5%	87.0%	0
AOC-92-B5-5.5	88.1%	89.2%	0
AOC-92-EW-3-4.0	89.0%	90.6%	0
AOC-92-SW-2-4.0	92.0%	92.1%	0

	LCS/MB LIMITS	QC LIMITS
(TFT) = Trifluorotoluene	(80-120)	(69-126)
(BBZ) = Bromobenzene	(80-120)	(49-143)

Log Number Range: 13-17039 to 13-17043

FORM II BETX

BETX WATER SURROGATE RECOVERY SUMMARY

ARI Job: XB22
Matrix: Water

QC Report No: XB22-The Boeing Company
Project: AOC-92
Event: NA

Client ID	TFT	BBZ	TOT OUT
Trip Blanks	98.3%	97.8%	0

		LCS/MB LIMITS	QC LIMITS
(TFT) = Trifluorotoluene	(5 mL PV)	(80-120)	(80-120)
(TFT) = Trifluorotoluene	(15 mL PV)	(79-120)	(80-120)
(BBZ) = Bromobenzene	(5 mL PV)	(80-120)	(77-120)
(BBZ) = Bromobenzene	(15 mL PV)	(79-120)	(80-120)

Log Number Range: 13-17044 to 13-17044

FORM II BETX

TPHG WATER SURROGATE RECOVERY SUMMARY

ARI Job: XB22
Matrix: Water

QC Report No: XB22-The Boeing Company
Project: AOC-92
Event: NA

Client ID	TFT	BBZ	TOT OUT
Trip Blanks	99.0%	99.1%	0

	LCS/MB LIMITS	QC LIMITS
(TFT) = Trifluorotoluene	(80-120)	(80-120)
(BBZ) = Bromobenzene	(80-120)	(80-120)

Log Number Range: 13-17044 to 13-17044

ORGANICS ANALYSIS DATA SHEET
TPHG by Method NWTPHG
Page 1 of 1

Sample ID: LCS-081913
LAB CONTROL SAMPLE

Lab Sample ID: LCS-081913
LIMS ID: 13-17039
Matrix: Soil
Data Release Authorized:
Reported: 08/20/13

QC Report No: XB22-The Boeing Company
Project: AOC-92
Event: NA
Date Sampled: NA
Date Received: NA

Date Analyzed LCS: 08/19/13 10:46
LCSD: 08/19/13 11:15
Instrument/Analyst LCS: PID1/PKC
LCSD: PID1/PKC

Purge Volume: 5.0 mL

Sample Amount LCS: 100 mg-dry-wt
LCSD: 100 mg-dry-wt

Analyte	**LCS**	**Spike Added-LCS**	**LCS Recovery**	**LCSD**	**Spike Added-LCSD**	**LCSD Recovery**	**RPD**
Gasoline Range Hydrocarbons	109	125	87.2%	120	125	96.0%	9.6%

Reported in mg/kg (ppm)

RPD calculated using sample concentrations per SW846.

TPHG Surrogate Recovery

	LCS	**LCSD**
Trifluorotoluene	104%	115%
Bromobenzene	91.4%	106%

FORM III

ANALYTICAL
RESOURCES
INCORPORATED

ORGANICS ANALYSIS DATA SHEET
BETX by Method SW8021BMod
Page 1 of 1

Sample ID: LCS-081913
LAB CONTROL SAMPLE

Lab Sample ID: LCS-081913
LIMS ID: 13-17039
Matrix: Soil
Data Release Authorized:
Reported: 08/20/13

QC Report No: XB22-The Boeing Company
Project: AOC-92
Event: NA
Date Sampled: NA
Date Received: NA

Date Analyzed LCS: 08/19/13 10:46
LCSD: 08/19/13 11:15
Instrument/Analyst LCS: PID1/PKC
LCSD: PID1/PKC

Purge Volume: 5.0 mL

Sample Amount LCS: 100 mg-dry-wt
LCSD: 100 mg-dry-wt

Analyte	**LCS**	**Spike Added-LCS**	**LCS Recovery**	**LCSD**	**Spike Added-LCSD**	**LCSD Recovery**	**RPD**
Benzene	85.0	105	81.0%	92.0	105	87.6%	7.9%

Reported in µg/kg (ppb)

RPD calculated using sample concentrations per SW846.

BETX Surrogate Recovery

	LCS	**LCSD**
Trifluorotoluene	99.4%	110%
Bromobenzene	91.0%	103%

FORM III

Analytical Resources, Incorporated
Analytical Chemists and Consultants

August 27, 2013

Crystal Neirby
Amec
One Union Square
600 University Street, Suite 600
Seattle, WA 98101

RE: Project: Renton AOC-92
ARI Job: XC25

Dear Crystal:

Please find enclosed the original Chain-of-Custody (COC) record, sample receipt documentation, and analytical results for the project referenced above. Analytical Resources, Inc. (ARI) accepted four soil samples and a trip blank on August 26, 2013.

The samples were analyzed for NWTPH-Gx plus Benzene, as requested on the COC.

No anomalies were associated with these samples.

Quality control analysis results are included for your review. An electronic copy of this report and all associated raw data will be kept on file at ARI. If you have any questions or require additional information, please contact me at your convenience.

Sincerely,
ANALYTICAL RESOURCES, INC.
Kelly Bottem
Client Services Manager
(206) 695-6211
kellyb@arilabs.com
www.arilabs.com
Enclosures
cc: Carl Bach, The Boeing Company, carl.m.bach@Boeing.com

Chain of Custody Record & Laboratory Analysis Request

Per Carl Bach

Analytical Resources, Incorporated
Analytical Chemists and Consultants
4611 South 134th Place, Suite 100
Tukwila, WA 98168
206-695-6200 206-695-6201 (fax)

ARI Assigned Number: XC25
Turn-around Requested: ~~Standard~~ SAME DAY
Page: 1 of 1
ARI Client Company: Boeing
Phone:
Date: 8/26/13
Ice Present? Y
Client Contact: Crystal Nearby (AMEC), Carl Bach (Boeing)
No. of Coolers: 1
Cooler Temps: 4.6
Client Project Name: AOC-92
Client Project #:
Samplers: Nathan Moxley

					Analysis Requested								Notes/Comments
Sample ID	Date	Time	Matrix	No Containers	TPH-G	Benzene							
AOC-92-B-6-5.0	8/26/13	1100	Soil	3	X	X							
AOC-92-WW-4-4.0	↓	1305	↓	↓	↓	↓							
AOC-92-B-7-5.0	↓	1315	↓	↓	↓	↓							
AOC-92-EW-4-4.0	↓	1400	↓	↓	↓	↓							
trip blanks					↓	↓							

Comments/Special Instructions	Relinquished by	Received by	Relinquished by:	Received by.
	(Signature)	(Signature)	(Signature)	(Signature)
	Printed Name. Nathan Moxlay	Printed Name: Jennifer Milbag	Printed Name	Printed Name
	Company AMEC	Company ARI	Company	Company.
	Date & Time 8/26/13 1450	Date & Time 8/26/13 1450	Date & Time:	Date & Time

Limits of Liability: *ARI will perform all requested services in accordance with appropriate methodology following ARI Standard Operating Procedures and the ARI Quality Assurance Program. This program meets standards for the industry. The total liability of ARI, its officers, agents, employees, or successors, arising out of or in connection with the requested services, shall not exceed the Invoiced amount for said services. The acceptance by the client of a proposal for services by ARI release ARI from any liability in excess thereof, not withstanding any provision to the contrary in any contract, purchase order or co-signed agreement between ARI and the Client.*

Sample Retention Policy: All samples submitted to ARI will be appropriately discarded no sooner than 90 days after receipt or 60 days after submission of hardcopy data, whichever is longer, unless alternate retention schedules have been established by work-order or contract.

[redacted]

Analytical Resources, Incorporated
Analytical Chemists and Consultants

Cooler Receipt Form

ARI Client: Boeing
Project Name: AOC-92
COC No(s): ______ [✓ NA]
Delivered by: Fed-Ex UPS Courier [✓ Hand Delivered] Other: ______
Assigned ARI Job No: XC25
Tracking No: ______ [✓ NA]

Preliminary Examination Phase:

Were intact, properly signed and dated custody seals attached to the outside of to cooler?	YES	[✓ NO]
Were custody papers included with the cooler?	[✓ YES]	NO
Were custody papers properly filled out (ink, signed, etc.)	[✓ YES]	NO

Temperature of Cooler(s) (°C) (recommended 2.0-6 0 °C for chemistry)...... 4.6 ____ ____ ____

If cooler temperature is out of compliance fill out form 00070F

Temp Gun ID# 122412224

Cooler Accepted by: JM Date 8/26/13 Time. 1450

Complete custody forms and attach all shipping documents

Log-In Phase:

Was a temperature blank included in the cooler?		YES	[✓ NO]

What kind of packing material was used? . . Bubble Wrap [✓ Wet Ice] Gel Packs [✓ Baggies] [✓ Foam Block] Paper Other: ______

Was sufficient ice used (if appropriate)?	NA	[✓ YES]	NO
Were all bottles sealed in individual plastic bags?		[✓ YES]	NO
Did all bottles arrive in good condition (unbroken)?		[✓ YES]	NO
Were all bottle labels complete and legible?		[✓ YES]	NO
Did the number of containers listed on COC match with the number of containers received?		[✓ YES]	NO
Did all bottle labels and tags agree with custody papers?		[✓ YES]	NO
Were all bottles used correct for the requested analyses?		[✓ YES]	NO
Do any of the analyses (bottles) require preservation? (attach preservation sheet, excluding VOCs)	[✓ NA]	YES	NO
Were all VOC vials free of air bubbles?	NA	YES	[✓ NO]
Was sufficient amount of sample sent in each bottle?		[✓ YES]	NO
Date VOC Trip Blank was made at ARI	NA	8/16/13	

Was Sample Split by ARI : [✓ NA] YES Date/Time ______ Equipment ______ Split by: ______

Samples Logged by: AV Date 8/26/13 Time. 1508

*** Notify Project Manager of discrepancies or concerns ***

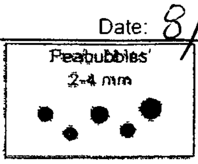
Sample ID on Bottle	Sample ID on COC	Sample ID on Bottle	Sample ID on COC

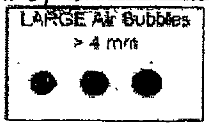
Additional Notes, Discrepancies, & Resolutions:

TB = 1pb

By: AV Date: 8/26/13


Small Air Bubbles ~2mm


Peabubbles' 2-4 mm


LARGE Air Bubbles > 4 mm

Small → "sm"	
Peabubbles → "pb"	
Large → "lg"	
Headspace → "hs"	

0016F
3/2/10

Cooler Receipt Form

Revision 014

[redacted]

Sample ID Cross Reference Report

ANALYTICAL RESOURCES INCORPORATED

ARI Job No: XC25
Client: The Boeing Company
Project Event: N/A
Project Name: AOC-92

	Sample ID	ARI Lab ID	ARI LIMS ID	Matrix	Sample Date/Time	VTSR
1.	AOC-92-B-6-5.0	XC25A	13-17671	Soil	08/26/13 11:00	08/26/13 14:50
2.	AOC-92-WW-4-4.0	XC25B	13-17672	Soil	08/26/13 13:05	08/26/13 14:50
3.	AOC-92-B-7-5.0	XC25C	13-17673	Soil	08/26/13 13:15	08/26/13 14:50
4.	AOC-92-EW-4-4.0	XC25D	13-17674	Soil	08/26/13 14:00	08/26/13 14:50
5.	Trip Blanks	XC25E	13-17675	Water	08/26/13	08/26/13 14:50

Printed 08/26/13 Page 1 of 1

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
BETX by Method SW8021BMod
TPHG by Method NWTPHG
Page 1 of 1

Sample ID: AOC-92-B-6-5.0
SAMPLE

Lab Sample ID: XC25A
LIMS ID: 13-17671
Matrix: Soil
Data Release Authorized:
Reported: 08/27/13

QC Report No: XC25-The Boeing Company
Project: AOC-92
Event: NA
Date Sampled: 08/26/13
Date Received: 08/26/13

Date Analyzed: 08/26/13 19:06
Instrument/Analyst: PID1/JLW

Purge Volume: 5.0 mL
Sample Amount: 82 mg-dry-wt
Percent Moisture: 15.6%

CAS Number	Analyte	RL	Result	GAS ID
71-43-2	Benzene	15	< 15 U	
	Gasoline Range Hydrocarbons	6.1	< 6.1 U	---

BETX Surrogate Recovery

Trifluorotoluene	81.0%
Bromobenzene	84.8%

Gasoline Surrogate Recovery

Trifluorotoluene	84.5%
Bromobenzene	90.2%

BETX values reported in µg/kg (ppb)
Gasoline values reported in mg/kg (ppm)

GAS: Indicates the presence of gasoline or weathered gasoline.
GRO: Positive result that does not match an identifiable gasoline pattern.

Quantitation on total peaks in the gasoline range from Toluene to Naphthalene.

Results corrected for soil moisture content per Section 11.10.5 of EPA Method 8000C.

[redacted]

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
BETX by Method SW8021BMod
TPHG by Method NWTPHG
Page 1 of 1

Sample ID: AOC-92-WW-4-4.0
SAMPLE

Lab Sample ID: XC25B
LIMS ID: 13-17672
Matrix: Soil
Data Release Authorized:
Reported: 08/27/13

QC Report No: XC25-The Boeing Company
Project: AOC-92
Event: NA
Date Sampled: 08/26/13
Date Received: 08/26/13

Date Analyzed: 08/26/13 19:36
Instrument/Analyst: PID1/JLW

Purge Volume: 5.0 mL
Sample Amount: 100 mg-dry-wt
Percent Moisture: 15.4%

CAS Number	Analyte	RL	Result	GAS ID
71-43-2	Benzene	12	< 12 U	
	Gasoline Range Hydrocarbons	5.0	< 5.0 U	---

BETX Surrogate Recovery

Trifluorotoluene	84.7%
Bromobenzene	89.1%

Gasoline Surrogate Recovery

Trifluorotoluene	88.1%
Bromobenzene	95.0%

BETX values reported in µg/kg (ppb)
Gasoline values reported in mg/kg (ppm)

GAS: Indicates the presence of gasoline or weathered gasoline.
GRO: Positive result that does not match an identifiable gasoline pattern.

Quantitation on total peaks in the gasoline range from Toluene to Naphthalene.

Results corrected for soil moisture content per Section 11.10.5 of EPA Method 8000C.

[redacted]

ANALYTICAL
RESOURCES
INCORPORATED

ORGANICS ANALYSIS DATA SHEET
BETX by Method SW8021BMod
TPHG by Method NWTPHG
Page 1 of 1

Sample ID: AOC-92-B-7-5.0
SAMPLE

Lab Sample ID: XC25C
LIMS ID: 13-17673
Matrix: Soil
Data Release Authorized:
Reported: 08/27/13

QC Report No: XC25-The Boeing Company
Project: AOC-92
Event: NA
Date Sampled: 08/26/13
Date Received: 08/26/13

Date Analyzed: 08/26/13 20:05
Instrument/Analyst: PID1/JLW

Purge Volume: 5.0 mL
Sample Amount: 55 mg-dry-wt
Percent Moisture: 30.9%

CAS Number	Analyte	RL	Result	GAS ID
71-43-2	Benzene	23	< 23 U	
	Gasoline Range Hydrocarbons	9.1	< 9.1 U	---

BETX Surrogate Recovery

Trifluorotoluene	86.2%
Bromobenzene	90.3%

Gasoline Surrogate Recovery

Trifluorotoluene	89.4%
Bromobenzene	95.8%

BETX values reported in µg/kg (ppb)
Gasoline values reported in mg/kg (ppm)

GAS: Indicates the presence of gasoline or weathered gasoline.
GRO: Positive result that does not match an identifiable gasoline pattern.

Quantitation on total peaks in the gasoline range from Toluene to Naphthalene.

Results corrected for soil moisture content per Section 11.10.5 of EPA Method 8000C.

[redacted]

ORGANICS ANALYSIS DATA SHEET
BETX by Method SW8021BMod
TPHG by Method NWTPHG
Page 1 of 1

Sample ID: AOC-92-EW-4-4.0
SAMPLE

Lab Sample ID: XC25D
LIMS ID: 13-17674
Matrix: Soil
Data Release Authorized:
Reported: 08/27/13

QC Report No: XC25-The Boeing Company
Project: AOC-92
Event: NA
Date Sampled: 08/26/13
Date Received: 08/26/13

Date Analyzed: 08/26/13 20:34
Instrument/Analyst: PID1/JLW

Purge Volume: 5.0 mL
Sample Amount: 92 mg-dry-wt
Percent Moisture: 21.9%

CAS Number	Analyte	RL	Result	GAS ID
71-43-2	**Benzene**	**14**	**21**	
	Gasoline Range Hydrocarbons	**5.5**	**31**	**GAS**

BETX Surrogate Recovery	
Trifluorotoluene	86.8%
Bromobenzene	92.2%

Gasoline Surrogate Recovery	
Trifluorotoluene	90.3%
Bromobenzene	96.5%

BETX values reported in µg/kg (ppb)
Gasoline values reported in mg/kg (ppm)

GAS: Indicates the presence of gasoline or weathered gasoline.
GRO: Positive result that does not match an identifiable gasoline pattern.

Quantitation on total peaks in the gasoline range from Toluene to Naphthalene.

Results corrected for soil moisture content per Section 11.10.5 of EPA Method 8000C.

FORM I

[redacted]

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
BETX by Method SW8021BMod
TPHG by Method NWTPHG
Page 1 of 1

Sample ID: Trip Blanks
SAMPLE

Lab Sample ID: XC25E
LIMS ID: 13-17675
Matrix: Water
Data Release Authorized:
Reported: 08/27/13

QC Report No: XC25-The Boeing Company
Project: AOC-92
Event: NA
Date Sampled: 08/26/13
Date Received: 08/26/13

Date Analyzed: 08/26/13 18:37
Instrument/Analyst: PID1/JLW

Purge Volume: 5.0 mL
Dilution Factor: 1.00

CAS Number	Analyte	RL	Result	GAS ID
71-43-2	Benzene	0.25	< 0.25 U	
	Gasoline Range Hydrocarbons	0.10	< 0.10 U	---

BETX Surrogate Recovery

Trifluorotoluene	83.0%
Bromobenzene	86.2%

Gasoline Surrogate Recovery

Trifluorotoluene	86.0%
Bromobenzene	91.6%

BETX values reported in µg/L (ppb)
Gasoline values reported in mg/L (ppm)

GAS: Indicates the presence of gasoline or weathered gasoline.
GRO: Positive result that does not match an identifiable gasoline pattern.

Quantitation on total peaks in the gasoline range from Toluene to Naphthalene.

FORM I

[redacted]

ORGANICS ANALYSIS DATA SHEET
BETX by Method SW8021BMod
TPHG by Method NWTPHG
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Sample ID: MB-082613
METHOD BLANK

Lab Sample ID: MB-082613
LIMS ID: 13-17671
Matrix: Soil
Data Release Authorized:
Reported: 08/27/13

QC Report No: XC25-The Boeing Company
Project: AOC-92
Event: NA
Date Sampled: NA
Date Received: NA

Date Analyzed: 08/26/13 18:08
Instrument/Analyst: PID1/JLW

Purge Volume: 5.0 mL
Sample Amount: 100 mg-dry-wt

CAS Number	Analyte	RL	Result	GAS ID
71-43-2	Benzene	12	< 12 U	
	Gasoline Range Hydrocarbons	5.0	< 5.0 U	---

BETX Surrogate Recovery

Trifluorotoluene	97.9%
Bromobenzene	94.8%

Gasoline Surrogate Recovery

Trifluorotoluene	100%
Bromobenzene	100%

BETX values reported in µg/kg (ppb)
Gasoline values reported in mg/kg (ppm)

GAS: Indicates the presence of gasoline or weathered gasoline.
GRO: Positive result that does not match an identifiable gasoline pattern.

Quantitation on total peaks in the gasoline range from Toluene to Naphthalene.

TPHG SOIL SURROGATE RECOVERY SUMMARY

ARI Job: XC25
Matrix: Soil

QC Report No: XC25-The Boeing Company
Project: AOC-92
Event: NA

Client ID	BFB	TFT	BBZ	TOT OUT
MB-082613	NA	100%	100%	0
LCS-082613	NA	116%	108%	0
LCSD-082613	NA	112%	104%	0
AOC-92-B-6-5.0	NA	84.5%	90.2%	0
AOC-92-WW-4-4.0	NA	88.1%	95.0%	0
AOC-92-B-7-5.0	NA	89.4%	95.8%	0
AOC-92-EW-4-4.0	NA	90.3%	96.5%	0

	LCS/MB LIMITS	QC LIMITS
(TFT) = Trifluorotoluene	(80-120)	(65-128)
(BBZ) = Bromobenzene	(80-120)	(52-149)

Log Number Range: 13-17671 to 13-17674

BETX SOIL SURROGATE RECOVERY SUMMARY

ARI Job: XC25
Matrix: Soil

QC Report No: XC25-The Boeing Company
Project: AOC-92
Event: NA

Client ID	TFT	BBZ	TOT OUT
MB-082613	97.9%	94.8%	0
LCS-082613	108%	100%	0
LCSD-082613	105%	97.5%	0
AOC-92-B-6-5.0	81.0%	84.8%	0
AOC-92-WW-4-4.0	84.7%	89.1%	0
AOC-92-B-7-5.0	86.2%	90.3%	0
AOC-92-EW-4-4.0	86.8%	92.2%	0

	LCS/MB LIMITS	QC LIMITS
(TFT) = Trifluorotoluene	(80-120)	(69-126)
(BBZ) = Bromobenzene	(80-120)	(49-143)

Log Number Range: 13-17671 to 13-17674

[redacted]

TPHG WATER SURROGATE RECOVERY SUMMARY

ARI Job: XC25
Matrix: Water

QC Report No: XC25-The Boeing Company
Project: AOC-92
Event: NA

Client ID	TFT	BBZ	TOT OUT
Trip Blanks	86.0%	91.6%	0

	LCS/MB LIMITS	QC LIMITS
(TFT) = Trifluorotoluene	(80-120)	(80-120)
(BBZ) = Bromobenzene	(80-120)	(80-120)

Log Number Range: 13-17675 to 13-17675

FORM II TPHG

[redacted]

BETX WATER SURROGATE RECOVERY SUMMARY

ARI Job: XC25
Matrix: Water

QC Report No: XC25-The Boeing Company
Project: AOC-92
Event: NA

Client ID	TFT	BBZ	TOT OUT
Trip Blanks	83.0%	86.2%	0

		LCS/MB LIMITS	QC LIMITS
(TFT) = Trifluorotoluene	(5 mL PV)	(80-120)	(80-120)
(TFT) = Trifluorotoluene	(15 mL PV)	(79-120)	(80-120)
(BBZ) = Bromobenzene	(5 mL PV)	(80-120)	(77-120)
(BBZ) = Bromobenzene	(15 mL PV)	(79-120)	(80-120)

Log Number Range: 13-17675 to 13-17675

[redacted]

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INCORPORATED

ORGANICS ANALYSIS DATA SHEET
TPHG by Method NWTPHG
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Sample ID: LCS-082613
LAB CONTROL SAMPLE

Lab Sample ID: LCS-082613
LIMS ID: 13-17671
Matrix: Soil
Data Release Authorized:
Reported: 08/27/13

QC Report No: XC25-The Boeing Company
Project: AOC-92
Event: NA
Date Sampled: NA
Date Received: NA

Date Analyzed LCS: 08/26/13 17:10
LCSD: 08/26/13 17:39
Instrument/Analyst LCS: PID1/JLW
LCSD: PID1/JLW

Purge Volume: 5.0 mL

Sample Amount LCS: 100 mg-dry-wt
LCSD: 100 mg-dry-wt

Analyte	**LCS**	**Spike Added-LCS**	**LCS Recovery**	**LCSD**	**Spike Added-LCSD**	**LCSD Recovery**	**RPD**
Gasoline Range Hydrocarbons	117	125	93.6%	120	125	96.0%	2.5%

Reported in mg/kg (ppm)

RPD calculated using sample concentrations per SW846.

TPHG Surrogate Recovery

	LCS	**LCSD**
Trifluorotoluene	116%	112%
Bromobenzene	108%	104%

FORM III

ANALYTICAL
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INCORPORATED

ORGANICS ANALYSIS DATA SHEET
BETX by Method SW8021BMod
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Sample ID: LCS-082613
LAB CONTROL SAMPLE

Lab Sample ID: LCS-082613
LIMS ID: 13-17671
Matrix: Soil
Data Release Authorized:
Reported: 08/27/13

QC Report No: XC25-The Boeing Company
Project: AOC-92
Event: NA
Date Sampled: NA
Date Received: NA

Date Analyzed LCS: 08/26/13 17:10
LCSD: 08/26/13 17:39
Instrument/Analyst LCS: PID1/JLW
LCSD: PID1/JLW

Purge Volume: 5.0 mL

Sample Amount LCS: 100 mg-dry-wt
LCSD: 100 mg-dry-wt

Analyte	**LCS**	**Spike Added-LCS**	**LCS Recovery**	**LCSD**	**Spike Added-LCSD**	**LCSD Recovery**	**RPD**
Benzene	86.0	105	81.9%	90.5	105	86.2%	5.1%

Reported in µg/kg (ppb)

RPD calculated using sample concentrations per SW846.

BETX Surrogate Recovery

	LCS	**LCSD**
Trifluorotoluene	108%	105%
Bromobenzene	100%	97.5%

FORM III

[redacted]

Analytical Resources, Incorporated
Analytical Chemists and Consultants

August 28, 2013

Crystal Neirby
Amec
One Union Square
600 University Street, Suite 600
Seattle, WA 98101

RE: Project: Renton AOC-92
ARI Job: XC55

Dear Crystal:

Please find enclosed the original Chain-of-Custody (COC) record, sample receipt documentation, and analytical results for the project referenced above. Analytical Resources, Inc. (ARI) accepted one soil sample on August 28, 2013.

The sample was analyzed for NWTPH-Gx plus Benzene, as requested on the COC.

No anomalies were associated with the sample.

Quality control analysis results are included for your review. An electronic copy of this report and all associated raw data will be kept on file at ARI. If you have any questions or require additional information, please contact me at your convenience.

Sincerely,
ANALYTICAL RESOURCES, INC.

Kelly Bottem
Client Services Manager
(206) 695-6211
kellyb@arilabs.com
www.arilabs.com
Enclosures
cc: Carl Bach, The Boeing Company, carl.m.bach@Boeing.com

Chain of Custody Record & Laboratory Analysis Request

ARI Assigned Number: XC55
Turn-around Requested: Same-Day TAT
ARI Client Company: Boeing
Phone:
Client Contact: Fred Wallace, Carl Bach
Client Project Name: AOC-92 Excavation
Client Project #:
Samplers: AMEC

Page: 1 of 1
Date: 8/28/13
Ice Present? Y
No. of Coolers: 1
Cooler Temps: 13.3

Analytical Resources, Incorporated
Analytical Chemists and Consultants
4611 South 134th Place, Suite 100
Tukwila, WA 98168
206-695-6200 206-695-6201 (fax)

Sample ID	Date	Time	Matrix	No Containers	Analysis Requested								Notes/Comments
					TPH-G	Benzene							
AOC-92-EW-S-4.0	8/28/13	0930	S	3	X	X							

Chelsea Jefferson
8/28/13

Comments/Special Instructions

Relinquished by (Signature)	Received by (Signature)	Relinquished by: (Signature)	Received by (Signature)
Chelsea Jefferson			
Printed Name: Chelsea Jefferson	Printed Name: A. Volgardsen	Printed Name:	Printed Name
Company: AMEC	Company: ARI	Company:	Company
Date & Time: 8/28/13 0950	Date & Time: 8/28/13 950	Date & Time	Date & Time

Limits of Liability: *ARI will perform all requested services in accordance with appropriate methodology following ARI Standard Operating Procedures and the ARI Quality Assurance Program. This program meets standards for the industry. The total liability of ARI, its officers, agents, employees, or successors, arising out of or in connection with the requested services, shall not exceed the Invoiced amount for said services. The acceptance by the client of a proposal for services by ARI release ARI from any liability in excess thereof, not withstanding any provision to the contrary in any contract, purchase order or co-signed agreement between ARI and the Client.*

Sample Retention Policy: All samples submitted to ARI will be appropriately discarded no sooner than 90 days after receipt or 60 days after submission of hardcopy data, whichever is longer, unless alternate retention schedules have been established by work-order or contract.

Analytical Resources, Incorporated
Analytical Chemists and Consultants

Cooler Receipt Form

ARI Client: Boeing
COC No(s).: [✓ NA]
Assigned ARI Job No: XC55

Project Name: AOC-92 Excavation
Delivered by: Fed-Ex UPS Courier [✓ Hand Delivered] Other: ______
Tracking No: [✓ NA]

Preliminary Examination Phase:

Were intact, properly signed and dated custody seals attached to the outside of to cooler? YES [✓ NO]
Were custody papers included with the cooler? [✓ YES] NO
Were custody papers properly filled out (ink, signed, etc.) [✓ YES] NO
Temperature of Cooler(s) (°C) (recommended 2 0-6 0 °C for chemistry) 13.3 ____ ____ ____ ____
If cooler temperature is out of compliance fill out form 00070F
Temp Gun ID#: 122412224
Cooler Accepted by: AV Date: 8/28/13 Time: 950

Complete custody forms and attach all shipping documents

Log-In Phase:

Was a temperature blank included in the cooler? YES [✓ NO]
What kind of packing material was used? ... Bubble Wrap Wet Ice [✓ Gel Packs] Baggies [✓ Foam Block] Paper Other: ______
Was sufficient ice used (if appropriate)? NA YES [✓ NO]
Were all bottles sealed in individual plastic bags? YES [✓ NO]
Did all bottles arrive in good condition (unbroken)? [✓ YES] NO
Were all bottle labels complete and legible? [✓ YES] NO
Did the number of containers listed on COC match with the number of containers received? [✓ YES] NO
Did all bottle labels and tags agree with custody papers? [✓ YES] NO
Were all bottles used correct for the requested analyses? [✓ YES] NO
Do any of the analyses (bottles) require preservation? (attach preservation sheet, excluding VOCs) [✓ NA] YES NO
Were all VOC vials free of air bubbles? [✓ NA] YES NO
Was sufficient amount of sample sent in each bottle? [✓ YES] NO
Date VOC Trip Blank was made at ARI [✓ NA] ______
Was Sample Split by ARI: [✓ NA] YES Date/Time: ______ Equipment: ______ Split by: ______

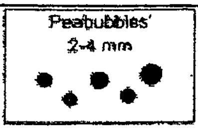
Samples Logged by: AV Date: 8/28/13 Time: 953

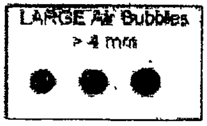
***** Notify Project Manager of discrepancies or concerns *****

Sample ID on Bottle	Sample ID on COC	Sample ID on Bottle	Sample ID on COC

Additional Notes, Discrepancies, & Resolutions:

By: Date:





Small → "sm"
Peabubbles → "pb"
Large → "lg"
Headspace → "hs"

Sample ID Cross Reference Report

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ARI Job No: XC55
Client: The Boeing Company
Project Event: N/A
Project Name: AOC-92 Excavation

	Sample ID	ARI Lab ID	ARI LIMS ID	Matrix	Sample Date/Time	VTSR
1.	AOC-92-EW-5-4.0	XC55A	13-17857	Soil	08/28/13 09:30	08/28/13 09:50

Printed 08/28/13 Page 1 of 1

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
BETX by Method SW8021BMod
TPHG by Method NWTPHG
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Sample ID: AOC-92-EW-5-4.0
SAMPLE

Lab Sample ID: XC55A
LIMS ID: 13-17857
Matrix: Soil
Data Release Authorized:
Reported: 08/28/13

QC Report No: XC55-The Boeing Company
Project: AOC-92 Excavation
Event: NA
Date Sampled: 08/28/13
Date Received: 08/28/13

Date Analyzed: 08/28/13 13:29
Instrument/Analyst: PID3/PKC

Purge Volume: 5.0 mL
Sample Amount: 79 mg-dry-wt
Percent Moisture: 26.3%

CAS Number	Analyte	RL	Result	GAS ID
71-43-2	Benzene	16	< 16 U	
	Gasoline Range Hydrocarbons	6.3	< 6.3 U	---

BETX Surrogate Recovery

Trifluorotoluene	105%
Bromobenzene	99.5%

Gasoline Surrogate Recovery

Trifluorotoluene	103%
Bromobenzene	99.5%

BETX values reported in µg/kg (ppb)
Gasoline values reported in mg/kg (ppm)

GAS: Indicates the presence of gasoline or weathered gasoline.
GRO: Positive result that does not match an identifiable gasoline pattern.

Quantitation on total peaks in the gasoline range from Toluene to Naphthalene.

Results corrected for soil moisture content per Section 11.10.5 of EPA Method 8000C.

FORM I

ANALYTICAL
RESOURCES
INCORPORATED

ORGANICS ANALYSIS DATA SHEET
BETX by Method SW8021BMod
TPHG by Method NWTPHG
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Sample ID: MB-082813
METHOD BLANK

Lab Sample ID: MB-082813
LIMS ID: 13-17857
Matrix: Soil
Data Release Authorized:
Reported: 08/28/13

QC Report No: XC55-The Boeing Company
Project: AOC-92 Excavation
Event: NA
Date Sampled: NA
Date Received: NA

Date Analyzed: 08/28/13 12:52
Instrument/Analyst: PID3/PKC

Purge Volume: 5.0 mL
Sample Amount: 100 mg-dry-wt

CAS Number	Analyte	RL	Result	GAS ID
71-43-2	Benzene	12	< 12 U	
	Gasoline Range Hydrocarbons	5.0	< 5.0 U	---

BETX Surrogate Recovery

Trifluorotoluene	101%
Bromobenzene	99.3%

Gasoline Surrogate Recovery

Trifluorotoluene	98.4%
Bromobenzene	97.0%

BETX values reported in µg/kg (ppb)
Gasoline values reported in mg/kg (ppm)

GAS: Indicates the presence of gasoline or weathered gasoline.
GRO: Positive result that does not match an identifiable gasoline pattern.

Quantitation on total peaks in the gasoline range from Toluene to Naphthalene.

FORM I

BETX SOIL SURROGATE RECOVERY SUMMARY

ARI Job: XC55
Matrix: Soil

QC Report No: XC55-The Boeing Company
Project: AOC-92 Excavation
Event: NA

Client ID	TFT	BBZ	TOT OUT
MB-082813	101%	99.3%	0
LCS-082813	108%	110%	0
LCSD-082813	104%	104%	0
AOC-92-EW-5-4.0	105%	99.5%	0

	LCS/MB LIMITS	QC LIMITS
(TFT) = Trifluorotoluene	(80-120)	(69-126)
(BBZ) = Bromobenzene	(80-120)	(49-143)

Log Number Range: 13-17857 to 13-17857

TPHG SOIL SURROGATE RECOVERY SUMMARY

ARI Job: XC55
Matrix: Soil

QC Report No: XC55-The Boeing Company
Project: AOC-92 Excavation
Event: NA

Client ID	BFB	TFT	BBZ	TOT OUT
MB-082813	NA	98.4%	97.0%	0
LCS-082813	NA	110%	114%	0
LCSD-082813	NA	106%	112%	0
AOC-92-EW-5-4.0	NA	103%	99.5%	0

	LCS/MB LIMITS	QC LIMITS
(TFT) = Trifluorotoluene	(80-120)	(65-128)
(BBZ) = Bromobenzene	(80-120)	(52-149)

Log Number Range: 13-17857 to 13-17857

ANALYTICAL
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INCORPORATED

ORGANICS ANALYSIS DATA SHEET
BETX by Method SW8021BMod
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Sample ID: LCS-082813
LAB CONTROL SAMPLE

Lab Sample ID: LCS-082813
LIMS ID: 13-17857
Matrix: Soil
Data Release Authorized:
Reported: 08/28/13

QC Report No: XC55-The Boeing Company
Project: AOC-92 Excavation
Event: NA
Date Sampled: NA
Date Received: NA

Date Analyzed LCS: 08/28/13 11:55
LCSD: 08/28/13 12:23
Instrument/Analyst LCS: PID3/PKC
LCSD: PID3/PKC

Purge Volume: 5.0 mL

Sample Amount LCS: 100 mg-dry-wt
LCSD: 100 mg-dry-wt

Analyte	**LCS**	**Spike Added-LCS**	**LCS Recovery**	**LCSD**	**Spike Added-LCSD**	**LCSD Recovery**	**RPD**
Benzene	112	105	107%	109	105	104%	2.7%

Reported in µg/kg (ppb)

RPD calculated using sample concentrations per SW846.

BETX Surrogate Recovery

	LCS	**LCSD**
Trifluorotoluene	108%	104%
Bromobenzene	110%	104%

FORM III

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
TPHG by Method NWTPHG
Page 1 of 1

Sample ID: LCS-082813
LAB CONTROL SAMPLE

Lab Sample ID: LCS-082813
LIMS ID: 13-17857
Matrix: Soil
Data Release Authorized:
Reported: 08/28/13

QC Report No: XC55-The Boeing Company
Project: AOC-92 Excavation
Event: NA
Date Sampled: NA
Date Received: NA

Date Analyzed LCS: 08/28/13 11:55
LCSD: 08/28/13 12:23
Instrument/Analyst LCS: PID3/PKC
LCSD: PID3/PKC

Purge Volume: 5.0 mL

Sample Amount LCS: 100 mg-dry-wt
LCSD: 100 mg-dry-wt

Analyte	**LCS**	**Spike Added-LCS**	**LCS Recovery**	**LCSD**	**Spike Added-LCSD**	**LCSD Recovery**	**RPD**
Gasoline Range Hydrocarbons	131	125	105%	130	125	104%	0.8%

Reported in mg/kg (ppm)

RPD calculated using sample concentrations per SW846.

TPHG Surrogate Recovery

	LCS	**LCSD**
Trifluorotoluene	110%	106%
Bromobenzene	114%	112%

FORM III

APPENDIX D

Compliance Monitoring Plan

COMPLIANCE MONITORING PLAN

Boeing Renton Facility

Renton, Washington

Prepared for:

The Boeing Company
Seattle, Washington

Prepared by:

AMEC Environment & Infrastructure, Inc.
600 University Street, Suite 600
Seattle, Washington 98101
(206) 342-1760

July 2014

Project No. 0088880100

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ATTACHMENTS

COMPLIANCE MONITORING PLAN
Boeing Renton
Renton, Washington

1.0 PURPOSE AND OBJECTIVES

The Boeing Company (Boeing) has been working with the Washington State Department of Ecology (Ecology) to address historic releases of hazardous substances at the Boeing Renton Facility (Facility) located in the City of Renton, Washington. Boeing has entered into Agreed Order No. 8191 (Order) with Ecology to remediate former releases at the Facility in accordance with the Cleanup Action Plan (CAP) for the Facility dated October 2012 (AMEC, 2012a). The Order was issued under the authority of the Revised Code of Washington (RCW) 70.105D.050(1) and Washington Administrative Code (WAC) 173 303-64630 and became effective on January 2, 2013.

The CAP for the Boeing Renton Facility specified the final remedies that will be implemented at the different Solid Waste Management Units (SWMUs) and Areas of Concern (AOC) after the Engineering Design Report (EDR) has been approved by Ecology (AMEC, 2012a). The CAP established cleanup standards for each SWMU or AOC. These standards specified groundwater cleanup levels and the Conditional Point-of Compliance (CPOC) where these cleanup levels were to be met. The cleanup levels were established such that concentrations of constituents of concern (COCs) at or below the cleanup level in groundwater samples collected at the CPOC would be protective of surface water in either the Cedar River Waterway or Lake Washington (AMEC, 2012a), as applicable to the specific CPOC. The Engineering Design Report (EDR) presents the engineering design to implement the cleanup remedies specified in the CAP. The EDR also presents the groundwater monitoring program to be implemented for each SWMU and/or AOC addressed by the CAP.

This Compliance Monitoring Plan documents the routine sampling program to be followed for implementing the groundwater monitoring program outlined in the EDR. This Compliance Monitoring Plan was prepared to address the regulatory requirements specified under the Model Toxics Control Act (MTCA) (Washington Administrative Code [WAC] 173-340-410) and the Order. This plan describes the conditions which must be met to determine if the cleanup actions for the various SWMUs or AOCs have achieved the cleanup levels specified in the CAP at the applicable CPOC.

The remedies specified in the CAP include soil vapor extraction (SVE) to remove volatile organic compounds (VOCs) and volatile hydrocarbon components from subsurface soils at SWMU-172/174 and the Building 4-78/79 SWMU/AOC Group. In accordance with requirements specified in the CAP, soil confirmation sampling will be conducted for these areas after it has been determined that the SVE system should be shut down. Details concerning the process to be used to decide on shutdown of the SVE system are presented in Section 7 of the EDR.

Section 2.0 of this Compliance Monitoring Plan summarizes the groundwater monitoring program. The soil confirmation sampling plan is described in Section 3.0. Procedures to request Ecology's approval for modifications to the groundwater monitoring program are discussed in Section 4.0. The process for demonstrating that the groundwater cleanup standard has been attained and that cleanup has been completed is described in Section 5.0. Details regarding soil and groundwater sampling are described in Attachment 1.

2.0 GROUNDWATER COMPLIANCE MONITORING PROGRAM

The EDR presents the groundwater compliance monitoring program that will be implemented after the EDR is approved. Table 1 summarizes the monitoring plan described in the CAP for each of the cleanup action areas. Table 2 presents the sampling schedule and the specific wells that will be sampled at each SWMU or AOC along with the appropriate analytical methods to be used for compliance monitoring. Figures 1 through 11 show the locations of the existing and planned groundwater monitoring wells included in the compliance monitoring program. Groundwater monitoring results will be reported in progress reports and quarterly monitoring reports, as described in Section 8 of the EDR.

The groundwater sampling and analytical methods that have been used for groundwater monitoring at the Facility are specified in the Groundwater Monitoring Plan Addendum (Geomatrix, 2007). The groundwater sampling methods that will be used for monitoring after approval of the EDR are included in Attachment 1. These sampling procedures were taken from the 2007 Groundwater Monitoring Plan Addendum (Geomatrix, 2007). Attachment 1 specifies the methods for water level measurement and equipment decontamination procedures to be used for future sampling events so that future monitoring results can be compared directly to historic monitoring results. Details concerning the quality assurance and quality control (QA/QC) requirements for compliance monitoring can be found in the Quality Assurance Project Plan (QAPP) for the Boeing Renton Facility (AMEC, 2012b).

Groundwater samples will be collected at the cleanup action areas being monitored using dedicated QED Well Wizard® submersible pneumatic bladder pumps or non-dedicated QED Well Wizard pumps to purge the well. The wells will be purged using low-flow groundwater sampling methods at a rate not to exceed 0.5 liter per minute. During purging, groundwater parameters consisting of pH, conductivity, dissolved oxygen, and temperature will be read from a QED FC 4000 flow cell and recorded by hand every 2 minutes and logged every 30 seconds with a data logger. Groundwater samples will be collected after the applicable readings stabilize within the limits prescribed by U.S. Environmental Protection Agency groundwater sampling guidance (EPA, 2002). The groundwater quality parameters measured during purging will be recorded in the field sampling records and included with each quarterly monitoring report. All purge water will be contained in 5-gallon carboys or Liquibins prior to being transferred to Boeing’s treatment plant.

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3.0 SOIL COMPLIANCE MONITORING

Soil compliance monitoring will be performed at all of the cleanup action areas following termination of SVE operations. Soil samples will be collected as described in Attachment 1, and the samples will be handled and analyzed as specified in the QAPP (AMEC, 2012b).

3.1 SWMU-172/174 SOIL COMPLIANCE MONITORING

COCs in soil at SWMU-172/174 include multiple VOCs and the nonvolatile metals copper, thallium, and zinc. SVE is expected to remove VOCs that can be recovered by this technology within 2 years of commencing operation. After a determination has been reached that the SVE system should be shut down as described in the EDR, soil compliance samples will be collected from the SVE target areas at the locations noted on Figure 2.

Soil samples will be collected in accordance with the sampling methodologies specified in Attachment 1. Samples will be collected using direct-push sampling methods that include EPA 5035 sampling methods for VOCs. Soil samples will be collected at depths of 2.0 and 8.5 feet from each sample location. The samples will be analyzed for VOCs and selected metals, as shown in Table 3. The location of the soil samples will be adjusted as necessary in the field to avoid utilities or other subsurface obstructions.

3.2 BUILDING 4-78/79 SWMU/AOC GROUP SOIL COMPLIANCE MONITORING

The soil COCs at the Building 4-78/79 SWMU/AOC Group include VOCs and total petroleum hydrocarbons in the gasoline range (TPH-G). SVE is expected to remove the recoverable VOCs from soils in the vadose zone within 2 years. After it is determined that the SVE system should be shut down, as described in the EDR, soil compliance samples will be collected from the SVE target area at the locations shown on Figure 3.

Soil samples will be collected following the sampling methodologies specified in Attachment 1. Samples will be collected using direct-push sampling methods to include EPA 5035 sampling methods for VOCs as described in Attachment 1. Soil samples will be collected from the vadose zone at depths of 1.0 and 3.0 feet from each sample location. The CAP indicated that soil samples would be collected from depths of 1.0 to 10 feet below ground surface (bgs); however, since SVE is expected to remediate soils only in the vadose zone, soil samples will be collected only at depths above the water table. The soil samples will be analyzed for VOCs and TPH-G, as shown in Table 3. The soil sampling locations may be adjusted as necessary in the field to avoid utilities and other subsurface obstructions.

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4.0 GROUNDWATER MONITORING PROGRAM REVISIONS

Changes to the monitoring plan described in this document and the EDR may be appropriate as cleanup proceeds within the Facility. These changes may include changes to sampling frequency or changes to the monitoring well network for specific cleanup action areas. Boeing will propose monitoring program revisions to Ecology as appropriate. Requests for program revision will be based on analytical results obtained from the monitoring wells after implementation of the EDR. Requested changes to the monitoring program will not be implemented until they are approved by Ecology.

It is envisioned that reductions in sampling frequency at selected SWMUs or AOCs may be appropriate after the cleanup actions are implemented and concentrations of COCs in groundwater begin to decrease and/or have been well characterized. It is expected that:

- Concentrations of COCs in source area monitoring wells will further decrease, especially at those SWMUs/AOCs where active remedial measures (excavation, SVE, and bioremediation) are implemented.
- Concentrations of COCs in upgradient, downgradient, or cross-gradient monitoring wells will decrease as dissolved-phase plumes contract.
- Concentrations of COCs in CPOC wells will decrease as the plume contracts, with concentrations ultimately achieving CULs.

Requests to modify the groundwater monitoring program will consist of a technical memorandum that describes the requested modification and provides supporting information. Supporting information will include an evaluation of groundwater monitoring results, both for recent monitoring events and historical results, that document trends in COC concentrations for the area(s) for which the modification is being requested and compares the results to the cleanup levels. A letter formally requesting the modification will accompany each technical memorandum.

In addition to the requested changes in the groundwater monitoring program described above, other changes to the monitoring program may be necessary to accommodate future changes in land use on City of Renton-owned property at the Renton Municipal Airport or in the Cedar River Trail Park. Land use changes may include construction, redevelopment, utility upgrades, or other changes beyond Boeing’s control. In accordance with the access agreement with the City of Renton (Appendix C of the CAP) when Boeing is alerted to pending changes in land use on City property, a letter outlining the scope of the changes and the need for modification of the groundwater monitoring program will be submitted to Ecology. The requested modifications will be implemented after approval by Ecology.

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5.0 COMPLETION OF GROUNDWATER COMPLIANCE MONITORING

CPOC wells were established for each of the SWMUs or AOCs, as shown in Figures 1 through 11. The CPOC wells at each cleanup action area will be monitored as long as any of the groundwater samples from the CPOC wells at the SWMU or AOC still contain COCs above their respective groundwater cleanup level and until cessation of monitoring is approved by Ecology.

As noted above, as cleanup proceeds at a cleanup action area, compliance monitoring is expected to show that groundwater COC concentrations at the CPOC wells have decreased to below the groundwater cleanup level. When monitoring results show that all COCs in all CPOC wells are at or below the groundwater cleanup levels specified in the CAP for a two-year monitoring period (e.g., four consecutive semiannual sampling events or eight consecutive quarterly sampling events), soil samples will be collected and analyzed for COCs to demonstrate that soil cleanup levels have been met for protection of groundwater and for protection of industrial workers. After receipt of analytical results for the soil samples, Boeing may propose to Ecology that the cleanup standard has been attained and request cessation of monitoring for that cleanup action area. Compliance monitoring will continue at these cleanup action areas in accordance with this Compliance Monitoring Plan until Ecology approves the requested cessation.

Upon Ecology approval, groundwater monitoring will be stopped for all groundwater monitoring network wells at the cleanup action area. Boeing will ensure that the wellheads for any wells removed from the monitoring program are secure and will maintain the wells as appropriate to protect groundwater quality. Boeing will request Ecology approval of cleanup standard attainment by preparing a letter and a technical memorandum supporting the request. The request may include plans for abandonment of monitoring wells, if well abandonment is considered appropriate to protect groundwater quality at the Facility.

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6.0 REFERENCES

AMEC Environment & Infrastructure, Inc. (AMEC), 2012a, Draft Cleanup Action Plan, Boeing Renton Facility, Renton, Washington: Prepared for the Boeing Company, October.

AMEC, 2012b, Quality Assurance Project Plan, Boeing Renton Facility, Renton, Washington: Prepared for the Boeing Company, February.

Geomatrix Consultants, Inc. (Geomatrix), 2007, Groundwater Monitoring Plan Addendum, Boeing Renton Facility, Renton, Washington: Prepared for The Boeing Company, Seattle, Washington, January 23.

U.S. Environmental Protection Agency (EPA), 2002, Groundwater Sampling Guidelines for Superfund and RCRA Project Managers, Office of Solid Waste and Emergency Response, EPA-542-S-01-001, May.

TABLES

TABLE 1

COMPLIANCE MONITORING PROGRAM

Boeing Renton Facility
Renton, Washington

SWMU or AOC	Groundwater Monitoring Wells		Monitoring Frequency[1]	
	Existing	New[2]	Quarterly	Semiannual
SWMU-168	--	4	X	--
SWMU-172/SWMU-174	6	5	X	--
Building 4-78/79 SWMU/AOC Group	8	8	X	--
Former Fuel Farm SWMU/AOC Group	7[3]	4	--	X
AOC-001/AOC-002	9	2[4]	X	--
AOC-003	1	3	X	--
AOC-004	1	3	X	--
AOC-034/035	6[5]	1	--	X
AOC-060	8[5]	3	--	X
AOC-090[6]	11	--	X	X
AOC-092	0	3	X	--
AOC-093	0	1[4]	X	--

Notes:

1 - Initial monitoring frequency for each SWMU/AOC. The number of monitoring wells sampled is expected to decrease after the first two full years of monitoring. Boeing will request a reduction after monitoring indicates sustained compliance with cleanup levels.

2 - "New" refers to new wells specified in the EDR. Wells already installed since completion of the cleanup action plan are considered existing wells.

3 - GW222S was abandoned due to pending construction; a replacement well will be reinstalled after redevelopment construction. GW101S, GW102S, GW219S, and GW220S were abandoned prior to construction by the current tenant. Three new wells will be installed to replace these wells.

4 - The numbers of new wells for AOC-001/002 includes both wells GW 245S and GW246S, which will be installed downgradient of AOC-001/002.

5 - Three of the wells at AOC-034/035 and two wells at AOC-060 will be monitored for water levels only and will not be sampled.

6 - GW189S will be monitored quarterly; all other wells will be monitored semiannually.

Abbreviations:

AOC = area of concern
EDR = Engineering Design Report
SWMU = solid waste management unit

TABLE 2

GROUNDWATER MONITORING SCHEDULE
Boeing Renton Facility
Renton, Washington

Cleanup Action Area	Groundwater Monitoring Wells		Monitoring Frequency[1]		Constituents of Concern [2]	Analyses [3]
	Existing	New [4]	Quarterly	Semiannual		
SWMU-168	--	GW228S, GW229S, GW230I, and GW231S	X	--	VC	SW8260C SIM
SWMU-172/SWMU-174	GW081S, GW152S, GW153S, GW172S, GW173S, GW226S	GW232S, GW233I, GW234S, GW235I, GW236S	X	--	Benzene, chloromethane, methylene chloride	SW8260C
					1,1-Dichloroethene, cis-1,2-DCE, PCE, TCE, VC	SW8260C SIM
					Bis(2-ethylhexyl) phthalate	SW8270D
					Arsenic and lead	EPA 6020
					Chromium (total as Cr(III)) and copper	EPA 6010C
					Chromium, total as Cr(VI)	EPA 7199
Building 4-78/79 SWMU/AOC Group	GW031S, GW033S, GW034S, GW038S, GW039S,GW143S, GW209S, GW210S	GW237S, GW238I, GW239I, GW240D, GW241S, GW242I, GW243I, GW244S	X	--	VC, TCE, *cis*-1,2-DCE, Benzene	SW8260C
					TPH-Gasoline	NWTPH-Gx
Former Fuel Farm SWMU/AOC Group	GW183S, GW184S, GW225I, GW221S, GW211S,GW212S, GW224S.	GW255S, GW256S, GW257S, GW258S	--	X	TPH-Jet Fuel, TPH-Diesel	NWTPH-Dx
AOC-001/AOC-002	GW185S, GW190S, GW191D, GW192S, GW193S, GW194S, GW195S, GW196D, GW197S	GW246S	X	--	Benzene, *trans*-1,2-DCE, chloroform	SW8260C
					TCE, *cis*-1,2-DCE, 1,1-dichloroethene, VC	SW8260C SIM
					Naphthalene	SW8270D
AOC-003	GW188S	GW247S, GW248I, GW249S	X	--	PCE, TCE	SW8260C
					VC, *cis*-1,2- DCE	SW8260C SIM
AOC-004	GW174S	GW250S	X	--	Benzene	SW8021B
					Lead	EPA 6020
					TPH-Gasoline	NWTPH-Gx
AOC-034/AOC-035	GW001S,[5] GW004S,[5] GW005S,[5] GW216S, GW217S, GW218S	GW251S	--	X	VC, *cis*-1,2- DCE	SW8260C
AOC-060	GW009S, GW010S,[5] GW011D,[5] GW012S, GW014S, GW147S, GW149S, GW150S	GW252S, GW253I, and GW254S	--	X	VC	SW8260C
					TCE, *cis*-1,2- DCE	SW8260C SIM
AOC-090	GW163I, GW165I, GW175I, GW176S, GW177I, GW178S, GW179I, GW180S, GW189S, GW207S, GW208S	--	X (GW189S)	X (all other wells)	1,1,2-Trichloroethane, Acetone, Benzene, Toluene, Carbon tetrachloride, Chloroform, *cis*-1,2-DCE, *trans*-1,2-DCE, Methylene chloride	SW8260C
					1,1-Dichloroethene, 1,1,2,2-Tetrachloroethane, VC, PCE, TCE	SW8260C SIM
					TPH-Gasoline	NWPTH-Gx
					TPH-Diesel, TPH-Motor Oil	NWTPH-Dx
AOC-092	GW227S	--	X	--	Benzene	SW8021B
					TPH-Gasoline	NWTPH-Gx
AOC-093	--	GW245S	X		TPH-Gasoline w/o Benzene	NWTPH-Gx

Notes:

1 - The EDR presents the groundwater monitoring frequency for each SWMU/AOC. For sites with semiannual monitoring frequency, specific quarters when monitoring will be conducted is indicated by Q1 for quarter 1, Q2 for quarter 2, etc.

2 - In addition to COCs, primary geochemical indicators will be monitored during each regular monitoring event, and secondary geochemical parameters will be monitored once annually. Geochmical indicators are listed in Table 6 of EDR.

3 - Details of analytical methods are specified in the QAPP (AMEC, 2012b).

4 - New refers to new monitoring wells specified for installation in the EDR. Existing wells include monitoring wells shown as existing wells in the cleanup action plan and new monitoring wells that have been installed since preparation of the draft cleanup action plan.

5 - Well will be monitored for water levels only and will not be sampled.

Abbreviations:

AOC = area of concern
cis-1,2-DCE = *cis*-1,2 dichloroethene
COCs = Constituents of Concern
PCE = tetrachloroethene
QAPP = Qaulity Assurance Project Plan
SWMU = solid waste management unit
TCE = trichloroethene
TPH = total petroleum hydrocarbons
trans-1,2-DCE = *trans*-1,2 dichloroethene
VC = vinyl chloride

TABLE 3

SOIL ANALYSIS DETAILS

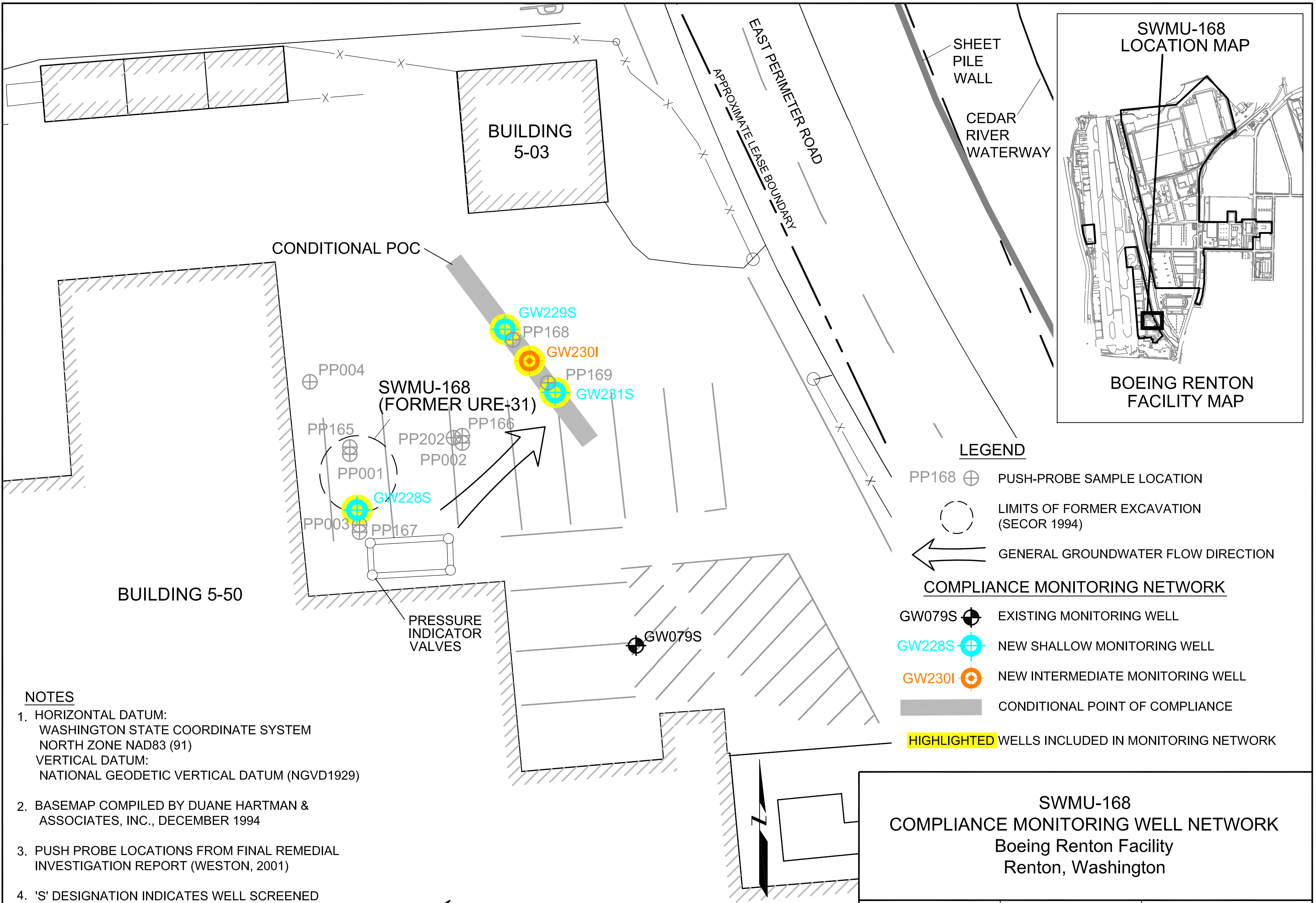
Boeing Renton Facility
Renton, Washington

Cleanup Action Area	Analytes	Analytical Method
SWMU-172174	PCE, TCE, VC, 1,1-DCE, *cis* -1,2-DCE, Methylene Chloride, Benzene	EPA Method 8260C
	Copper, Zinc	EPA Method 6010C
	Thallium	EPA Method 6020
Building 4-78/79 SWMU/AOC Group	PCE, TCE, VC, 1,1-DCE, *cis-* 1,2-DCE, Carbon Disulfide, Benzene	EPA Method 8260C
	TPH-G	Method NWTPH-Gx

Abbreviations:

1,1-DCE = 1,1-dichloroethene
AOC = area of concern
cis -1,2-DCE = *cis* -1,2-dichloroethene
EPA = U.S. Environmental Protection Agency
PCE = tetrachloroethene
SWMU = solid waste management unit
TCE = trichloroethene
TPH-G = total petroleum hydrocarbons, gasoline range
VC = vinyl chloride

FIGURES



NOTES

1. HORIZONTAL DATUM:
   WASHINGTON STATE COORDINATE SYSTEM
   NORTH ZONE NAD83 (91)
   VERTICAL DATUM:
   NATIONAL GEODETIC VERTICAL DATUM (NGVD1929)
2. BASEMAP COMPILED BY DUANE HARTMAN & ASSOCIATES, INC., DECEMBER 1994
3. PUSH PROBE LOCATIONS FROM FINAL REMEDIAL INVESTIGATION REPORT (WESTON, 2001)
4. 'S' DESIGNATION INDICATES WELL SCREENED LESS THAN 20 FEET IN DEPTH.
   "I" DESIGNATION INDICATES WELL SCREENED GREATER THAN 20 FEET IN DEPTH

BOEING

SWMU-168
COMPLIANCE MONITORING WELL NETWORK
Boeing Renton Facility
Renton, Washington

By: APS	Date: 10/10/13	Project No. 8888
amec		Figure 1

Plot Date: 10/10/13 - 3:58pm, Plotted by: adam.stenberg
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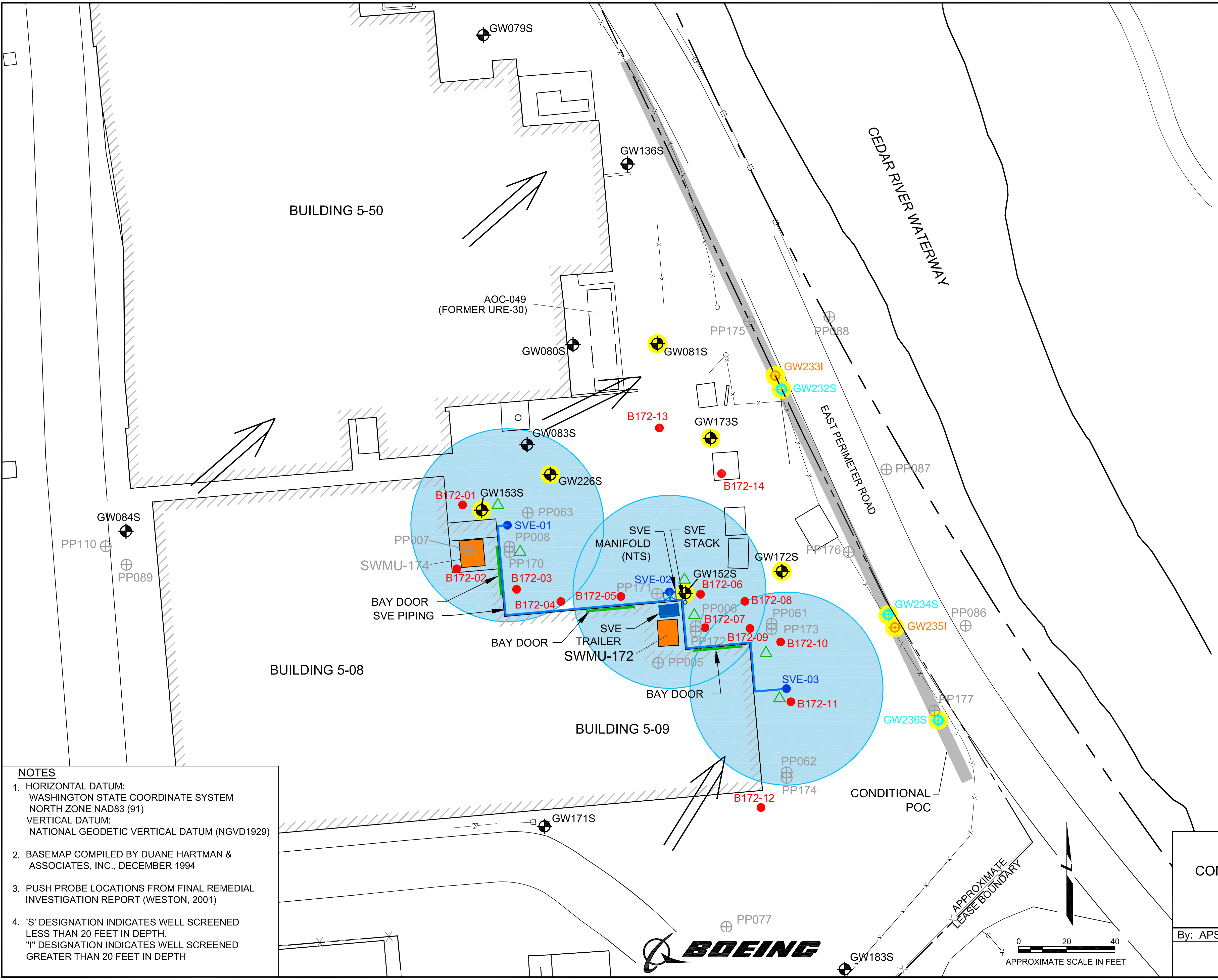

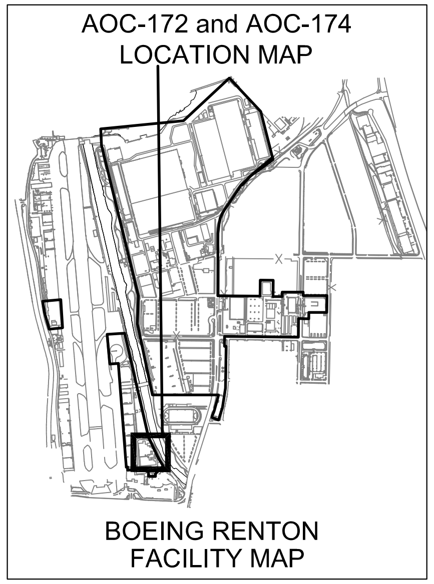

AOC-172 and AOC-174
LOCATION MAP

BOEING RENTON
FACILITY MAP

LEGEND

△ SOIL CONFIRMATION SAMPLE LOCATION
PP061 ⊕ PUSH-PROBE SAMPLE LOCATION
—x— FENCE
🟧 APPROXIMATE SOURCE AREA
⇒ GENERAL GROUNDWATER FLOW DIRECTION

SVE BIOREMEDIATION KEY

SVE-02 ● NEW SVE WELL
WITH 40' RADIUS OF INFLUENCE
☒ SVE MANIFOLD
— SVE PIPING LAYOUT
■ SVE TRAILER
B172-10 ● NEW BIOREMEDIATION INJECTION WELL

COMPLIANCE MONITORING NETWORK

GW083S ⊕ EXISTING MONITORING WELL
GW232S ⊕ NEW SHALLOW MONITORING WELL
GW235I ⊕ NEW INTERMEDIATE MONITORING WELL
▬ CONDITIONAL POINT OF COMPLIANCE
HIGHLIGHTED WELLS INCLUDED IN MONITORING NETWORK

NOTES

1. HORIZONTAL DATUM:
WASHINGTON STATE COORDINATE SYSTEM
NORTH ZONE NAD83 (91)
VERTICAL DATUM:
NATIONAL GEODETIC VERTICAL DATUM (NGVD1929)

2. BASEMAP COMPILED BY DUANE HARTMAN & ASSOCIATES, INC., DECEMBER 1994

3. PUSH PROBE LOCATIONS FROM FINAL REMEDIAL INVESTIGATION REPORT (WESTON, 2001)

4. 'S' DESIGNATION INDICATES WELL SCREENED LESS THAN 20 FEET IN DEPTH.
"I" DESIGNATION INDICATES WELL SCREENED GREATER THAN 20 FEET IN DEPTH

BOEING

SWMU-172 and SWMU-174
COMPLIANCE MONITORING WELL NETWORK
Boeing Renton Facility
Renton, Washington

By: APS
Date: 10/08/13
Project No. 8888

amec

Figure 2

Plot Date: 10/08/13 - 4:34pm, Plotted by: adam.stenberg
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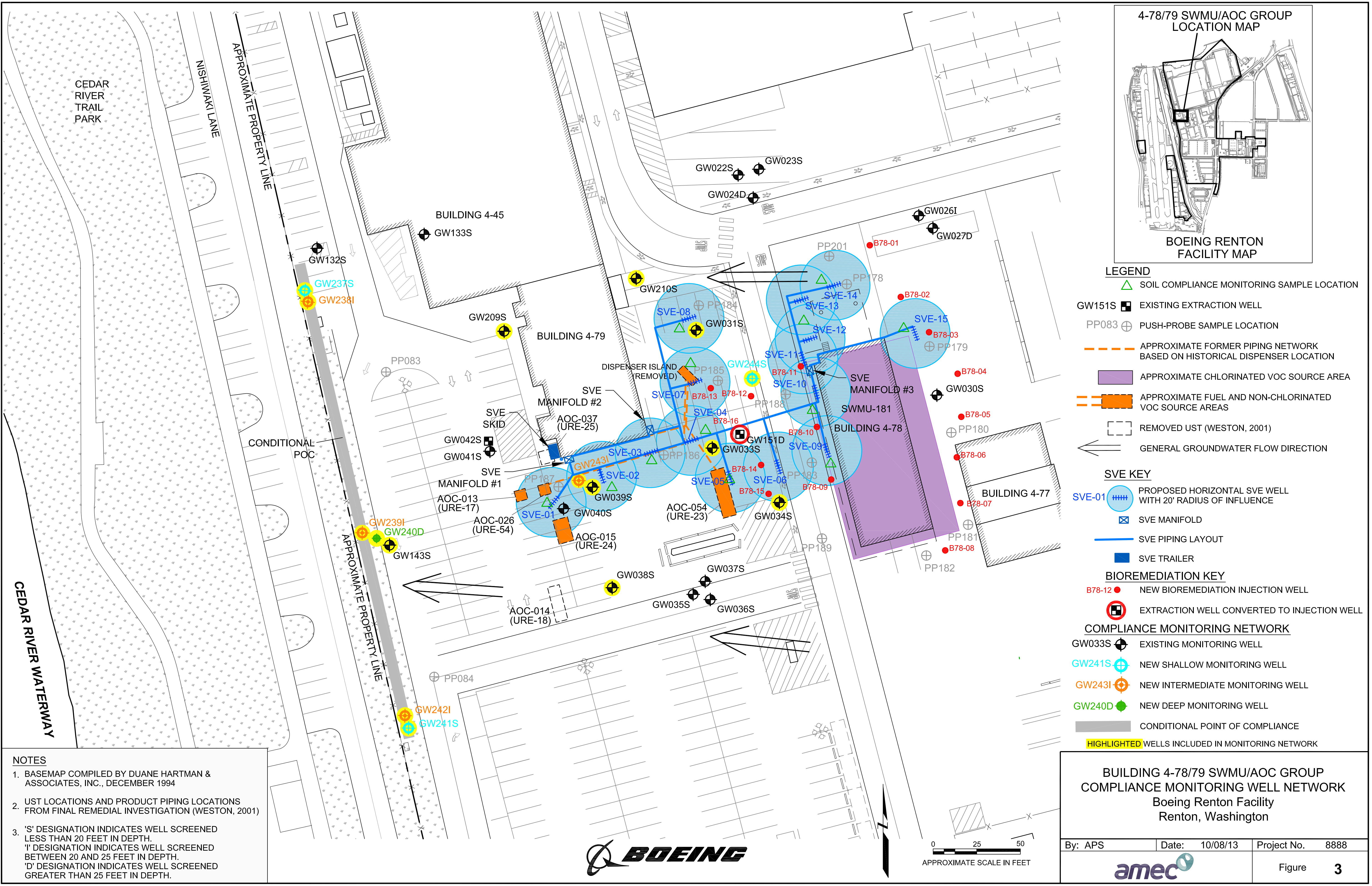

NOTES

1. BASEMAP COMPILED BY DUANE HARTMAN & ASSOCIATES, INC., DECEMBER 1994
2. UST LOCATIONS AND PRODUCT PIPING LOCATIONS FROM FINAL REMEDIAL INVESTIGATION (WESTON, 2001)
3. 'S' DESIGNATION INDICATES WELL SCREENED LESS THAN 20 FEET IN DEPTH.
'I' DESIGNATION INDICATES WELL SCREENED BETWEEN 20 AND 25 FEET IN DEPTH.
'D' DESIGNATION INDICATES WELL SCREENED GREATER THAN 25 FEET IN DEPTH.

BUILDING 4-78/79 SWMU/AOC GROUP
COMPLIANCE MONITORING WELL NETWORK
Boeing Renton Facility
Renton, Washington

By: APS	Date: 10/08/13	Project No. 8888
amec		Figure 3

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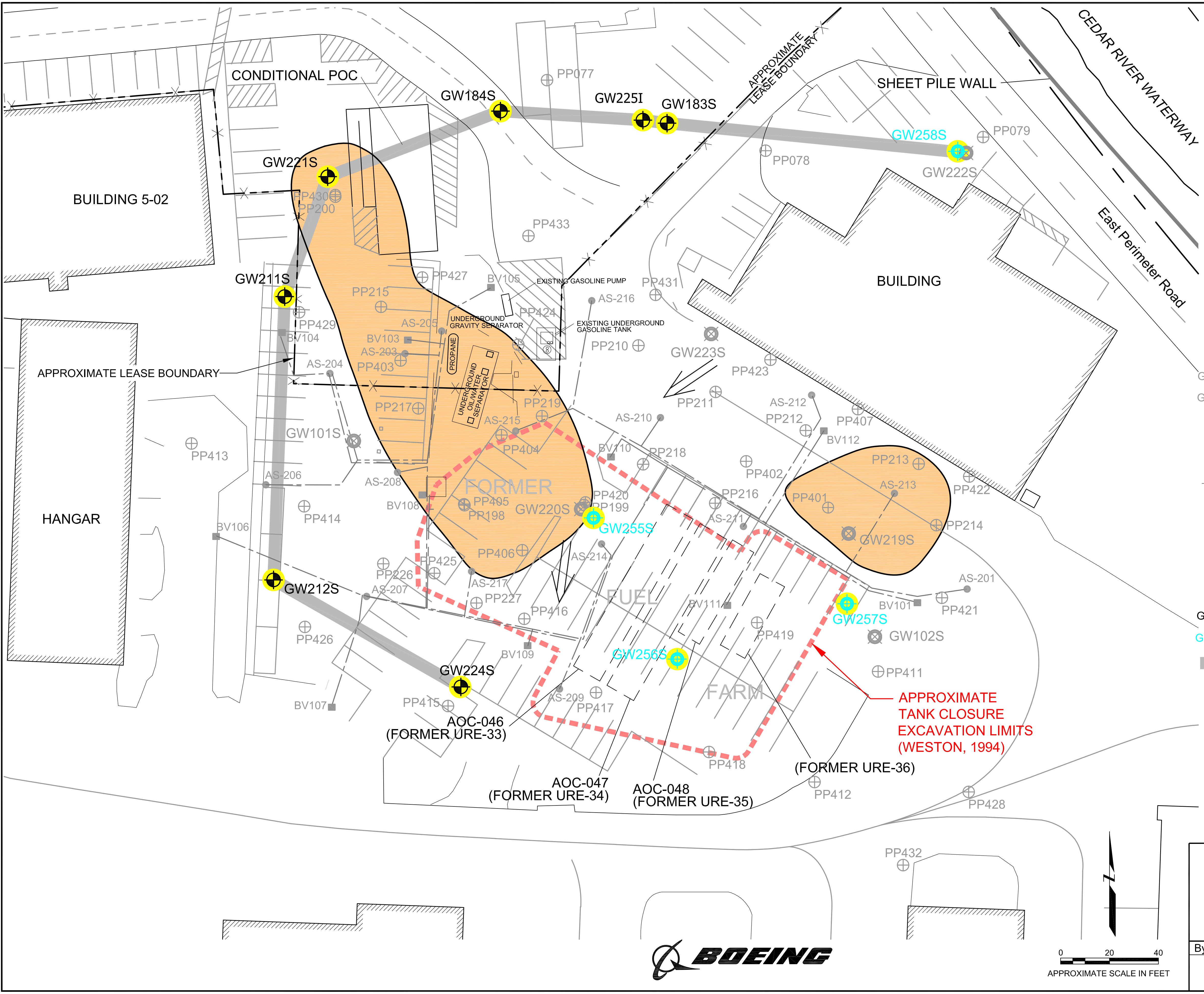

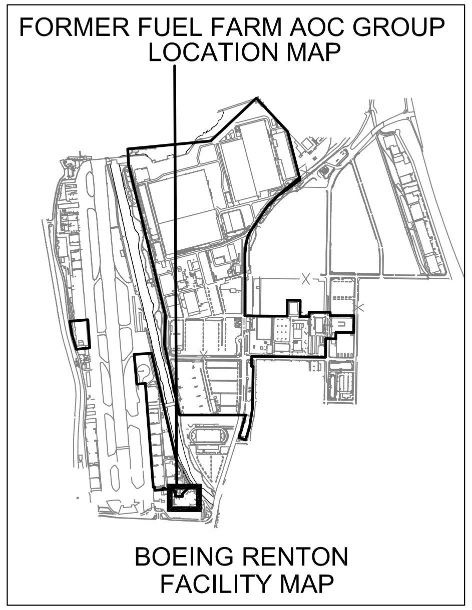

FORMER FUEL FARM AOC GROUP LOCATION MAP

BOEING RENTON FACILITY MAP

LEGEND

PP420 ⊕	PUSH-PROBE SAMPLE LOCATION
GW222S ⊕	MONITORING WELL
GW223S ⊗	ABANDONED MONITORING WELL
AS-204 ●	ABANDONED AIR SPARGING WELL
BV112 ■	ABANDONED BIOVENTING WELL
— - —	ABANDONED LINES
—x—	FENCE
🟧	TPH-JET SOIL AND GROUNDWATER SOURCE AREAS AS IDENTIFIED IN THE 1999 REMEDIAL INVESTIGATION. CONCENTRATIONS AND BOUNDARIES MAY NO LONGER BE REPRESENTATIVE OF CURRENT CONDITIONS.
⇐	APPROXIMATE GROUNDWATER FLOW DIRECTION POST AIR SPARGE/BIOVENT SHUTDOWN

COMPLIANCE MONITORING NETWORK

GW101S ⊕	EXISTING MONITORING WELL
GW256S ⊕	NEW SHALLOW MONITORING WELL
▬	CONDITIONAL POINT OF COMPLIANCE
HIGHLIGHTED	WELLS INCLUDED IN MONITORING NETWORK

NOTES

1. BASEMAP COMPILED BY DUANE HARTMAN & ASSOCIATES, INC., DECEMBER 1994.
2. PUSH-PROBE LOCATIONS FROM FINAL REMEDIAL INVESTIGATION REPORT (WESTON, 2001).
3. PIPING LOCATIONS APPROXIMATE.
4. 'S' DESIGNATION INDICATES WELL SCREENED LESS THAN 18 FEET IN DEPTH.
'I' DESIGNATION INDICATES WELL SCREENED GREATER THAN 20 FEET IN DEPTH.

FORMER FUEL FARM
COMPLIANCE MONITORING WELL NETWORK
Boeing Renton Facility
Renton, Washington

By: APS	Date: 10/08/13	Project No. 8888
amec		Figure 4

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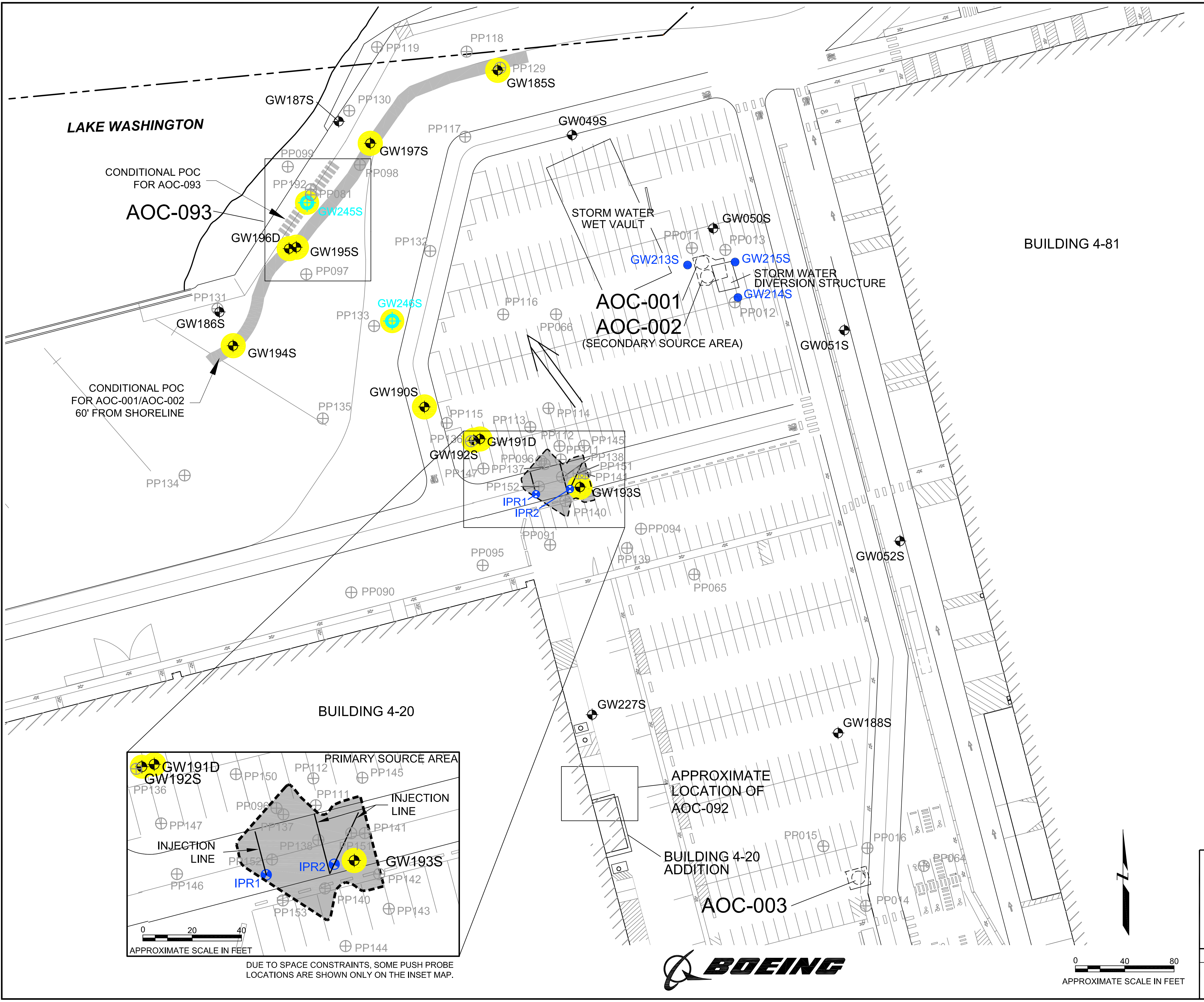
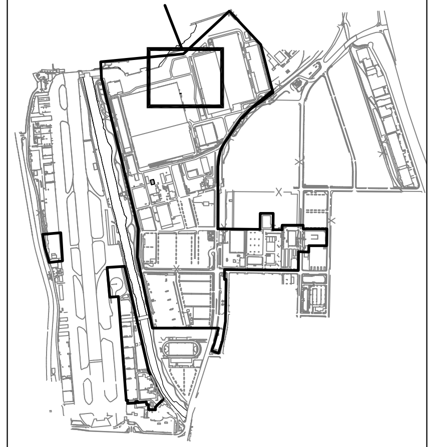


DUE TO SPACE CONSTRAINTS, SOME PUSH PROBE LOCATIONS ARE SHOWN ONLY ON THE INSET MAP.

AOC-001 AND AOC-002
LOCATION MAP



BOEING RENTON
FACILITY MAP

LEGEND

- PP011 ⊕ PUSH-PROBE SAMPLE LOCATION
- — — — APPROXIMATE PROPERTY LINE
- ▨ APPROXIMATE NOVEMBER 2005 EXCAVATION AREA, SHOWING EXISTING REMEDIATION PORTS AND LINES.
- ⇒ GENERAL GROUNDWATER FLOW DIRECTION FROM SECOND QUARTER 2013 GROUNDWATER MONITORING

BIOREMEDIATION KEY

- GW215S ● EXISTING ELECTRON DONOR INJECTION WELL
- IPR1 ⊗ EXISTING INJECTION PIPE RISER

COMPLIANCE MONITORING NETWORK

- GW050S ⊕ EXISTING MONITORING WELL
- GW245S ⊕ NEW SHALLOW MONITORING WELL
- ▨ CONDITIONAL POINT OF COMPLIANCE
- HIGHLIGHTED WELLS INCLUDED IN MONITORING NETWORK

NOTES

1. HORIZONTAL DATUM:
   WASHINGTON STATE COORDINATE SYSTEM
   NORTH ZONE NAD83 (91)
   VERTICAL DATUM:
   NATIONAL GEODETIC VERTICAL DATUM (NGVD1929)
2. BASEMAP COMPILED BY DUANE HARTMAN & ASSOCIATES, INC., DECEMBER 1994
3. 'S' DESIGNATION INDICATES WELL SCREENED LESS THAN 24 FEET IN DEPTH.

BOEING

AOC-001, AOC-002 and AOC-093
COMPLIANCE MONITORING WELL NETWORK
Boeing Renton Facility
Renton, Washington

By: APS	Date: 10/08/13	Project No. 8888
amec		Figure 5

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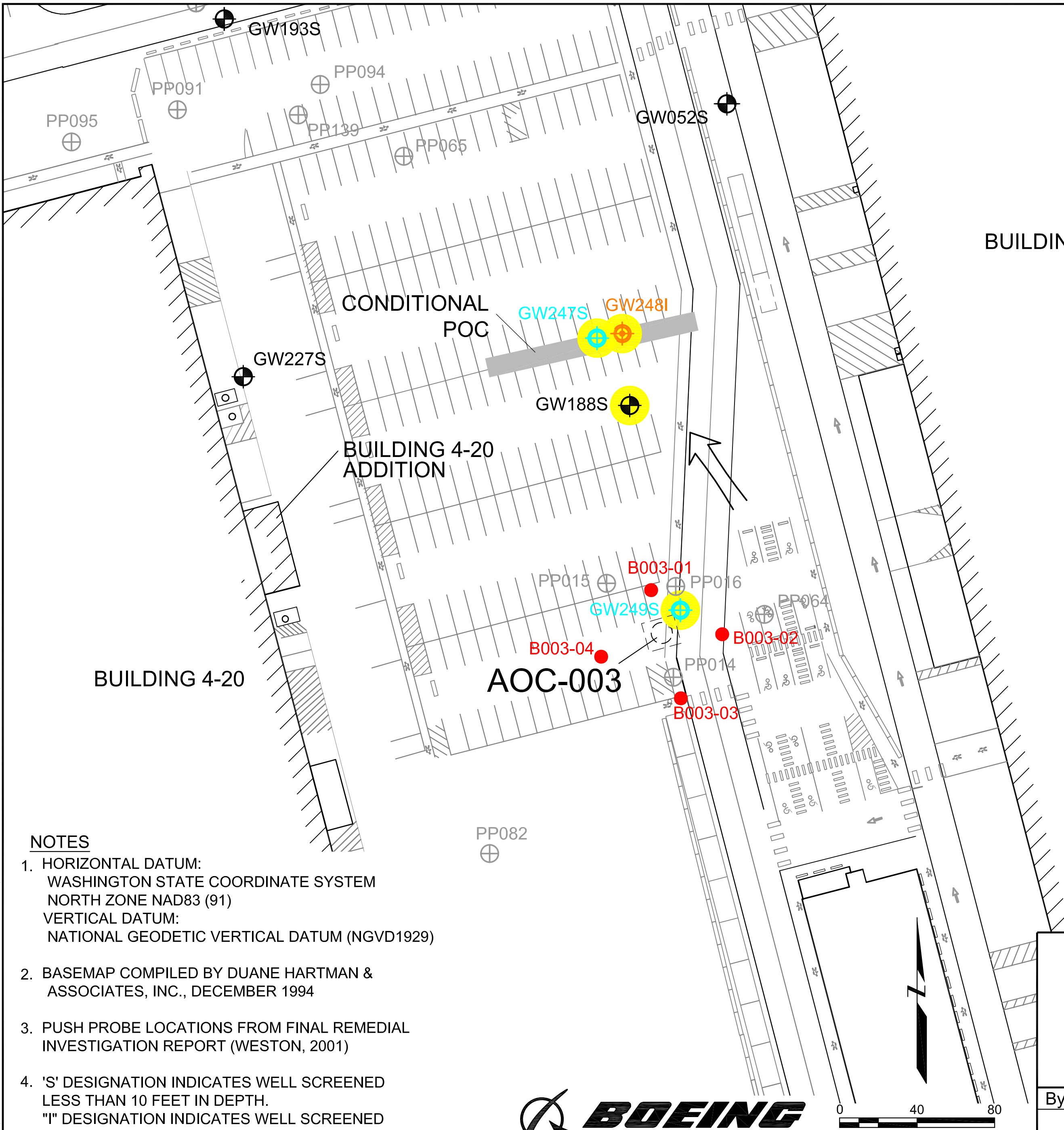

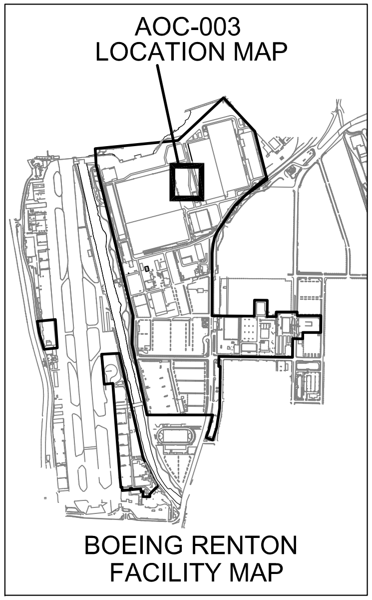

LEGEND

PP016 ⊕ PUSH-PROBE SAMPLE LOCATION

⇐ GENERAL GROUNDWATER FLOW DIRECTION FROM SECOND QUARTER 2013 GROUNDWATER MONITORING

BIOREMEDIATION KEY

B003-01 ● NEW BIOREMEDIATION INJECTION WELL

COMPLIANCE MONITORING NETWORK

GW188S ⊕ EXISTING MONITORING WELL

GW247S ⊕ NEW SHALLOW MONITORING WELL

GW248I ⊕ NEW INTERMEDIATE MONITORING WELL

▬ CONDITIONAL POINT OF COMPLIANCE

HIGHLIGHTED WELLS INCLUDED IN MONITORING NETWORK

NOTES

1. HORIZONTAL DATUM:
   WASHINGTON STATE COORDINATE SYSTEM
   NORTH ZONE NAD83 (91)
   VERTICAL DATUM:
   NATIONAL GEODETIC VERTICAL DATUM (NGVD1929)
2. BASEMAP COMPILED BY DUANE HARTMAN & ASSOCIATES, INC., DECEMBER 1994
3. PUSH PROBE LOCATIONS FROM FINAL REMEDIAL INVESTIGATION REPORT (WESTON, 2001)
4. 'S' DESIGNATION INDICATES WELL SCREENED LESS THAN 10 FEET IN DEPTH.
   "I" DESIGNATION INDICATES WELL SCREENED GREATER THAN 10 FEET IN DEPTH

BOEING

AOC-003
COMPLIANCE MONITORING WELL NETWORK

Boeing Renton Facility
Renton, Washington

By: APS	Date: 10/10/13	Project No. 8888
amec		Figure 6

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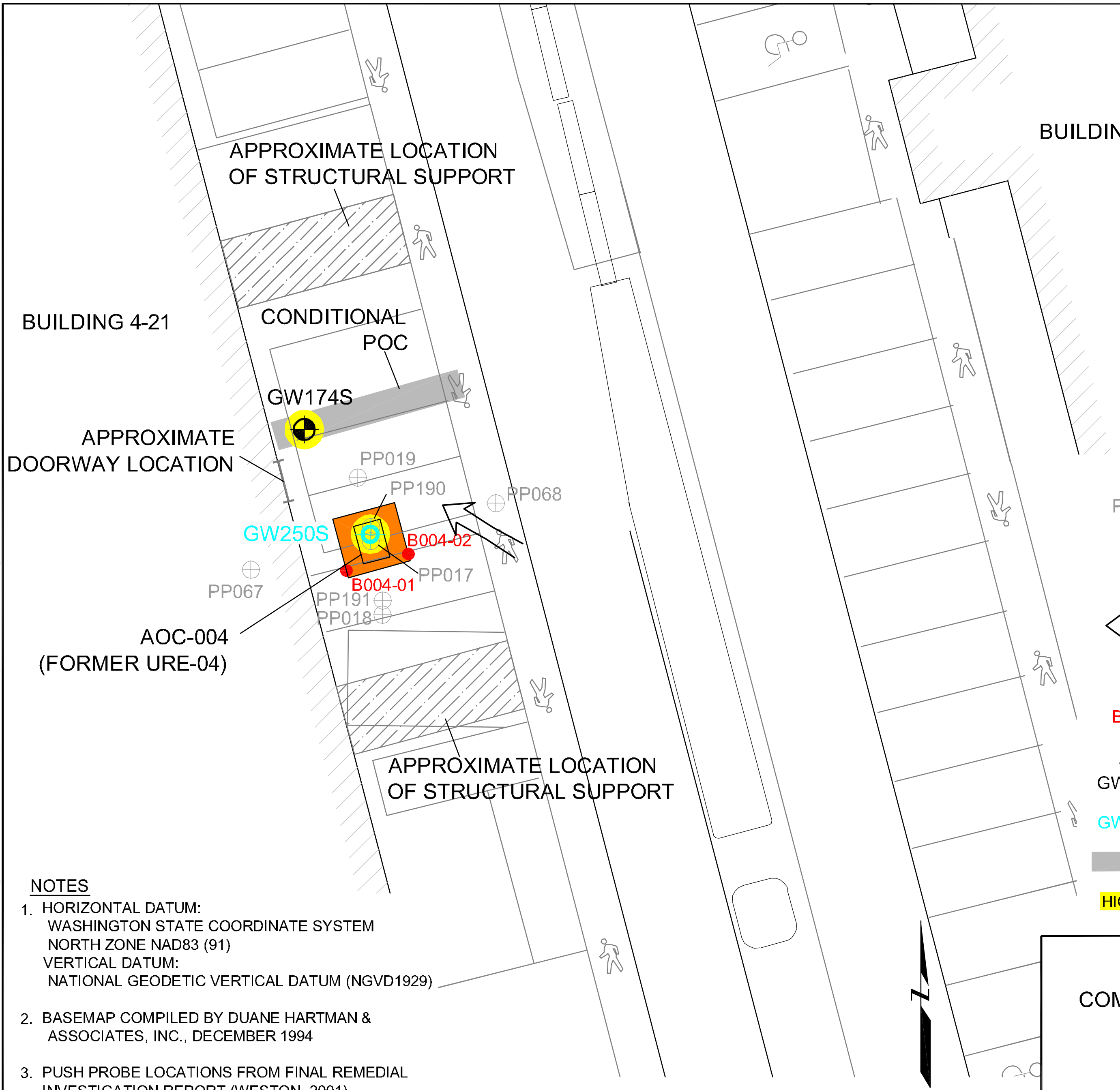
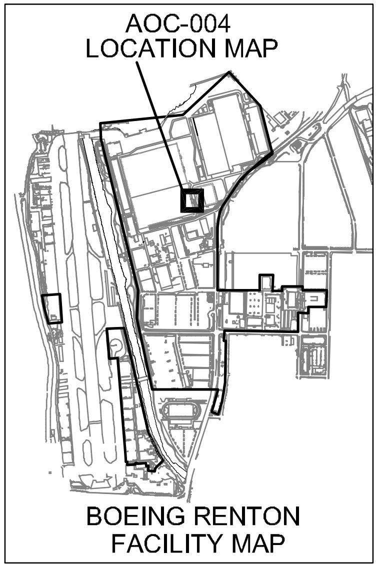




LEGEND

PP190 ⊕	PUSH-PROBE SAMPLE LOCATION
☐	FORMER UST LOCATION
🟧	APPROXIMATE AOC-004 SOURCE AREA
⇐	GENERAL GROUNDWATER FLOW DIRECTION BASED ON REMEDIAL INVESTIGATION (WESTON, 2001)

BIOREMEDIATION KEY

B004-01 ●	NEW BIOREMEDIATION INJECTION WELL

COMPLIANCE MONITORING NETWORK

GW174S ⊕	EXISTING MONITORING WELL
GW250S ⊕	NEW SHALLOW MONITORING WELL
▬	CONDITIONAL POINT OF COMPLIANCE
HIGHLIGHTED	WELLS INCLUDED IN MONITORING NETWORK

NOTES

1. HORIZONTAL DATUM:
   WASHINGTON STATE COORDINATE SYSTEM
   NORTH ZONE NAD83 (91)
   VERTICAL DATUM:
   NATIONAL GEODETIC VERTICAL DATUM (NGVD1929)
2. BASEMAP COMPILED BY DUANE HARTMAN & ASSOCIATES, INC., DECEMBER 1994
3. PUSH PROBE LOCATIONS FROM FINAL REMEDIAL INVESTIGATION REPORT (WESTON, 2001)
4. 'S' DESIGNATION INDICATES WELL SCREENED LESS THAN 10 FEET IN DEPTH.

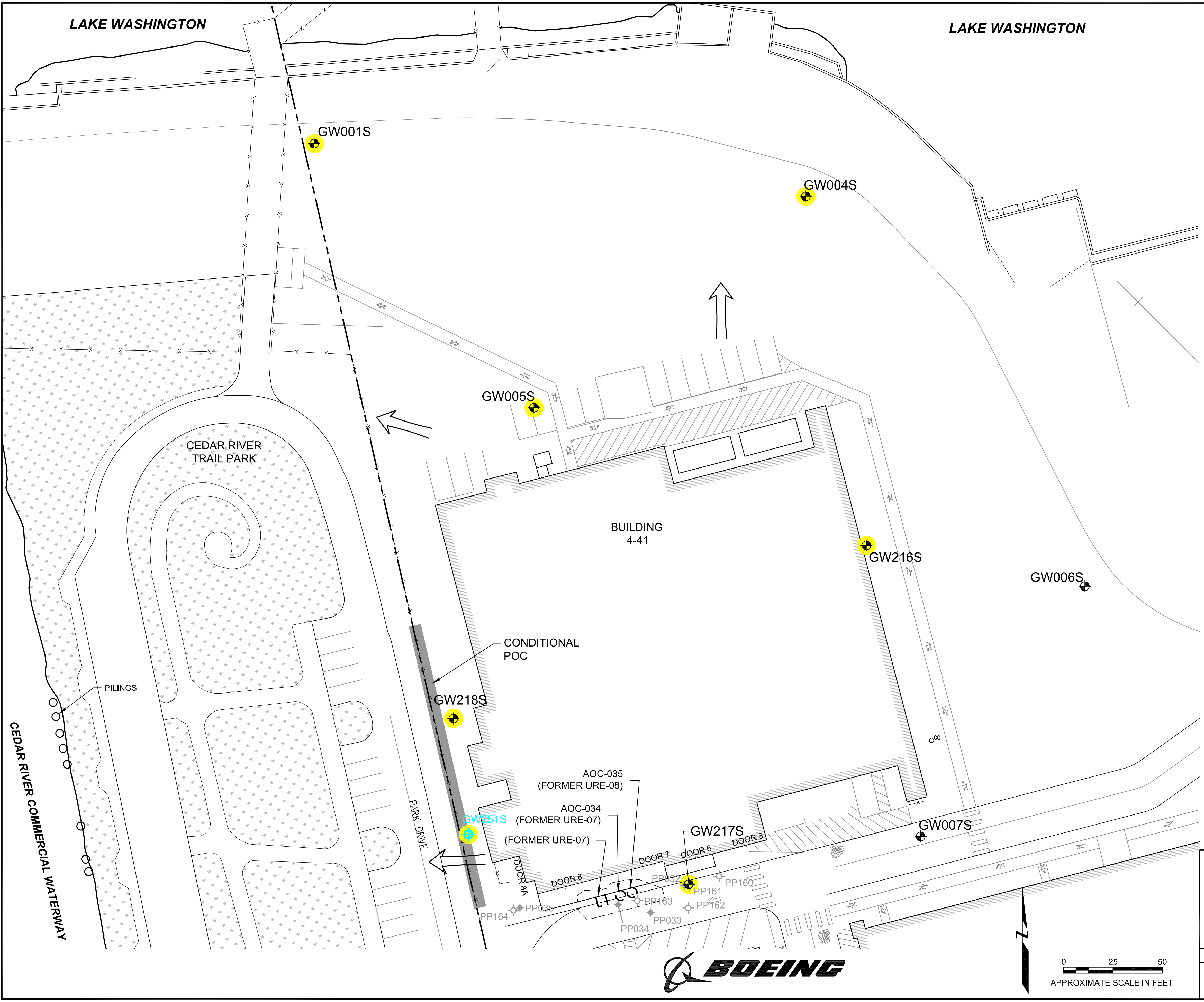
BOEING

0 10 20
APPROXIMATE SCALE IN FEET

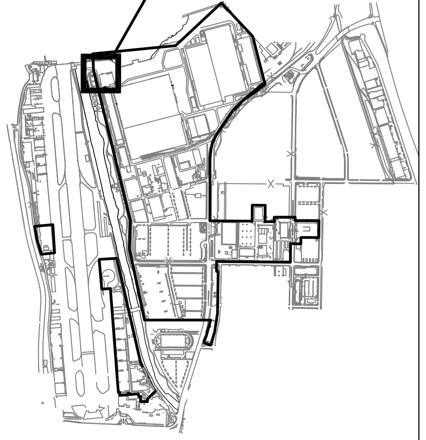
AOC-004
COMPLIANCE MONITORING WELL NETWORK
Boeing Renton Facility
Renton, Washington

By: APS	Date: 03/21/14	Project No. 8888
amec		Figure 7

Plot Date: 03/21/14 - 12:01pm, Plotted by: mike.stenberg
Drawing Path: S:\8888_2006\069_EDR\, Drawing Name: AOC-004_ProposedCleanupAction_031814.dwg



AOC-034 and AOC-035 LOCATION MAP



BOEING RENTON FACILITY MAP

LEGEND

PP162 ⌖	12/14/2006 PUSH-PROBE SOIL AND GROUNDWATER SAMPLE LOCATION
PP032 ✦	HISTORICAL PUSH-PROBE SAMPLE LOCATION
⬚	LIMITS OF PREVIOUS EXCAVATION
⌐¬	FORMER UST LOCATION
—x—	FENCE
⟵	GENERAL GROUNDWATER FLOW DIRECTION

COMPLIANCE MONITORING NETWORK

GW218S ⊕	EXISTING MONITORING WELL
GW251S ⊕	NEW SHALLOW MONITORING WELL
▬	CONDITIONAL POINT OF COMPLIANCE
HIGHLIGHTED	WELLS INCLUDED IN MONITORING NETWORK

NOTES

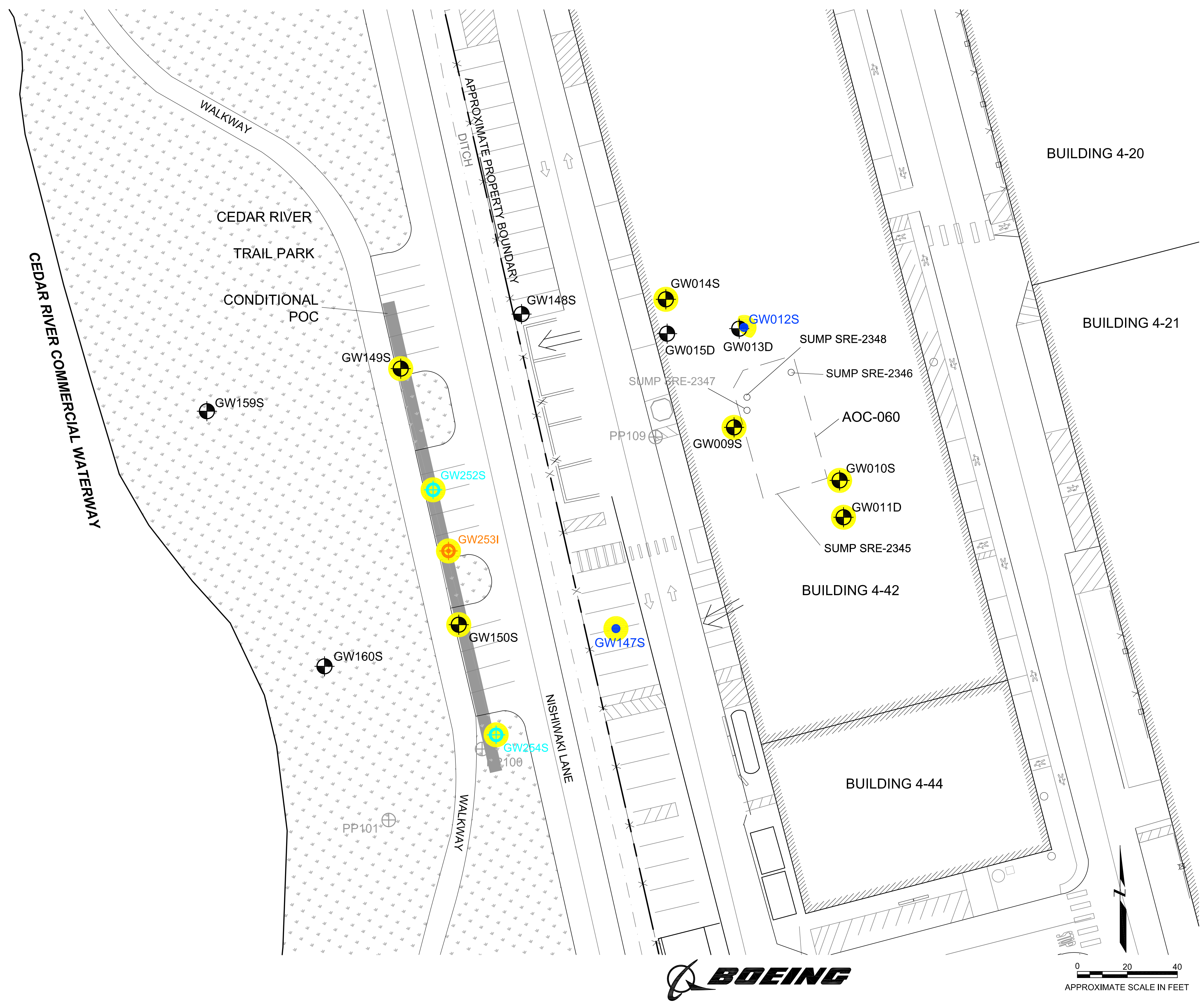
1. HORIZONTAL DATUM:
   WASHINGTON STATE COORDINATE SYSTEM
   NORTH ZONE NAD83 (91)
   VERTICAL DATUM:
   NATIONAL GEODETIC VERTICAL DATUM (NGVD1929)
2. BASEMAP COMPILED BY DUANE HARTMAN & ASSOCIATES, INC., DECEMBER 1994
3. 'S' DESIGNATION INDICATES WELL SCREENED LESS THAN 24 FEET IN DEPTH.
   'D' DESIGNATION INDICATES WELL SCREENED GREATER THAN 24 FEET IN DEPTH.

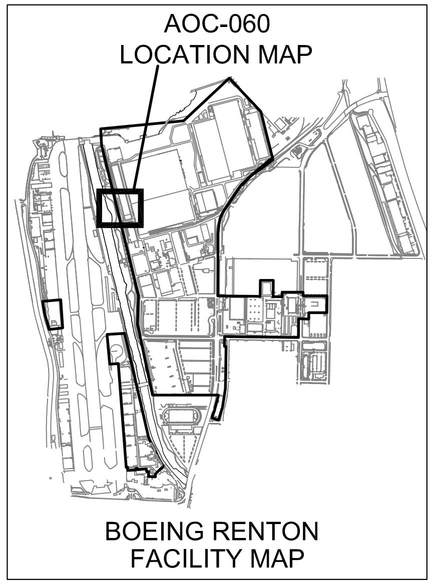
AOC-034 and AOC-035
COMPLIANCE MONITORING WELL NETWORK
Boeing Renton Facility
Renton, Washington

By: APS	Date: 10/08/13	Project No. 8888
amec		Figure 8

BOEING

Plot Date: 10/08/13 - 5:54pm, Plotted by: adam.stenberg
Drawing Path: S:\8888_2006\069_EDR\, Drawing Name: AOC-034-035_ProposedCleanupAction_092413.dwg





LEGEND

PP109 ⊕ PUSH-PROBE SAMPLE LOCATION

GENERAL GROUNDWATER FLOW DIRECTION BASED ON REMEDIAL INVESTIGATION (WESTON, 2001)

BIOREMEDIATION KEY

GW012S ● EXISTING ELECTRON DONOR INJECTION WELL

COMPLIANCE MONITORING NETWORK

GW050S ⊕ EXISTING MONITORING WELL

GW245S ⊕ NEW SHALLOW MONITORING WELL

GW255I ⊕ NEW INTERMEDIATE MONITORING WELL

▬ CONDITIONAL POINT OF COMPLIANCE

HIGHLIGHTED WELLS INCLUDED IN MONITORING NETWORK

NOTES

1. HORIZONTAL DATUM:
WASHINGTON STATE COORDINATE SYSTEM
NORTH ZONE NAD83 (91)
VERTICAL DATUM:
NATIONAL GEODETIC VERTICAL DATUM (NGVD1929)

2. BASEMAP COMPILED BY DUANE HARTMAN & ASSOCIATES, INC., DECEMBER, 1994

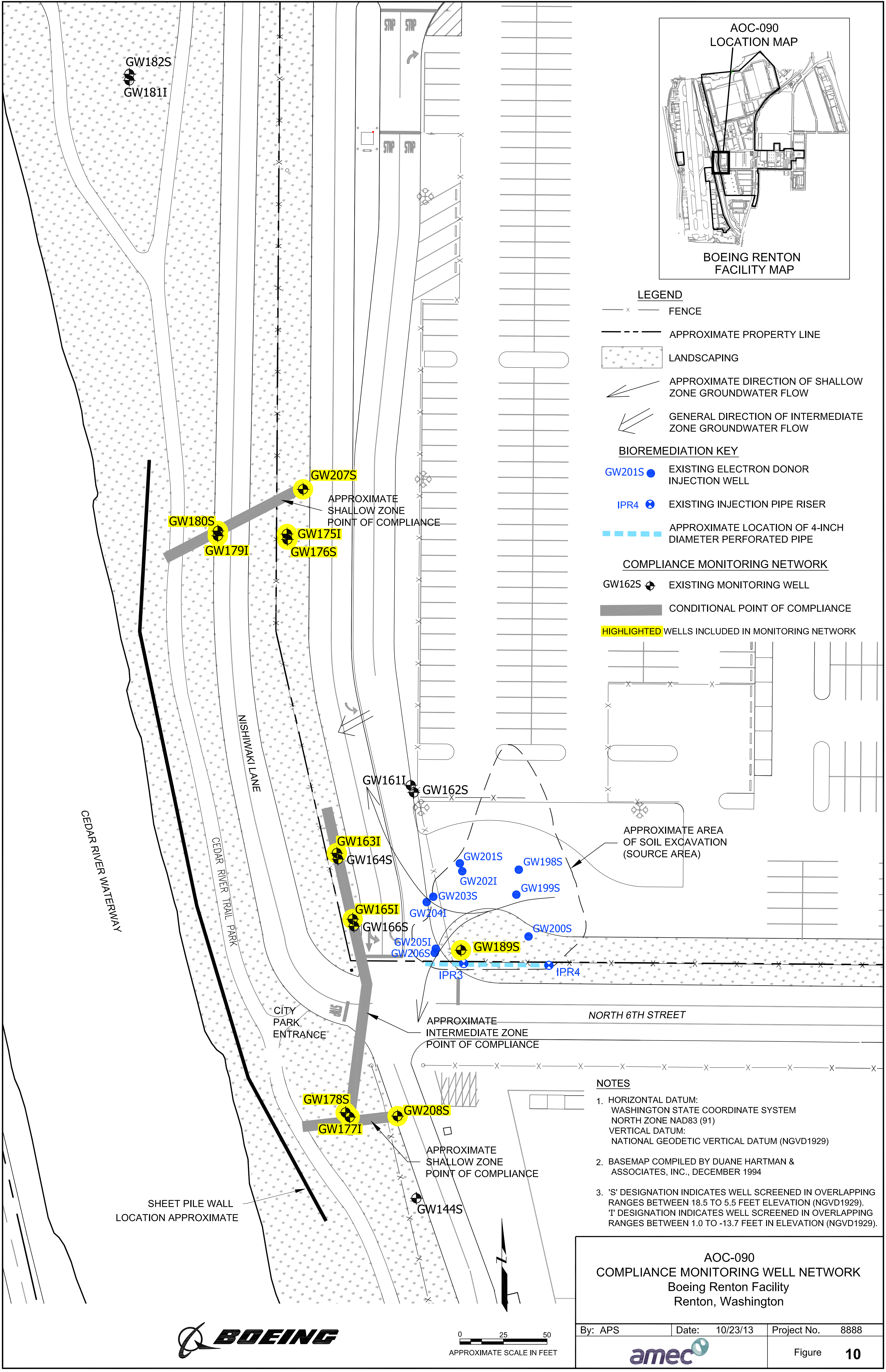
3. 'S' DESIGNATION INDICATES WELL SCREENED LESS THAN 15 FEET IN DEPTH.
'I' DESIGNATION INDICATES WELL SCREENED BETWEEN 15 AND 29 FEET.
'D' DESIGNATION INDICATES WELL SCREENED GREATER THAN 29 FEET IN DEPTH.

AOC-060
COMPLIANCE MONITORING WELL NETWORK
Boeing Renton Facility
Renton, Washington

By: APS
Date: 10/22/13
Project No. 8888
Figure 9

Plot Date: 10/22/13 - 4:52pm, Plotted by: adam.stenberg
Drawing Path: S:\8888_2006\069_EDR\, Drawing Name: AOC-060_ProposedCleanupAction_092413.dwg

Plot Date: 10/23/13 - 1:55pm, Plotted by: adam.stenberg
Drawing Path: S:\8888_2006\069_EDR\, Drawing Name: AOC-090_ProposedCleanupAction_091613.dwg

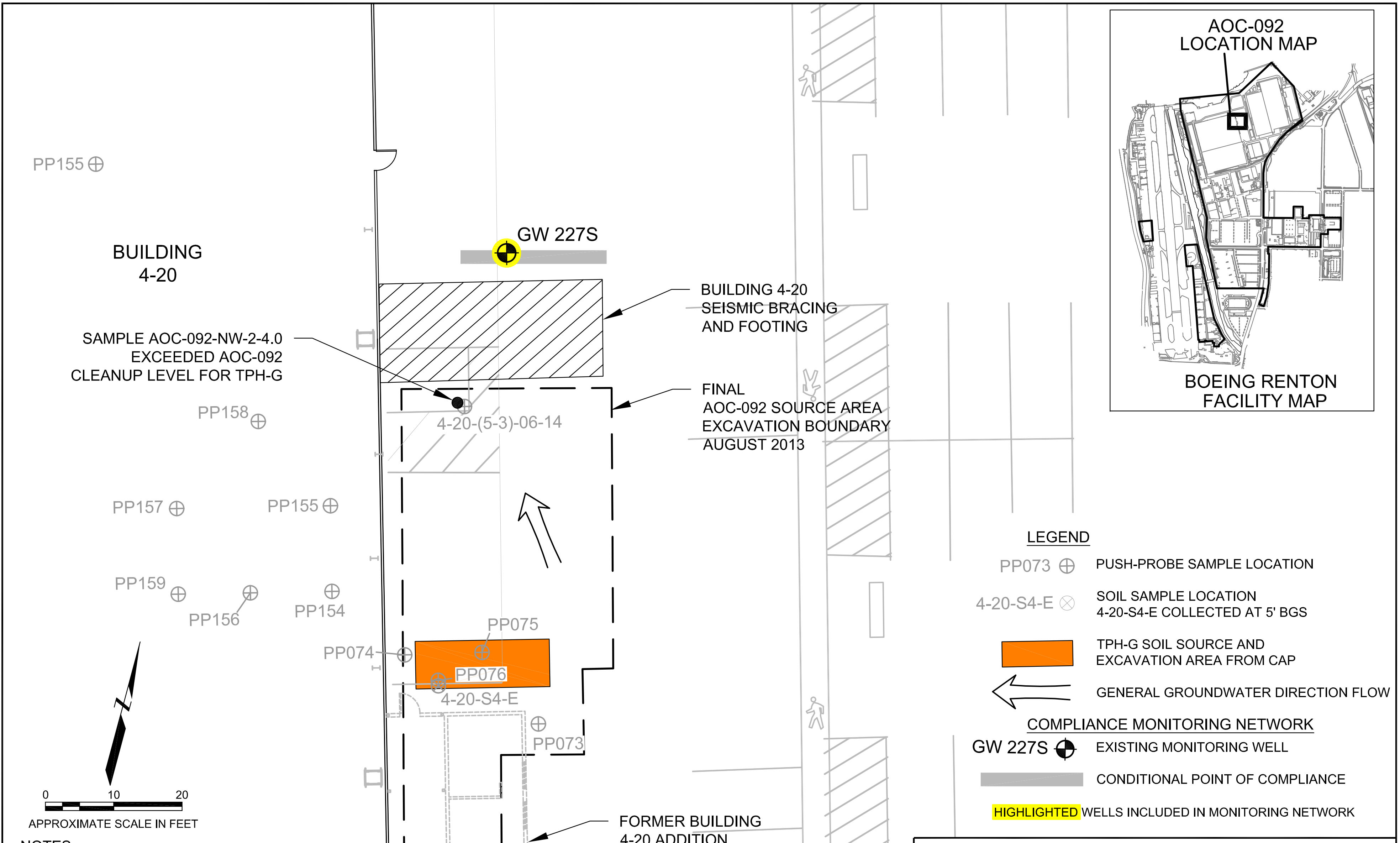


NOTES

1. HORIZONTAL DATUM:
   WASHINGTON STATE COORDINATE SYSTEM
   NORTH ZONE NAD83 (91)
   VERTICAL DATUM:
   NATIONAL GEODETIC VERTICAL DATUM (NGVD1929)
2. BASEMAP COMPILED BY DUANE HARTMAN & ASSOCIATES, INC., DECEMBER 1994
3. 'S' DESIGNATION INDICATES WELL SCREENED IN OVERLAPPING RANGES BETWEEN 18.5 TO 5.5 FEET ELEVATION (NGVD1929). 'I' DESIGNATION INDICATES WELL SCREENED IN OVERLAPPING RANGES BETWEEN 1.0 TO -13.7 FEET IN ELEVATION (NGVD1929).

AOC-090
COMPLIANCE MONITORING WELL NETWORK
Boeing Renton Facility
Renton, Washington

By: APS	Date: 10/23/13	Project No. 8888
amec		Figure 10



NOTES

1. BASEMAP COMPILED FROM DATA SUPPLIED BY DUANE HARTMAN & ASSOCIATES, INC., DECEMBER, 1994 AND WESTON, 2001

2. PUSH PROBE LOCATIONS AND BUILDING 4-20 ADDITION FROM BUILDING 4-20 EXTERIOR, COLUMN S-4 (AOC-092) SOIL AND GROUNDWATER SAMPLING REPORT (WESTON, AUGUST 2001)

3. 'S' DESIGNATION INDICATES WELL SCREENED LESS THAN 15 FEET IN DEPTH.

Plot Date: 10/29/13 - 2:30pm, Plotted by: adam.stenberg
Drawing Path: S:\8888_2006\069_EDR\, Drawing Name: AOC-092_ProposedCleanupAction_100313.dwg

AOC-092
COMPLIANCE MONITORING WELL NETWORK
Boeing Renton Facility
Renton, Washington

By: MDS
Date: 10/29/13
Project No. 8888
Figure 11

ATTACHMENT 1

Sampling Plan Boeing Renton Facility

SOIL AND GROUNDWATER SAMPLING METHODOLOGY

Boeing Renton Facility

Renton, Washington

Prepared for:

The Boeing Company
Seattle, Washingtong

Prepared by:

AMEC Environment & Infrastructure, Inc.
600 University Street, Suite 600
Seattle, Washington 98101
(206) 342-1760

October 2013

Project No. 0088880100

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(Continued)

SOIL AND GROUNDWATER SAMPLING METHODOLOGY
Boeing Renton Facility
Renton, Washington

1.0 INTRODUCTION

The sampling procedures described below will be used for soil and/or groundwater sampling performed under the Compliance Monitoring Plan for implementing the Cleanup Action Plan (CAP) at the Boeing, Renton Facility. These methods are consistent with the soil and groundwater sampling procedures specified in the Remedial Investigation Work Plan (Weston, 1999) and the Groundwater Monitoring Plan Addendum (Geomatrix, 2007).

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2.0 SOIL SAMPLING METHODOLOGY

Soil samples for compliance monitoring may be collected using direct-push drilling, hollow-stem auger drilling, or by collection from an excavation. The procedures for collection of samples from these different sampling methods are described below.

2.1 DIRECT PUSH SOIL SAMPLING

Direct push soil sampling can be used to lithologically log borings and to obtain soil samples for chemical analysis in accordance with the requirements of the Compliance Monitoring Plan. The drilling subcontractor, under the direction of a licensed geologist, will advance a direct push sampling apparatus in either 2- or 4-foot intervals from ground surface, depending on which specific type of direct push tooling is provided with the drill rig. Direct push soil cores for lithologic logging will be collected continuously within clear plastic liners inside the direct push sample core barrel. Once the liners are placed on polyethylene sheeting to contain possible spillage, the plastic liner will be cut-open to access the soils. A qualified geologist working under supervision of a licensed geologist will log each soil core in accordance with ASTM International (ASTM) Method D2488-93, (Standard Practice for Description and Identification of Soil [Visual-Manual Procedure]). The lithologic log for each boring will be based on visual observation and description of the corresponding soil samples. After the plastic liner is cut, the qualified geologist will screen the core for odors and staining; and select a portion of the core for field head-space screening for volatile organic compound vapors. The selected soil portion will be placed into a zip-lock polyethylene bag and sealed. A photoionization detector (PID) will be used to record the peak PID reading when the tip of the probe is inserted into the headspace of the polyethylene bag.

The lithologic log for each boring will be based on visual observation and description of the corresponding soil types in the core samples. Lithologic soil descriptions will contain the following information:

- Boring identifier;
- Sample depth interval, in feet bgs;
- Color, based on Munsell® color chart;
- Signs of weathering (e.g., rust-colored stains or coatings);
- Texture (particle size, angularity and sorting);
- Soil type, based on Unified Soil Classification System (USCS);
- Percent recovery;

- Estimated moisture content (qualitative);
- Organic matter (e.g., plant detritus, woody or fibrous vegetative matter, coal fragments, shell fragments);
- Artificial debris – type and material (e.g., metal filings, wood chips, plastic bottles, glass fragments); and
- Noticeable odor, if any.

Discrete samples for analysis will be collected by the qualified geologist at the sample depths specified in the Compliance Monitoring Plan. Soil samples collected for analysis of VOCs will be collected using the U.S. Environmental Protection Agency (EPA) Method 5035A (EPA, 2002) soil sampling method and following Ecology's Implementation Memo #5 (Ecology, 2004). This method requires a discrete soil sampler to minimize VOC loss and to store the soil samples in sealed 40-mL glass vials with Teflon© septa.

Soil samples for analysis of non-VOCs will be collected from each designated depth using a decontaminated stainless-steel spoon directly from the polyethylene core liners. A decontaminated spoon will be used for collection of each soil sample. Additional sample volume may need to be collected to have sufficient soil volume for analysis for QA/QC samples. The required QA/QC samples will be collected in accordance with the Quality Assurance Project Plan for the Boeing Renton Facility (AMEC, 2012b).

Direct push drilling will be conducted in accordance with WAC 173-760 by Cascade Drilling of Woodinville, Washington or another Boeing-approved Washington state-licensed drilling company.

2.2 HOLLOW-STEM AUGER SOIL SAMPLING

Soil samples may be collected using a hollow-stem auger (HSA) drill rig to conduct soil borings or to install larger wells (i.e., greater than 2-inch diameter wells) and can be used to install smaller diameter wells. Soil samples collected using a HSA can be collected continuously or at 5-foot intervals using a split-spoon sampler. Typical split-spoons are 1.5 feet long, and 3-inches in width. If the HSA rig is suitably equipped, the driller can provide blow counts as the sampler is advanced in 6-inch increments.

Soil samples collected using a HSA and decontaminated split-spoon sampler will be logged and sampled by a qualified geologist working under the supervision of a licensed geologist in the same manner as described above for direct push soil sampling. Head space screening from split-spoon samples is also performed as described above for direct-push sampling. Samples for analysis of VOC and/or non-VOCs will be collected from the split-spoon barrel at the target depth as described above for direct-push sampling. Additional sample volume may need to be collected as appropriate to have sufficient volume for analysis for QA/QC samples. The required QA/QC samples will be collected in accordance with the Quality Assurance Project Plan for the Boeing Renton Facility (AMEC, 2012b).

HSA drilling will be conducted in accordance with WAC 173-760 by Cascade Drilling of Woodinville, Washington, or another Boeing-approved Washington state-licensed drilling company.

2.3 EXCAVATION SOIL SAMPLING

Soil samples may be collected from excavations to confirm that COC-affected soil has been removed, or to characterize soil that must remain in place due to physical limitations, such as structures or utilities, that limit the extent of the excavation that can be conducted. Soil samples collected from an excavation can be collected manually by entering the excavation if it is shallower than 4-feet in depth, or they can be collected from soil excavated by a backhoe or excavator bucket. Sampling personnel will not enter excavations greater than 4-feet in depth because excavations of this depth are considered a confined space and require special safety procedures for personnel entry.

Soil samples collected for volatiles will be collected from the excavation surface or the excavator bucket using EPA Method 5035A (EPA, 2002) and in accordance with Ecology's Implementation Memo #5 (Ecology, 2004). This sampling method requires a discrete soil sampler to minimize VOC loss and to store the soil samples in 40-mL glass vials with Teflon© septa. Samples for non-VOCs will be collected using a decontaminated stainless-steel spoon directly from the excavation or excavator bucket. Additional sample volume may be collected to have sufficient volume for analysis for QA/QC samples. QA/QC samples will be collected in accordance with the QAPP for the Boeing Renton Facility (AMEC, 2012b).

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3.0 GROUNDWATER SAMPLING METHODOLOGY

This section describes the method for low-flow purging and sampling of monitoring wells and push probes.

3.1 LOW-FLOW GROUNDWATER SAMPLING FROM MONITORING WELLS USING BLADDER PUMPS

3.1.1 DISCUSSION

A low-flow purge and sample method creates less disturbance and agitation in the well; therefore, excess turbidity is not generated during the purging and sampling process. The result is more rapid stabilization of turbidity and other field parameters, hence a sample that is more representative of conditions in the formation. The field parameters, which will be measured in the field, are dissolved oxygen, pH, temperature, and conductivity. In addition, groundwater levels are generally collected from the general monitoring well network for each SWMU/AOC at the site.

3.1.2 PROCEDURES

3.1.2.1 Preparation

3.1.2.1.1 Office

A. Review the project Work Plan and/or the Quality Assurance Project Plan/Sampling Analysis Plan (QAPP/SAP).

B. Coordinate schedules and actions with Boeing facility personnel.

C. Assemble the equipment and supplies. Ensure the proper operation of all sampling equipment. Be sure the measuring device for field parameters (i.e., flow-through cell) has been calibrated. All samples will be collected in bottles supplied by the laboratory and all bottles will be pre-preserved if required.

3.1.2.1.2 Documentation

Consult the site manager or RI or IA Work Plan for a current list of sampling codes, location IDs, and sample numbers used in the completion of data forms.

3.1.2.1.3 Field

A. Locate monitoring wells to be sampled and check decontamination zones and barriers to public access.

B. Decontaminate all sampling equipment before and between sampling locations

3.1.3 Operation

Low-flow sampling can be conducted using dedicated or non-dedicated pumps as noted in the procedures below. The following procedure will be used for monitoring well purging and sampling:

A. Check and record the condition of the well for any damage or evidence of tampering.

B. Remove the locking compression cap from the well. For wells with dedicated pumps, lift the attached sampling system out of the well slightly to allow for collection of water levels.

C. Measure and record the depth to water with an electronic water level device and record the measurement on the groundwater sampling form. Do not measure the depth to the bottom of the well at this time (to avoid disturbing any sediment that may have accumulated).

D. Re-check and record the depth to water after approximately 5 minutes. If the measurement has changed more than 0.02 ft, check and record the measurement again, then begin well purging.

E. For dedicated wells, attach the compressed air line to the wellhead fittings and connect the pump discharge lines to the low-flow cell and then to the discharge bucket. For non-dedicated systems, lower the decontaminated pump system into the well, and attach the compressed air lines and discharge lines to the low flow cell and discharge bucket.

F. Start purging the well at a steady flowrate of 300 to 500 mL per minute.

G. The water level in the well should be monitored during pumping, and ideally, the pump rate should equal the well recharge rate with little or no water level drawdown in the well. Record the pumping rate and depth(s) to water in the logbook. If the recharge rate of the well is very low and the well is purged dry, then the sampler must wait until the well recharges to a sufficient level to collect the appropriate volume of sample.

H. During purging, the field parameters will be monitored and recorded by hand every 2 minutes and logged every 30 seconds with a datalogger. Once three successive readings of the field parameters agree within ±0.1 for pH, ±3% for conductivity, and ±10% for DO, then the purge water is considered stabilized and sampling may begin.

(Note: If three successive readings are not within the stabilization guidelines after purging approximately 30 minutes and, in the judgment of field sampling staff, the readings fluctuate but are stable, then sampling may occur. The justification to sample will be documented on the groundwater sampling record. These sampling records will be provided to Ecology upon request. Ecology has requested that these records be submitted for review.)

A. The pumping rate during sampling should not exceed the purge rate in order to minimize sample disturbance.

B. The total metals samples must be collected first directly into the pre-preserved sample container. If dissolved metals sample will be collected, an in-line 0.45 μm filter will be connected to the sample discharge line to collect the dissolved metals sample.

C. Disconnect the air pressure line, and the groundwater discharge line from the flow cell. For non-dedicated sampling systems, remove the pump from the well and decontaminate it. Close and lock the well.

3.1.4 Post-Operation

3.1.4.1 Field

A. Ensure that all equipment is accounted for and all samples stored prior to demobilizing from the well.

3.1.4.2 Documentation

A. Complete data entries, verify the accuracy of entries, and sign and initial all pages.

B. Review data collection forms for completeness.

C. Once all samples have been collected, transport the samples to the analytical laboratory or shipping facility.

D. Send a copy of the chain of custody form, the groundwater sampling data sheet(s), and any water levels collected during the sampling event to the Boeing personnel or contractor in charge of compiling the monitoring reports.

3.2 LOW-FLOW GROUNDWATER SAMPLE FROM PUSH PROBE BORINGS

This methodology describes the method for groundwater sampling using push-probe technology (i.e. StrataprobeTM, GeoprobeTM, HydropunchTM).

3.2.1 DISCUSSION

For sample collection, a drive rod and a groundwater sampling tool will be advanced with a hydraulic ram and/or percussion hammer, as necessary, to the appropriate depth whereupon the sampling device will be deployed. After the groundwater sample is collected, the rod will be withdrawn and the hole backfilled with bentonite granules. A concrete patch will complete the surface seal.

3.2.2 PROCEDURES

3.2.2.1 Preparation

3.2.2.1.1 Office

A. Review the project Work Plan and/or the Quality Assurance Project Plan/Sampling Analysis Plan (QAPP/SAP).

B. Coordinate schedules and actions with the site owners/managers.

C. Obtain appropriate permission for property access.

D. Assemble the equipment and supplies. Ensure the proper operation of all sampling equipment. Be sure the measuring device for field parameters (i.e., flow -through cell) has been calibrated.

E. Contact the carrier that will transport the samples to obtain information on regulations and specifications.

3.2.2.2 Documentation

A. Consult the site manager or project data administrator for a current list of information management codes, location IDs, and sample numbers used in the completion of data forms.

3.2.2.2.1 Field

A. Locate and mark underground utilities in the area to be investigated.

B. Decontaminate all sampling equipment before and between sampling locations.

3.2.2.3 Operation

The procedure for soil and groundwater sampling is discussed in the following subsections.

3.2.2.3.1 Groundwater Sampling

A. Install a disposable tip at the base of the groundwater sampling tool. Drive the sampler (in a shielded position) into the soil using the hydraulic ram and percussion hammer to the base of the desired sample depth.

B. Retract the groundwater sampling tool to the top of the sample interval. Push the slotted screen inside the sampler into the void space to expose to the screen to groundwater.

C. Measure and record the depth to water with an electronic water level device and record the measurement on the groundwater sampling form.

D. Lay out the polyethylene sheeting and place the monitoring, purging and sampling equipment on the sheeting. To avoid cross-contamination, do not let any downhole equipment touch the ground.

E. Attach and secure new polyethylene tubing to a low-flow pump (peristaltic). Slowly lower the tubing into the well; place the tubing at the midpoint of the screen.

F. Start purging to remove fines from the groundwater.

G. The well should be purged at a low-flow rate (less than 0.5 liter per minute). If sufficient groundwater is available during the purging, the field parameters must be monitored and recorded for every sample tube volume (tubing from midpoint in the screen the point of discharge). Once three successive readings of the field parameters agree within ± ten percent, then the purge water is considered stabilized and sampling may begin.

H. Sampling rate (for non-volatile organic analyses) should be the same as the purge rate in order to minimize sample disturbance.

I. The total metals samples must be collected first then filter a water sample for dissolved metals, if needed. An in-line 0.45 µm filter will be used at the well head.

J. All samples for volatile organic analyses will be collected from the purge line at a flow rate not to exceed 0.2 liters per minute.

Between sampling locations all non-dedicated sampling equipment must be disposed of or decontaminated. All used tubing is to be disposed.

3.2.2.4 Abandonment of Push-Probe Location

Following the completion of groundwater sampling, the push-probe boring will be backfilled with bentonite granules. A concrete plug (approximately 2 feet thick) will complete the surface seal.

3.2.3 Post-Operation

3.2.3.1 Field

A. Ensure that all equipment is accounted for, decontaminated and ready for shipment.

B. Restore the site to pre-sampling conditions as specified in the QAPP/SAP.

C. Document the location of each sample point.

3.2.3.2 Documentation

A. Complete data entries, verify the accuracy of entries, and sign/initial all pages.

B. Review data collection forms for completeness.

3.2.3.3 Office

A. Deliver original forms to the project manager for technical review.

B. Inventory equipment and supplies. Repair or replace all broken or damaged equipment. Replace expendable items. Return equipment to the Equipment Manager and report incidents of malfunction or damage.

4.0 SAMPLE IDENTIFICATION AND NUMBERING

For tracking and data management, samples will be assigned a unique 20-character alphanumeric identifier using the method described in this section. This numbering system will be used to identify each sample collected; to facilitate tracking, retrieval, and data processing; and to maintain relationships between samples. The sample designation scheme is illustrated below:

M – mm[rr] – Location – t ddd

Where: M = program (Monitoring)

mm = Media (SB = Subsurface soil, GW = groundwater)
rr = Sampling Round (optional)
Location = GW (Monitoring Well), PP (Push Probe), EX (Excavation)
t = Sample type (numeric): 0 = Field Sample, 1 = duplicate, 2 = VOC trip blank, 3 = Ambient transfer blank, 4 = equipment rinsate blank
ddd = top of depth interval in tenths of feet (125 = 12.5 feet)

As an example, the sample designation M-SB-PP298-00035 would be a soil sample at PP298 where the top of the sampling interval would be 3.5 feet bgs in depth. This sample numbering nomenclature is consistent with the nomenclature used in past sampling and will support samples to be entered into the existing Access sample database so that the data can be retrieved in the same way as sample data already in the database. .

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5.0 FIELD SAMPLE LOCATION DETERMINATION

The horizontal position for soil sample or push-probe groundwater sample locations will be measured from fixed objects, such as a building wall, doorway, or structural support, using a measuring tape. All sample locations from a sampling round will be measured prior to demobilizing from the site. GPS coordinates may also be used to determine the sample locations when the GPS unit is not hindered by the presence of obstructions.

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6.0 WATER LEVEL MEASUREMENT

This procedure describes the method for determining the depth-to-water in an open borehole, cased borehole, monitoring well, or piezometer.

6.1 DISCUSSION

Generally, water level measurements from boreholes, piezometers, or monitoring wells are used to construct potentiometric surface maps. Therefore, all water level measurements at a given site should be collected within a 24-hour period. Under the following conditions, all measurements must be taken within a shorter interval.

- A range of observed changes between wells that is too large to be indicative of natural gradient groundwater;
- Drastic atmospheric pressure changes;
- Tidally influenced aquifers;
- Aquifers affected by river stage, impoundments, or unlined ditches;
- Aquifers stressed by intermittent pumping of production wells; or
- Aquifers being actively recharged because of a precipitation event or induced infiltration.

The device used to measure water levels should be adequate to attain an accuracy of 0.01 feet. Generally acceptable devices are listed below.

- Chalked steel tape.
- Fiberglass tape with a popper.
- An electric sounder.
- A petroleum product probe.
- A reflection sounder.
- A transducer.

There should be a survey mark on the casing as a reference measuring point. If there is not a survey mark, place one on the casing and resurvey the casing elevation. The mark should be pennanent; a groove cut with a file is recommended. There should be an alternate measuring reference on the grout apron or guard pipe. If there is not an alternate reference, mark one. Document the alternate measuring point on the data form.

Allow water levels in piezometers and monitoring wells to stabilize for a minimum of 24 hours after well construction and development before measurements are taken. Recovery may take longer in wells completed in tight formations.

6.2 PROCEDURES

6.2.1 Preparation

6.2.1.1 Office

A. Review the project Work Plan and/or the Quality Assurance Project Plan/Sampling

A. Analysis Plan (QAPP/SAP).

B. Coordinate schedules and actions with the site owners/managers.

C. Obtain appropriate permission for property access.

D. Assemble the equipment and supplies. Ensure the proper operation of all sampling equipment. Be sure the measuring device for field parameters (i.e., flow -through cell) has been calibrated.

E. Contact the carrier that will transport the sample to obtain information on regulations and specifications.

6.2.2 Documentation

A. Consult the site manager or project data administrator for a current list of information management codes, location IDs, and sample numbers used in the completion of data forms.

6.2.2.1 Field

A. Locate monitoring wells to be measured and the appropriate decontamination area. Check decontamination zones and barriers to public access.

B. Decontaminate all sampling equipment before taking the first measurement and between sampling locations measurement intervals

C. When taking a number of water level measurements, it is preferable to start at those wells that are the least contaminated and proceed to those wells that are the most contaminated.

6.2.3 Operation

A. Whenever a water level is to be measured, enter a description of the measuring location onto the Groundwater Level Data Form or the Groundwater Levels and Product Thickness Data Form. Use the latter when a petroleum, gasoline, or other product is floating on the static water in the well.

B. Place equipment on a plastic sheet.

C. Remove locking well cap. Note the location, time of day, weather conditions, and date on the appropriate data form.

D. Remove the well casing cap. Note whether the well cap was vented or unvented and record the information in the logbook and on the appropriate data form.

E. If required by site-specific conditions, monitor the headspace of the well with a photoionization detector or a flame ionization detector to determine the presence of volatile organic compounds and record the measurements in the logbook or on appropriate forms.

F. Lower the measuring device into the well until the water surface is encountered; or attach the input lead from the dedicated device to the read-out device.

G. Measure the total depth of the well and the distance (in feet, tenths of feet, or hundredths of feet) from the water surface to the reference measuring point on the well casing. Record the well depth and distance to water on the data form in the comments column. If the well casing is damaged, measure from the alternate measuring point and note this modification in the logbook and data form.

H. If the total depth of the well has increased, and/or if the well appears to have heaved, a re-survey of the vertical elevation must be performed. If the total well depth has decreased, the well screen may have silted in, and redeveloping may be needed. Notify the site manager if any of these situations has occurred before proceeding any further.

I. Measure depth-to-water at least twice or until results are reproduced and record each measurement in the logbook and in the column of the data form. Record the reproduced measurement in the depth-to-water column on the field form.

J. Remove all downhole equipment. Replace the well casing cap and locking steel caps.

K. Rinse all down hole equipment and store for transit to the decontamination area.

L. Note any physical changes (like erosion or cracks) in the protective concrete pad or variation in the total depth of the well on the field form. Check the operational condition of the padlock, and clean all rust and debris with steel wool.

6.2.4 Post-Operation

6.2.4.1 Field

A. Ensure that all equipment is accounted for, decontaminated and ready for shipment.

B. Restore the site to pre-sampling conditions as specified in the QAPP/SAP.

C. Make sure the monitoring well is labeled or the borehole is properly staked and the location ID is readily visible on the location stake or protective casing.

D. Return well keys to property owner or storage location.

6.2.4.2 Documentation

A. Complete data entries, verify the accuracy of entries, and sign/initial all pages.

B. Review data collection forms for completeness.

6.2.4.3 Office

A. Deliver original forms to the site manager for technical review. He/she will review, sign forms, and transmit to the Document Control Officer (copies to the files) for placement in the project document control system, if required.

B. Inventory equipment and supplies. Repair or replace all broken or damaged equipment. Replace expendable items. Return equipment to the Equipment Manager and report incidents of malfunction or damage.

7.0 EQUIPMENT DECONTAMINATION

This procedure describes methods for the decontamination of field equipment potentially contaminated during soil or groundwater sample collection.

7.1 DISCUSSION

Decontamination is mainly achieved by rinsing with liquids that include soap or detergent solutions, tap water, deionized water, and methanol. Equipment is allowed to air dry after being cleaned or wiped dry with chemical-free cloths or paper towels. It can then be reused immediately. Steam cleaning should be used whenever visible contamination exists or for large machinery/vehicles.

It is the primary responsibility of the site manager to assure that proper decontamination procedures are followed and that all waste materials produced are properly stored or disposed of. It is the responsibility of all personnel involved with sample collection or decontamination to maintain a clean working environment and ensure that contaminants are not negligently introduced into the environment.

7.2 DECONTAMINATION PROCEDURES

7.2.1 Preparation

7.2.1.1 Office

A. Review the project Work Plan and/or the Quality Assurance Project Plan/Sampling Analysis Plan (QAPPISAP).

B. Coordinate schedules and actions with the site owners/managers.

C. Obtain appropriate permission for property access.

D. Assemble the equipment and supplies listed in the Equipment Checklist Below.

E. Notify the analytical laboratory of the decontamination blank sample and the approximate arrival date.

F. Contact the carrier that will transport the sample to obtain information on regulations and specifications.

7.1.2 Documentation

Document decontamination procedures implemented on the Daily Log Form.

7.2.1.2 Field

A. Assemble containers and equipment for decontamination.

B. Decontaminate all equipment before use.

7.2.2 Operation

The extent of known contamination determines the extent to which equipment must be decontaminated. If the extent of contamination cannot be readily determined, clean the equipment on the assumption that it is highly contaminated until enough data are available to allow an accurate assessment of the level of contamination.

Adequate supplies of rinsing liquids and all materials should be available. Perform decontamination in the same level of protective clothing as sampling activities unless a different level of protection is specified in the Health and Safety Plan.

The procedure for decontamination follows. Any deviations from this procedure for a specific project will be included in the applicable Work Plan(s).

Decontamination Steps

- The purpose of the initial step is to remove gross contamination. Remove any solid particles from the equipment or material by brushing and then rinsing with available tap water. For drilling equipment, steam cleaning is necessary.
- Wash equipment with soap or detergent solution.
- Rinse with tap water by submerging or spraying.
- For organic contaminants an optional rinse with a solvent (methanol or acetone) may be completed to dissolve and remove contaminants.
- Rinse thoroughly with **distilled water.**
- Air dry equipment or rinse with nanograde methanol to expedite drying.

7.2.3 Post Operation

7.2.3.1 Field

A. Decontaminate as much sampling equipment as possible and properly dispose of expendable items that cannot be decontaminated. Proper disposal may involve on-site drumming of liquids and solids in approved containers for subsequent disposal. Expensive items like machinery may require a more advanced decontamination analysis.

B. Store containers of solutions produced during decontamination in a secure area.

7.2.3.2 Office

A. Deliver original forms to the site manager for technical review. He/she will review, sign forms, and transmit to the Document Control Officer (copies to the files) for eventual delivery to the project document control system, if required.

B. Inventory equipment and supplies. Repair or replace all broken or damaged equipment. Replace expendable items. Return equipment to the equipment manager and report incidents of malfunction or damage.

EQUIPMENT AND SUPPLIES CHECKLIST

____ Decontamination solutions preselected by the laboratory.

____ Cleaning liquids: soap or detergent solutions, tap water, deionized water, and methanol.

_____ Chemical-free paper towels.

____ Cleaning brushes.

____ Cleaning containers: plastic buckets and galvanized steel pans.

____ Waste storage containers: drums and plastic bags.

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8.0 REFERENCES

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APPENDIX E

Health & Safety Plan

SITE-SPECIFIC HEALTH & SAFETY PLAN

Boeing Renton Facility

Renton, Washington

Prepared for:

The Boeing Company
Seattle, Washington

Prepared by:

AMEC Environment & Infrastructure, Inc.
600 University Street, Suite 600
Seattle, Washington 98101
(206) 342-1760

April 2013

Project No.8888

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Boeing Renton Facility
Renton, Washington

1.0 PURPOSE

This Site-Specific Health and Safety Plan (HASP) outlines the health and safety procedures that shall be followed during field work conducted for the Boeing Company (Boeing) at the Boeing Commercial Airplane Group – Renton Plant (the site) during the direct-push drilling, excavation work for installation of soil vapor extraction (SVE) piping, saw cutting, pressure testing, soil sampling and operations and maintenance (O&M) tasks planned for the site. The observance and practice of the procedures in this plan are mandatory for all AMEC employees at the site. All contractors and site visitors shall be made aware of the requirements of this plan; however, contractors are responsible for the health and safety of their own employees and for following all applicable federal, state, and local regulations.

This plan defines site-specific hazards and controls to prevent injury and illness among AMEC Environment & Infrastructure, Inc., (AMEC) personnel. Its implementation is in concert with the written AMEC Accident Prevention Program.

This plan has been reviewed by the Project Manager (PM) and Project Health and Safety Officer (PHSO). Prior to entering the site, AMEC personnel shall read this plan and be familiar with health and safety procedures required when working on site. Whenever AMEC personnel are present at the work site, a copy of the plan shall be available on site for inspection and review.

For emergencies on Boeing property, personnel shall be familiar with the information and directions given in the Boeing Safety Dashboard Card for the site. The Boeing Renton Safety Dashboard Card can be found in Appendix A.

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2.0 ADMINISTRATIVE INFORMATION

Project Name: Boeing Renton Engineering Design Report Implementation

Project Start Date: To Be Determined

Project Number: To Be Determined

Project Address: Boeing Commercial Airplane Group – Renton Plant
Renton, Washington

Client: The Boeing Company
Client Contact: Carl Bach
Telephone No.: 206-898-0438 (Cell)

Project Manager: Larry McGaughey (AMEC)
Telephone No.: (206) 342-1788

Senior Technical Lead: Patrick Hsieh (AMEC)
Telephone No.: (206) 342-1773

Project Health &
Safety Officer: Tim Reinhardt, CIH (AMEC)
Telephone No.: (206) 838-8464 (work) / (425) 241-5816 (cell)

Site Safety Officer: Trevor Louviere (AMEC) or other staff as needed.
Telephone No.: (425) 785-6322 (cell)

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3.0 PROJECT DESCRIPTION

This HASP addresses the hazards associated with oversight of hollow-stem auger drilling, direct-push drilling, soil and groundwater sampling, installation and development of monitoring wells, excavation related to installation of SVE piping, saw cutting, pressure testing, paving, installation and testing of SVE equipment, and O&M tasks associated with cleanup action plans being implemented for the site (Figure 1). Boeing has been working with the Washington State Department of Ecology (Ecology) to address historic releases of hazardous substances at the site, which is located in Renton, Washington. The final cleanup actions specified in the Ecology-approved Cleanup Action Plan are being implemented to satisfy the Resource Conservation and Recovery Act corrective action requirements under Agreed Order No. 8191 and Model Toxics Control Act for solid waste management units (SWMUs) and areas of concern (AOCs) at the site under the authority of Washington Administrative Code (WAC) 173-340-430. The primary constituents of concern (COCs) consist of jet fuel and gasoline range petroleum hydrocarbons and volatile organic compounds (VOCs), including chlorinated solvents. Field activities may include the collection of grab soil and groundwater samples; installation of monitoring wells, bioremediation injection wells, and SVE wells; construction oversight for SVE system installation; and engineering support tasks related to SVE system O&M and maintenance of bioremediation.

3.1 SITE PHYSICAL DESCRIPTION

The site setting is discussed in AMEC's 2013 Engineering Design Report. The site is an active industrial facility that manufactures airplanes located in Renton, Washington. The site is located on Boeing-owned property and property leased from the City of Renton. The property owned by Boeing neighbors a city park located on the Cedar River Waterway and Lake Washington. Vehicle traffic will be present near the field activities. Industrial work also will take place nearby. Underground utility lines related to the manufacturing facility are present at the site and must be protected. Boeing has an on-site fire and medical response team for site emergencies.

3.2 SCOPE OF FIELD ACTIVITIES

The following are the major field tasks for AMEC personnel on this project:

1. Oversight of direct-push boring installation and sampling of soil and/or groundwater.

2. Oversight of monitoring well installation.

3. Oversight of bioremediation well installation

4. Oversight of SVE well installation.

5. Oversight of SVE system installation.

6. Oversight of SVE system commissioning and startup.

4.0 PRIMARY RESPONSIBILITIES

4.1 PROJECT MANAGER AND SENIOR TECHNICAL LEAD

The PM will have overall responsibility for the success of the project, including the implementation of this HASP. The PM will review health and safety issues as needed and as consulted, and will have the authority to reallocate resources and personnel to safely accomplish the field work. If the PM decides, he can delegate this responsibility to the Senior Technical Lead.

In addition the PM (or Senior Technical Lead) shall:

1. Direct all AMEC personnel involved in investigative, monitoring, construction, and/or remedial activities at the site and vicinity;
2. Make the PHSO aware of pertinent project developments and plans;
3. Make available the resources that are necessary for a safe working environment;
4. Maintain communications with the client, as necessary; and
5. Ensure that all AMEC project personnel assigned to the project have received required training, are aware of the potential hazards associated with site operations, have been instructed in the work practices necessary for personal health and safety, and are familiar with the site HASP's procedures for all scheduled activities and for dealing with emergencies.

4.2 PROJECT HEALTH AND SAFETY OFFICER

The PHSO shall:

1. Advise PM and project personnel on all known health and safety aspects of investigative, monitoring, and remedial activities conducted by AMEC personnel at the site and vicinity;
2. Specify required exposure monitoring to assess site health and safety conditions;
3. Review any accident/incident reports and make corrective action recommendations;
4. Modify the site HASP as required based on accidents/incidents and findings regarding site hazards and work practices;
5. Report all accidents/incidents and findings regarding personnel exposure, site hazards, and work practices to the PM; and
6. Suspend hazardous site work if the PHSO believes that AMEC or a contractor's personnel are or may be exposed to an immediate health hazard.

4.3 SITE SAFETY OFFICER

The Site Safety Officer (SSO) may be a person dedicated to this task or the SSO functions may be a collateral duty of the Site Supervisor. The SSO shall:

1. Ensure that appropriate personal protective equipment (PPE) is available for AMEC site personnel and enforce proper utilization of PPE by all on-site AMEC personnel.
2. Ensure that AMEC personnel working on the site have received required training, have read and signed this HASP, are aware of the potential hazards associated with site operations, have been instructed in the work practices necessary for personal health and safety, and are familiar with the site HASP's procedures for all scheduled activities and for dealing with emergencies.
3. Observe AMEC's and contractor's procedures with respect to health and safety. If the SSO believes that AMEC or a contractor's personnel are or may be exposed to an imminent health hazard, the SSO shall suspend the hazardous site work by AMEC personnel and notify contractor management of the hazard. If site personnel do not have required protective equipment, the SSO shall consult with the PHSO before proceeding with the work.
4. Implement this HASP and report any observed significant differences from the site conditions described in the plan to the project manager.
5. Conduct daily site safety briefings and additional briefings as needed.
6. Calibrate monitoring equipment specified in the HASP daily and properly record and file calibration and monitoring results.
7. Perform required exposure monitoring under direction of the PHSO.
8. Maintain monitoring equipment or arrange maintenance as necessary.
9. Assume other duties as directed by the PHSO.
10. Prepare reports of any observed accidents/incidents or inadequate work practices and communicate them to the PM and PHSO.

4.4 SITE SUPERVISOR

The Site Supervisor (SS) shall:

1. Maintain control of the site and direct daily site operations to be consistent with applicable environmental and health and safety regulations, site work plans and this project HASP, and enforce safe work practices and proper utilization of PPE by all on-site AMEC and contractor personnel.
2. With guidance from the PHSO, observe AMEC and contractor's procedures with respect to health and safety. If the SS believes that AMEC or a contractor's personnel are or may be exposed to an imminent health hazard, the SS shall suspend the hazardous site work for AMEC personnel and coordinate that suspension with the subcontractor's site supervisor.

If site personnel do not have required protective equipment, the SS shall consult with the PHSO before proceeding with the work.

3. Implement this HASP and report any observed significant differences from the site conditions described in the plan to the PM.
4. Conduct site safety briefings as needed.
5. Ensure that required PPE, monitoring equipment, and emergency equipment is provided and maintained in effective working condition at all times when work occurs on site.
6. Report observed accidents/incidents or inadequate work practices to the PM and the PHSO.

4.5 PROJECT PERSONNEL

Project personnel involved in on-site work shall:

1. Take reasonable precautions to prevent injury to themselves and to their fellow employees;
2. Perform only those tasks that they can do safely;
3. Immediately report accidents and/or unsafe conditions to the SSO or PHSO;
4. Follow the procedures set forth in the site HASP and report to the SSO, SS, or PHSO any observed deviations by AMEC or contractor personnel from the procedures described in the plan; and
5. Inform the SSO and PHSO of any physical conditions that might affect their ability to perform the planned field tasks.

4.6 TRAINING REQUIREMENTS

All AMEC project personnel must comply with applicable regulations specified in Title 29, U.S. Code of Federal Regulations (CFR) Part 1910.120 and WAC Chapter 296-843, hazardous waste operations (HAZWOPER), administered by the Washington State Department of Labor and Industries (L&I). These include completion of a 40-hour health and safety training course for HAZWOPER, an annual 8-hour refresher training, and participation in AMEC's medical surveillance program and respiratory protection program. In addition to the 40-hour course and 8-hour refreshers, the SS (and SSO, if performing the duties of the SS) will have completed an 8-hour course for hazardous waste site supervisors as required by WAC 296-843-20015. Each site worker also will have a minimum of three days of supervised field experience at hazardous waste sites before being allowed to work on site without close direct supervision. At least one person on site will be current in CPR/First Aid. Documentation of all required training will be maintained on site by the SS.

Additional site-specific training that covers on-site hazards, PPE requirements, use and limitations, decontamination procedures, and emergency response information as outlined in this site HASP will be given by the PHSO or SSO before beginning on-site work. Site-specific training briefings should be documented on the “Project Health and Safety Field Meeting Form” provided in Appendix B.

4.7 MEDICAL SURVEILLANCE

All AMEC personnel working on site shall participate in AMEC’s medical surveillance program, which includes audiometric and physical examinations for employees involved in HAZWOPER projects conducted in accordance with AMEC policies. The program requires medical clearance before respirator use or participating in HAZWOPER activities. Frequency of medical examinations, which comply with 29 CFR § 1910.120(f3) and WAC 296-843-21005 are:

1. Prior to performing field work;
2. At least once every 12–24 months, depending on exposure potential;
3. At termination of employment;
4. Upon occurrence of possible unprotected overexposure to chemicals or harmful physical agents; and
5. More frequently if deemed necessary by a physician.

5.0 HAZARD ASSESSMENT

An assessment of the potential hazards that may be encountered during field activities at the site is designated by field task in Table 1 and discussed in this section. Task-specific Job Safety Analyses are included in Appendix C. These address only the hazards to AMEC staff. Subcontractors have many additional hazards specific to their activities; these should be identified and appropriate controls specified in the subcontractors' HASP.

TABLE 1

ANTICIPATED HAZARDS

Task	Hazard														
	Chemical	**Slip/Trip/Fall**	**Heavy Equipment**	**Underground Utilities**	**Overhead Power Lines**	**Noise**	**Heat Stress**	**Cold Stress**	**Sunburn**	**Sharp/abrasion**	**Trench/ Excavation**	**Confined Space**	**Traffic**	**Insects and Wildlife**	**Energy**
Direct-push boring installation and sampling	X	X	X	X	X	X	X	X	X	X			X	X	
Hollow stem auger drilling	X	X	X	X	X	X	X	X	X	X			X	X	
Groundwater monitoring	X	X					X	X	X	X			X	X	
Hand auger drilling	X	X		X			X	X	X	X			X	X	
Grab soil sampling	X	X	X	X	X	X	X	X	X	X	X		X	X	
Soil excavation/ trenching	X	X	X	X	X	X	X	X	X	X	X		X	X	X
Pipe installation	X	X	X	X			X	X	X	X			X	X	
Saw-cutting	X	X		X		X	X	X	X	X			X	X	X
Pressure testing						X	X	X	X	X			X	X	X
Paving	X	X	X			X	X		X				X	X	
SVE Startup/ Commissioning	X	X				X	X	X	X	X			X	X	X

5.1 POTENTIAL CHEMICAL HAZARDS

Hazardous substances or COCs that have been found or are suspected to be present at the site are listed below. Additional information on these chemicals, including their acute effects, is included in the material safety data sheets (MSDSs) provided in Appendix D.

TABLE 2

HAZARDOUS SUBSTANCES OR CONSTITUENTS OF CONCERN KNOWN OR SUSPECTED AT SITE

Substance	**Media**	**Maximum Concentration**	**Routes of Exposure**
Ethylbenzene	Soil	1.2 mg/Kg in soil	Inhalation, dermal contact, ingestion, eye contact
Acetone	Soil & groundwater	23 mg/Kg in soil	Inhalation, dermal contact, ingestion, eye contact
Bis (2-ethylhexyl) phthalate	Groundwater	3.6 ppb in GW	Inhalation, dermal contact, ingestion, eye contact
Diesel fuel	Soil & groundwater	3,800 mg/Kg in soil	Inhalation, dermal contact, ingestion, eye contact
Jet-A fuel	Soil & groundwater	6,400 mg/Kg in soil	Inhalation, dermal contact, ingestion, eye contact
Benzene	Soil & groundwater	82 mg/Kg in soil	Inhalation, dermal contact, ingestion, eye contact
Carbon disulfide	Soil	0.56 mg/Kg in soil	Inhalation, dermal contact, ingestion, eye contact
Carbon tetrachloride	Soil & groundwater	5650 ppb in GW	Inhalation, dermal contact, ingestion, eye contact
Chloroform	Groundwater	30 ppm in GW	Inhalation, dermal contact, ingestion, eye contact
Chloromethane	Groundwater	16 ppb in GW	Inhalation, dermal contact, ingestion, eye contact
Toluene	Soil & groundwater	0.16 mg/Kg in soil	Inhalation, dermal contact, ingestion, eye contact
Methylene chloroide	Soil & groundwater	625 ppb in	Inhalation, dermal contact, ingestion, eye contact
2-Methyl naphthalene	soil	21 mg/Kg in soil	Inhalation, dermal contact, ingestion, eye contact
Naphthalene	Groundwater	1.4 ppm in GW	Inhalation, dermal contact, ingestion, eye contact
Diesel particulate matter	Vehicle exhaust	160 µg/m^3	Inhalation, dermal contact, ingestion, eye contact
Gasoline	Soil & groundwater	22 mg/Kg in soil	Inhalation, dermal contact, ingestion, eye contact
Isophorone	Soil	12 mg/Kg in soil	Inhalation, dermal contact, ingestion, eye contact

Substance	**Media**	**Maximum Concentration**	**Routes of Exposure**
Motor oil	Soil & groundwater	190 ppm in GW	Inhalation, dermal contact, ingestion, eye contact
Phenanthrene	Soil	34 mg/Kg in soil	Inhalation, dermal contact, ingestion, eye contact
Vinyl chloride	Soil & groundwater	5.2 mg/Kg in soil	Inhalation, dermal contact, ingestion, eye contact
Cis-1,2-Dichloroethene	Soil & groundwater	100 mg/Kg in soil	Inhalation, dermal contact, ingestion, eye contact
trans-1,2-Dichloroethene	Groundwater	360 ug/Kg	Inhalation, dermal contact, ingestion, eye contact
1,1-Dichloroethene	Soil & groundwater	69 ppb in soil	Inhalation, dermal contact, ingestion, eye contact
1,1,2-Trichloroethane	Soil & groundwater	5.1 mg/Kg in soil	Inhalation, dermal contact, ingestion, eye contact
1,1,2,2-Tetrachloroethane	Groundwater	16.2 ppb in GW	Inhalation, dermal contact, ingestion, eye contact
Trichloroethene	Soil & groundwater	870 mg/Kg in soil	Inhalation, dermal contact, ingestion, eye contact
Tetrachloroethene	Soil & groundwater	27 mg/kg in soil	Inhalation, dermal contact, ingestion, eye contact
Silver	Soil	215 mg/kg in soil	Inhalation, dermal contact, ingestion, eye contact
Arsenic	Soil	150 mg/kg in soil	Inhalation, dermal contact, ingestion, eye contact
Cadmium	Soil	30.3 mg/kg in soil	Inhalation, dermal contact, ingestion, eye contact
Chromium (III)	Soil & groundwater	71 mg/kg in soil	Inhalation, dermal contact, ingestion, eye contact
Chromium (VI)	Soil & groundwater	415 mg/kg in soil	Inhalation, dermal contact, ingestion, eye contact
Copper	Soil & groundwater	343 mg/kg in soil	Inhalation, dermal contact, ingestion, eye contact
Mercury	Soil	1.57 mg/kg in soil	Inhalation, dermal contact, ingestion, eye contact
Lead	groundwater	560 mg/kg in soil	Inhalation, dermal contact, ingestion, eye contact

Substance	Media	Maximum Concentration	Routes of Exposure
Selenium	Soil	20 mg/kg in soil	Inhalation, dermal contact, ingestion, eye contact
Antimony	Soil	20 mg/kg in soil	
Thallium	Soil	40 mg/kg in soil	Inhalation, dermal contact, ingestion, eye contact
Zinc	Soil	1530 mg/kg in soil	Inhalation, dermal contact, ingestion, eye contact

Abbreviations:
μg/m^3 = micrograms per cubic meter
mg/kg = milligrams per kilogram
ppm = parts per million

These are the highest concentrations that have been detected at the site at during investigation of the known SWMUs or AOCs, and these are likely worst-case concentrations. These are not likely to be representative of the general concentrations encountered at any of the SWMUS/AOCs that are not known or suspected to be used in handling or storing wastes or fuels. Soil and/or groundwater at these SWMUS/AOCs are much more likely to have lower concentrations of these same COCs.

Air monitoring requirements and action levels related to potential chemical hazards on the site are discussed in Section 6.0. Specific measures and general safe work practices to prevent chemical exposures are given in Sections 5.17, 7.0, 8.0, and 9.0. For the chemicals brought on site by AMEC for the work (e.g., Alconox solution for cleaning, methanol in vials for sample preservation), MSDSs included in Appendix D will be available on site and reviewed by staff who are unfamiliar with the chemical products being used. The SSO must request notice from the contractor or any subcontractors of other chemicals that may be used in the work and must request access to the MSDSs for those chemicals. The specific hazards of any other chemicals brought on site, methods to detect a spill or release, and appropriate exposure prevention and first aid measures will be reviewed by the SSO and made available to site personnel when the chemicals are brought on site.

5.2 POTENTIAL SLIP/TRIP/FALL HAZARDS

Common field safety hazards include slip/trip/fall hazards, sharp or rough-surface equipment, debris and tools, and hazards associated with working around heavy equipment. All field personnel will keep materials, equipment, and debris organized and flagged as necessary to prevent trip hazards. Field personnel will wear sturdy work boots or shoes at the site. Steel toe and shanks are required on site when working around heavy loads, heavy equipment, or in areas where construction debris that contains nails or screws is present. Field personnel will wear sturdy outer gloves when handling sharp or rough-surfaced objects.

5.3 POTENTIAL HEAVY EQUIPMENT HAZARDS

Personnel working on site in the vicinity of operating equipment or trucks will wear high-visibility safety vests and maintain safe distances to avoid contact with vehicles and moving equipment parts, such as augers and the drill rig, tires, tracks, etc. Site personnel will be sure drivers and heavy equipment operators can see them or know where they are whenever they are within striking distance of the equipment. Equipment will only be approached from the front or side of the cab, eye contact will be made with the equipment operator, and their acknowledgement that it is safe to approach will be obtained. Trucks on site will comply with the inspection requirements for controls and safety features as outlined for heavy equipment. Rigs leaving the site will have all loose items secured and any dispersable material will be securely covered to prevent loss of material on the highway.

Portions of the site work areas are located in an active airplane manufacturing facility that exposes site personnel to moving machinery, forklifts, and other sources of hazardous energy such as energized equipment and compressed gases. The SSO and SS will coordinate and document a daily work permit with the Boeing site representative for the project. The work permit will identify manufacturing machinery and equipment hazards in the work area that pose a potential risk to site personnel and will establish procedures for the shift to mitigate the hazards. Where drilling or sampling for site contaminants must occur within the operating range of fixed equipment such as computerized numerical control, assembly line systems, or overhead crane equipment, the SS or SSO will ensure documentation of a coordinated group Lockout/Tagout (LOTO) procedure under a written permit governed by Boeing LOTO policy. The AMEC staff exposed to the mechanized hazard will also apply their lock to the control system and verify deenergization in accordance with AMEC LOTO procedures. No AMEC personnel will be within the point of operation area or exposed to an energized system hazard without designation as an Authorized Person for energy control procedures by AMEC.

5.4 POTENTIAL UNDERGROUND UTILITY HAZARDS

An underground utility check via the Washington State Utilities and Transportation Commission (WUTC) and a private utility locator service shall be performed prior to initiating any subsurface investigation or work. The check will include:

X WUTC Note: WUTC must be notified at least 2 working days before any subsurface work begins (800-424-5555). The confirmation number will be recorded in project field notes.

X Private Locator: Applied Professional Services Locating

X Boeing Plans Check, Facility Contact: Ray Power, 425-234-7744

___ Geophysical Survey

5.5 Potential Overhead & General Electrical Hazards

Whenever possible, site personnel will avoid working under overhead high voltage lines. The SS is responsible for documenting a determination of the voltage and minimum approach distance to any potentially energized electrical distribution line. Lines will be confirmed to be de-energized when minimum approach distances cannot be met. The following are minimum clearances for overhead high voltage lines.

Normal Voltage (phase to phase)	Minimum Required Clearance (feet)
less than or equal to 50,000	10
more than 50,000	10 + 0.4 inch per kV

(Reference: WAC 296-24-963)

To prevent electrocution hazards from utilization of equipment, all electrical extension cords will be rated for the combined amperage of the equipment they power, and must be factory listed as rated SJOW or STOW (an “-A” extension is acceptable for either) and inspected prior to use for defects in the cord and plugs. Any reduction in the original jacket, gap between the strain relief, and any evidence of overheating (cord discoloration or melting) will result in the immediate destruction of the cord and replacement as necessary. The following safe work practices will also be enforced:

- No exposed energized conductors operating above 50 volts to ground will be allowed on site unless properly guarded from contact by unqualified persons;
- Electrical distribution systems and repairs to utilization equipment operating above 50 volts to ground will be performed only by a qualified licensed electrician;
- All portable power tools are to be of a double-insulated design and will be inspected for defects before use, and of a double-insulated design;
- Any generator brought on site will must be suitably grounded to a suitable earth and will be equipped with overcurrent protection;
- All extension cords running outside buildings will be protected by a ground-fault circuit interrupter, which will be tested daily; and
- No extension cords will be routed through walls, ceilings, doors or windows.

5.6 POTENTIAL NOISE HAZARDS

Site personnel will wear hearing protection when working near large heavy equipment such as drill rigs or earth movers, or in other noisy conditions. Hearing protection will be worn when two people standing within 3 feet of each other cannot communicate at normal conversational voice levels. This is to prevent hearing loss that can occur when daily 8-hour time weighted average noise exposures meet or exceed 85 A-weighted decibels (dBA) (WAC 296-817-20015). To prevent adverse impact on nearby community receptors, work will be limited to the hours of 7 am to 7 pm, during which normal construction noise impacts are permitted.

5.7 POTENTIAL HEAT STRESS HAZARDS

Heat stress is a slight hazard during the summer months in the Pacific Northwest, but becomes a significant hazard for workers wearing protective clothing under certain conditions. Heat stress may affect workers to varying degrees. The signs, symptoms, and treatment of these varying degrees of heat stress are summarized below.

- Heat rash may result from exposure to heat or humid air.
- Heat cramps are caused by heavy sweating with inadequate electrolyte replacement. Signs and symptoms include muscle spasms and pain in the hands, feet, and abdomen. Persons experiencing these symptoms should rest in a cooler area, drink cool (not cold) liquids, and gently massage cramped muscles.
- Heat exhaustion occurs from increased stress on various body organs and may include inadequate blood circulation due to cardiovascular insufficiency or dehydration. Signs and symptoms include pale, cool, moist skin; heavy sweating; dizziness; nausea; and fainting. Persons experiencing these symptoms should lie down in a cooler area, drink cool liquids with electrolytes (Gatorade, etc.), remove any protective clothing, and cool body with wet compresses at forehead, back and neck, and/or armpits.
- Heat stroke is the most serious form of heat stress. Temperature regulation fails and the body temperature rises to critical levels. Immediate action must be taken to cool the body before serious injury and death occur. Competent medical help must be obtained. Signs and symptoms are red, hot, usually dry skin; lack of or reduced perspiration; nausea; dizziness and confusion; strong, rapid pulse; and coma.

From May 1 to September 30, if physically demanding field work will occur in the combination of temperatures and clothing/PPE ensembles shown in Table 3, actions will be taken to prevent heat stress among the affected workers.

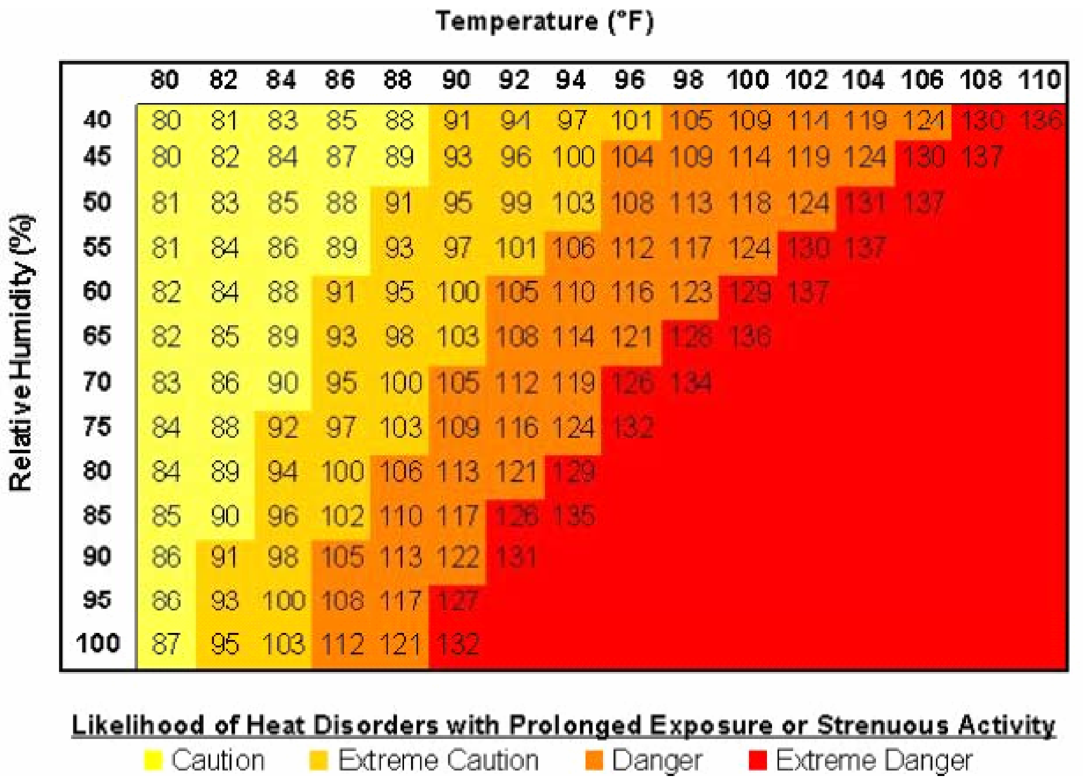
TABLE 3

OUTDOOR TEMPERATURE ACTION LEVELS

Clothing/PPE Ensembles	**Temperature**
Nonbreathing clothes, including vapor- and chemical-resistant suits (Levels B and A, and impermeable raingear)	**52° F**
Double-layer woven clothes, including coveralls, jackets, and sweatshirts	**77° F**

All other clothing	**89° F**

To prevent heat stress, at least one quart per person-hour of cool potable water will be readily available via individual cups, and field personnel will be encouraged to drink plenty of fluids and take periodic work breaks in hot weather. The SSO will promptly consult with the PHSO, and a radial pulse monitoring method will be implemented to ensure that adequate work-rest cycles will be established to manage heat stress potential among the affected workers. The following chart indicates the relative risk of heat stress at combinations of temperature and relative humidity.



Temperature (°F)

Relative Humidity (%)

	80	82	84	86	88	90	92	94	96	98	100	102	104	106	108	110
40	80	81	83	85	88	91	94	97	101	105	109	114	119	124	130	136
45	80	82	84	87	89	93	96	100	104	109	114	119	124	130	137	
50	81	83	85	88	91	95	99	103	108	113	118	124	131	137		
55	81	84	86	89	93	97	101	106	112	117	124	130	137			
60	82	84	88	91	95	100	105	110	116	123	129	137				
65	82	85	89	93	98	103	108	114	121	128	136					
70	83	86	90	95	100	105	112	119	126	134						
75	84	88	92	97	103	109	116	124	132							
80	84	89	94	100	106	113	121	129								
85	85	90	96	102	110	117	126	135								
90	86	91	98	105	113	122	131									
95	86	93	100	108	117	127										
100	87	95	103	112	121	132										

Likelihood of Heat Disorders with Prolonged Exposure or Strenuous Activity

🟨 Caution 🟧 Extreme Caution 🟧 Danger 🟥 Extreme Danger

Combined temperature and humidity conditions that result in a heat index exceeding 100° Fahrenheit will trigger mandatory radial pulse monitoring and heat stress management. The above chart indicates the relative risk of heat stress.

5.8 POTENTIAL COLD STRESS HAZARDS

Exposure to even moderate levels of cold can cause the body's internal temperature to drop to a dangerously low level. This is called hypothermia, and may be a significant hazard at any time in the Pacific Northwest. Exposure to temperatures below freezing can also cause frostbite of hands, feet, and face. Symptoms of hypothermia include:

- Vague, slow, slurred speech;
- Forgetfulness, memory lapses;
- Inability to use hands;
- Frequent stumbling; and
- Drowsiness.

To prevent hypothermia, site personnel will stay dry and avoid exposure. Site personnel will be encouraged to wear sufficient clothing in layers such that outer clothing is wind-proof and waterproof, and inner layers retain warmth (wool or polypropylene). Site personnel will keep hands and feet well protected at all times.

5.9 POTENTIAL SUNBURN HAZARDS

Skin exposure to ultraviolet radiation can result in sunburn. Site personnel will use long-sleeved shirts, hats, and sunscreen as needed to protect against sunburn.

5.10 POTENTIAL SHARP/ABRASION HAZARDS

SVE system installation will require saw cutting and use of other cutting devices during pipe installation. Site personnel will use PPE, including boots and gloves made of cut-resistant and puncture-resistant materials. Work boots should be equipped with steel-reinforced shanks and personnel will handle materials with appropriate equipment, not hands or feet, to avoid injury.

5.11 POTENTIAL TRENCH/EXCAVATION HAZARDS

Trench/excavation hazards are anticipated for this project related to SVE installation. Utilities in and near the excavation areas will be located and clearly marked prior to excavation, as described in Section 5.4. The exact location of the utilities will be determined by hand excavation when nearing the utility depth if the utility line cannot be proven to be both de-energized and locked out (for electrical utilities) or locked out, double-blanked, and bled (for lines or vessels containing hazardous liquids or gases).

In trenches less than 4 feet deep, precautions will be taken to ensure the safety of employees in and around the immediate area (e.g., flagging, warning signs, and verbal instructions). Workers required to enter the trench shall spend the as little time in the trench as possible and shall avoid areas that appear unstable until corrective measures are taken. Shallow trenches shall be sloped according to trenching regulations in unconsolidated soil to prevent cave-ins. As shallow trenching situations arise, they shall be assessed by the SHSC. Proper steps shall be taken to ensure a safe working area for the employees.

Adjacent structures and encumbrances will be assessed for structural hazards prior to any excavation. A competent person will perform and document daily inspections of any excavation and adjacent facilities for hazards. Appropriate physical barricades will be placed around exposed vertical faces of excavations to the lower level where a worker may walk. The following persons are those to be considered directly involved in the excavation process:

- Foreman of the crew,
- Signal person,
- Employee hooking on pipe or other materials,
- Grade person,
- Inspectors assessing the excavation or trench.

Care will be taken when approaching the edge of any excavation (e.g., when sampling the excavation area from above) to be sure the ground is stable and not undercut.

If entry into trenches/excavations greater than 4 feet deep is determined to be required, the PHSO will be contacted prior to entry.

5.12 POTENTIAL CONFINED SPACE HAZARDS

No confined space entries are anticipated for this project. If entry into a confined space is required, the PHSO must be consulted and a confined space entry plan prepared and followed prior to anyone entering the space.

5.13 POTENTIAL TRAFFIC HAZARDS

The site is an active airplane manufacturing facility with pedestrian, bicycle, vehicle and airplane traffic. All AMEC personnel will wear high-visibility safety vests at all times. An on-site speed limit of 15 miles per hour will be enforced by the SS.

5.14 POTENTIAL INSECT AND WILDLIFE HAZARDS

Bees and other insects may be encountered during the fieldwork tasks. Persons with allergies to bees are required make the SS and SSO aware of their allergies prior to commencing work at the site and will avoid areas where bees are identified. Black widow and brown recluse spiders are occasionally encountered in dry, dark areas. Site personnel will maintain a safe distance from any urban wildlife encountered, including raccoons and rodents, to preclude a bite from a sick or injured animal. Personnel will not put ungloved hands into dark places that could contain spiders, and will use tools to lift covers from catch basins and monitoring wells.

5.15 POTENTIAL ENERGY HAZARDS

The SVE system poses a hazard from exposure to hazardous energy during construction, operation, maintenance, and repair due to pressurized air, rotating equipment, and electrical energy. Written AMEC lockout procedures will be followed whenever these systems must be shut down for maintenance or repair/replacement if the unexpected energizing of the system (or release of stored energy such as pressure) could cause serious injury to employees. Such activities will be implemented or overseen only by employees named as AMEC authorized persons trained in LOTO procedures.

5.16 GENERAL SAFE WORK PRACTICES

In working with or around any hazardous or potentially hazardous substances or situations, site personnel should plan all activities before starting any task. Site personnel shall identify health and safety hazards involved with the work planned and consult with the PHSO or SSO as to how the task can be performed in the safest manner, if he/she has any uncertainties.

All field personnel will adhere to the following general safety rules.

1. Wear protective equipment and clothing provided, when required.
2. Wear a hard hat and safety glasses in all construction areas.
3. Do not eat, drink, or use tobacco or cosmetics in restricted work areas.
4. Prevent splashing of liquids containing chemicals, and minimize emissions of dust.
5. Prevent back injury by never lifting or carrying a load that is heavier than you can comfortably handle. When lifting heavy objects, bend the knees and use the leg muscles, and get assistance when necessary.
6. Keep all heat and ignition sources away from combustible liquids, gases, or any flammable materials. When working in areas where combustible gases are present, use only intrinsically safe (non-sparking) equipment.
7. Field personnel shall be familiar with the physical characteristics of the site, including:
   - wind direction in relation to restricted work areas
   - accessibility of other personnel, equipment, and vehicles
   - areas of known or suspected chemicals in soil and groundwater
   - site access
   - nearest water sources
   - location of communication devices

8. Personnel and equipment in restricted work areas (Exclusion Zone and Contaminant Reduction Zone) should be limited to the number necessary to perform the task at hand. The buddy system will apply when working in restricted work areas.
9. All wastes generated during investigative activities at the site shall be disposed of as directed by the Project Manager.
10. Inspect power cords for damage such as cuts and frays. Suspend cords only with nylon rope or plastic ties.
11. When in doubt of your safety, it is better to overprotect.
12. Practice defensive driving.
13. A first-aid kit shall be kept at the site and/or in a field vehicle when performing field work.

6.0 AIR MONITORING

This section defines the air monitoring necessary to protect workers on site from overexposure, in accordance with L&I rules. Site characterization data indicate that only low levels of a few VOCs are present in the work areas of investigation, including benzene, ethylbenzene, toluene, and xylenes. The predominant COPCs at the Former Fuel Farm are TPH-Jet fuel, diesel-range organics, and small amounts of methyl naphthalene. Because of: 1) the limited volatility of these semivolatiles; 2) the minimal production of cuttings and exposure of contaminated soils inherent in direct-push sampling, and 3) the occurrence of work outdoors, no breathing zone exposures that would pose an inhalation hazard are anticipated. No confined space entries are anticipated for this project. Because other areas at the site were historically impacted by VOCs, the following air monitoring equipment will be used as a precautionary measure to screen each new boring for VOC emissions and exposures.

X Photoionization Detector (PID)

To protect workers from exposure to diesel particulate matter (DPM) while working indoors near idling vehicles, the following air monitoring equipment will be used as a precautionary measure to screen for DPM emissions.

X Aerosol Monitor (AM 510)

The type and frequency of air monitoring for each work task is specified in Table 4. Monitoring will be repeated any time odors are detected in the breathing zone of site workers. Air monitoring instruments will be calibrated and maintained according to manufacturer’s specifications. Monitoring will occur in the breathing zone of the most-affected worker, although area results can be used to supplement the required breathing zone monitoring. Calibration information and air monitoring results will be recorded in project field notes.

TABLE 4

AIR MONITORING

Task	Instrument	Frequency
Direct-push boring, hollow stem auger, well installation, excavation, soil vapor extraction operations and groundwater and soil sampling	PID	During drilling: when collecting samples, every two hours and when site activities pose new potential exposure
Idling vehicles indoors (drilling, direct push boring, etc.)	AM 510	Working near idling vehicles indoors: one hour average of most exposed worker in breathing zone

6.1 ACTION LEVELS

Table 5 presents the chemical hazard exposure limits for the COCs at the site.

TABLE 5

CHEMICAL HAZARD EXPOSURE LIMITS

INHALATION HAZARD	L&I PEL/(8-hr/15-min. STEL)[a]	ACGIH TLV® (8-hr/15-min. STEL)[a]
2-methylnaphthalene	None	None
TPH – Diesel	None	100 mg/m^3
TPH – Jet-A	None	200 mg/m^3
Benzene	1 ppm/5 ppm	0.5 ppm/2.5 ppm
Toluene	100 ppm/150 ppm; IDLH: 500 ppm	50 ppm
TPH – Gasoline	300 ppm / 500 ppm	300 ppm / 500 ppm
Vinyl Chloride	1 ppm / 5 ppm	1 ppm
Cis-1,2- Dichloroethene	200 ppm / 250 ppm	5 ppm
Trichloroethene	50 ppm / 200 ppm	50 ppm / 100 ppm
Tetrachloroethene	25 ppm / 38 ppm	25 ppm / 100 ppm

Note:
a. Generic STEL—15 minute duration maximum exposure recommended.

Abbreviations:
ACGIH = American Conference of Governmental Industrial Hygienists
IDLH =
L&I = Labor and Industries
mg/m^3 = milligrams per cubic meter
PEL = permissible exposure limit
ppm = parts per million
STEL = short-term exposure limit
TLV = Threshold Limit Values®
TPH = total petroleum hydrocarbons

The lowest listed criterion in Table 5 will be applied, and mixture exposure to the summary exposure will be evaluated to assess total hazard exposure if action levels listed in Table 6 are exceeded. Respiratory protection is not anticipated to be necessary for AMEC personnel because they should not be exposed to significant levels of air contaminants while performing the tasks delineated in this plan. Should air monitoring indicate that vapors exceed the action levels listed in Table 6, work will be stopped and either ventilation will be provided or a respiratory protection program for the site will be developed in a separate addendum. The SS or SSO will take the actions listed in Table 6 when air monitoring indicates that concentrations exceed the listed action levels in the breathing zone of any worker.

TABLE 6

AIR MONITORING ACTION LEVELS

Reading	Concentration	Action
PID Monitor Reading (ppm) sustained for more than 1 min in breathing zone	≥ 10 ppm and < 50 ppm	Check for VC with Draeger Tube.
Draeger Tube Reading for VC in breathing zone.	VC < 0.5 ppm	Continue work.
Draeger Tube Reading for VC in breathing zone.	VC ≥ 0.5 ppm	Stop work and consult PHSO to develop additional controls and/or a respiratory protection addendum to the plan.
PID Monitor Reading (ppm) sustained for more than 1 min in breathing zone	≥ 50 ppm	Stop work and consult PHSO to develop additional controls and/or a respiratory protection addendum to the plan.
Aerosol Monitor (AM-510) Reading (μg/m^3) sustained for more than 1 hour average in breathing zone	> 160 μg/m^3	Stop work and consult PHSO to develop additional controls and/or a respiratory protection addendum to the plan. If exposure is at 160 for four hours, improve engineering controls.

Abbreviations:
μg/m^3 = micrograms per cubic meter
PHSO = Project Health and Safety Officer
PID = photoionization detector
ppm = parts per million
VC = vinyl chloride

Research has shown an agreement between the DPM integrated method and the AM-510 when a correction factor of 0.214 is applied. The “factory-calibrated” AM-510 measurement result (μg/m^3) multiplied by the correction factor of 0.214 equals the actual DPM concentration (as total carbon).

If workers suspect significant chemical exposures (e.g., detect unusual odors, develop symptoms of occupational exposure to the site contaminants) or have other unexplained adverse health effects (e.g., dizziness, nausea), workers are advised to stop work and notify the PHSO.

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7.0 PERSONAL PROTECTIVE EQUIPMENT

A modified Level D PPE ensemble will be used, with the main objective to prevent unnecessary dermal exposure to affected soil and/or groundwater. The PHSO will be consulted to up- or downgrade the PPE requirements if there are any concerns regarding the adequacy of Level D. The PPE listed in Table 7 below is required, unless conditions change:

TABLE 7

PERSONAL PROTECTIVE EQUIPMENT BY TASK

PPE Required	General Site Work & Sampling
Steel-Toe/Shank Boots (Rubber)	O
Steel-Toe/Shank Boots (Leather)	X
Hard Hat	X
Safety Glasses/Goggles	X
Face Shield(for pressure washing)	
Ear Plugs	Av
Gloves (nitrile inner/leather outer):	Av
Inner and Outer	Av
Inner Only	
Tyvek Coverall (permeable)	Av
Saranex Coverall	
High-visibility Vest	X
Other (specify)	

Key:
X = PPE Required; O = PPE Optional; Av = Have available at work site, use as needed
Cartridge Types = Organic Vapor (OV); HEPA Filter (N100); Combination OV and HEPA (Comb.)
Glove Types = Nitrile, Vinyl, Neoprene, Butyl

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8.0 SITE CONTROL

The purpose of site control is to minimize the potential exposure to site hazards, to prevent vandalism at the site and access by children and other unauthorized persons, and to provide adequate facilities for workers. A daily field log will be maintained by the SS. The field log will include a list of all persons present, and will be updated whenever a visitor or contractor is allowed on site. Their arrival and departure times will be noted to enable an accurate roll call to occur in the event of an emergency.

Work area controls and decontamination areas will be provided to limit the potential for chemical exposure associated with site activities. The support zone for the site is considered to be all areas outside the work area and decontamination areas. Readily available restroom and washing facilities will be identified by the SS and maintained in hygienic conditions at all times.

8.1 WORK AREA

An exclusion zone (EZ) will be set up around each excavation work area or other location with exposed contaminated soils. Only authorized personnel shall be permitted access to the EZ. The EZ will be demarcated with barrier hazard tape or fencing as needed to effectively limit unauthorized access. No eating, drinking, or smoking is allowed in the EZ. Egress from the EZ will only be through a contamination reduction zone (CRZ), unless warranted for imminent hazards during an emergency. A buddy system will be implemented at all times when workers are in the EZ and CRZ. In this system, for each worker in the EZ or CRZ, either another worker in that zone will be designated to keep an eye on them and maintain alertness for imminent hazards and symptoms of distress, or a standby person will be outside the work zone in the appropriate PPE and will be ready to immediately enter the work area and assist the person in the work zone. Decontamination (decon) procedures shall include a boot wash station utilizing Alconox for decon and a rinse station. All solids shall be removed prior to exit of the CRZ into the Support Zone and all necessary PPE will be containerized and stored in the CRZ for disposal.

8.2 COMMUNICATIONS

A field representative should contact the PM or office at least once a day while on site. Upon initial mobilization to the site, cell phone signals will be checked for those phones available to the SS and SSO.

On-site communications will be by voice, hand held radio, or cell phone. Under noisy conditions on site, or when electronic systems are ineffective, a written system of hand signals will be established by the SS and reviewed with all site personnel to enable basic communications among field staff.

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9.0 DECONTAMINATION

Decontamination procedures will be strictly followed to prevent off-site spread of site contaminants. If boots or equipment are covered with contaminated soil, they will be brushed off, then washed with soapy water, and then rinsed with water. Contaminants are associated with site soils, and therefore the absence of soil indicates sufficiently clean levels have been achieved. Rinsate will be collected and containerized on site, and disposal arranged in accordance with applicable regulations.

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10.0 EMERGENCY RESPONSE

This section defines the emergency action plan for the work to be conducted on site. It will be rehearsed with all site personnel and reviewed with visitors upon their initial site visit, whenever the plan is modified, or whenever the SS or SSO believe that site personnel are unclear about the appropriate emergency actions. This plan will be implemented in the event of an emergency associated with the site work or in the event of an emergency within Boeing facilities unrelated to the site work.

A muster point of refuge will be identified by the SS and communicated to the field team each day. This point will be clear of adjacent hazards and preferably upwind or cross-wind for the entire day. In an emergency, all site personnel and visitors will evacuate to the muster point for roll call using the daily site log. It is important that each person on site understand their role in an emergency, and that they remain calm and act efficiently to ensure everyone's safety.

After an emergency is resolved, the entire on-site project team will meet and debrief on the incident—the purpose is not to fix blame, but to improve the planning and response to future emergencies. The debriefing will review the sequence of events, what was done well, and what can be improved. The debriefing will be documented in a written format and communicated to the PHSO. Modifications to the emergency plan will be approved by the PHSO.

Reasonably foreseeable emergency situations include: medical emergencies, accidental release of hazardous materials (such as gasoline or diesel) or hazardous waste, and general emergencies such as fire, thunderstorm, flooding, and earthquake or other emergencies related to Boeing manufacturing operations. Expected actions for each potential incident are outlined below.

Field personnel will follow the Boeing procedures for emergencies, as stated on the Boeing Renton Safety Dashboard Card, which is included at the end of this plan.

10.1 MEDICAL EMERGENCIES

In the event of a medical emergency, the following procedures should be used.

1. Stop any imminent hazard if you can safely do it.
2. Remove ill, injured or exposed person(s) from immediate danger if moving them will clearly not cause them harm, and no hazards exist to the rescuers.
3. Evacuate other on-site personnel to a safe place in an upwind or cross-wind direction until it is safe for work to resume.

4. Contact Boeing Renton Emergency Response at (206) 655-2222 and follow the incident reporting procedures on the Boeing Renton Safety Dashboard Card. Clearly describe the location, injury and conditions to the dispatcher. Designate a person to go to the site entrance and direct emergency equipment to the injured person(s). Provide the responders with a copy of this health and safety plan, to alert them to chemicals of potential concern.
5. Trained personnel may provide first aid/cardiopulmonary resuscitation if it appears to be appropriate and is safe to do so. Remove contaminated clothing and PPE only if this can be done without endangering the injured person.
6. Call the PHSO or PM.
7. Immediately implement steps to prevent recurrence of the accident.

A map showing the route to the nearest hospital is included in Appendix E.

Hospital:	Valley Medical Center
Address:	400 S 43rd Street Renton, Washington
Telephone:	425-228-3450

Telephone number of nearest Poison Control Center: (800) 222-1222 800-860-0620

10.2 ACCIDENTAL RELEASE OF HAZARDOUS MATERIALS OR WASTES

1. Evacuate all on-site personnel to a safe place in an upwind direction until the PHSO determines that it is safe for work to resume.
2. Contact Boeing Renton Emergency Response at (206) 655-2222 and follow the incident reporting procedures on the Boeing Renton Safety Dashboard Card.
3. Instruct a designated person to contact the PHSO and confirm a response.
4. Contain spill, if it is possible and can be done safely.
5. Initiate cleanup.

10.3 GENERAL EMERGENCIES

In the case of fire, rapid flooding, explosion, earthquake or other imminent hazard, work shall be halted and procedures on the Boeing Renton Safety Dashboard Card shall be followed. The Boeing Fire Department is the primary emergency response at the Boeing Renton Plant and will call in additional resources as needed. All on-site personnel will be immediately evacuated to a safe place.

In the event of a thunderstorm, outdoor work will be discontinued until the threat of lightning has abated.

During the incipient phase of a fire, the available fire extinguisher(s) may be used by persons trained in putting out fires, if it is safe for them to do so.

10.4 EMERGENCY COMMUNICATIONS

In the case of an emergency, the air horn or car horn will be used as needed to signal the emergency. One long (5-second) blast will be given as the emergency/stop work signal. If the air horn is not working, a vehicle horn and/or overhead waving of arms will be used to signal the emergency. In any emergency, all personnel will evacuate to the designated refuge area and await further instruction.

10.5 EMERGENCY EQUIPMENT

The following minimum emergency equipment will be readily available on site and functional at all times:

- First Aid Kit—Contents approved by the PHSO, including two bloodborne pathogen barriers;
- Sorbent material sufficient to contain the volume of the largest single container of hazardous materials (e.g., gas and diesel) brought on site;
- Portable fire extinguisher (6: B/C min) e.g. in truck or drill rig cab.
- Two spare sets of PPE suitable for entering the EZ; and
- A copy of the current site-specific health and safety plan.

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11.0 APPROVALS

Project Manager or Senior Technical Lead	Date
Project Health & Safety Officer	Date
Site Safety Officer	Date

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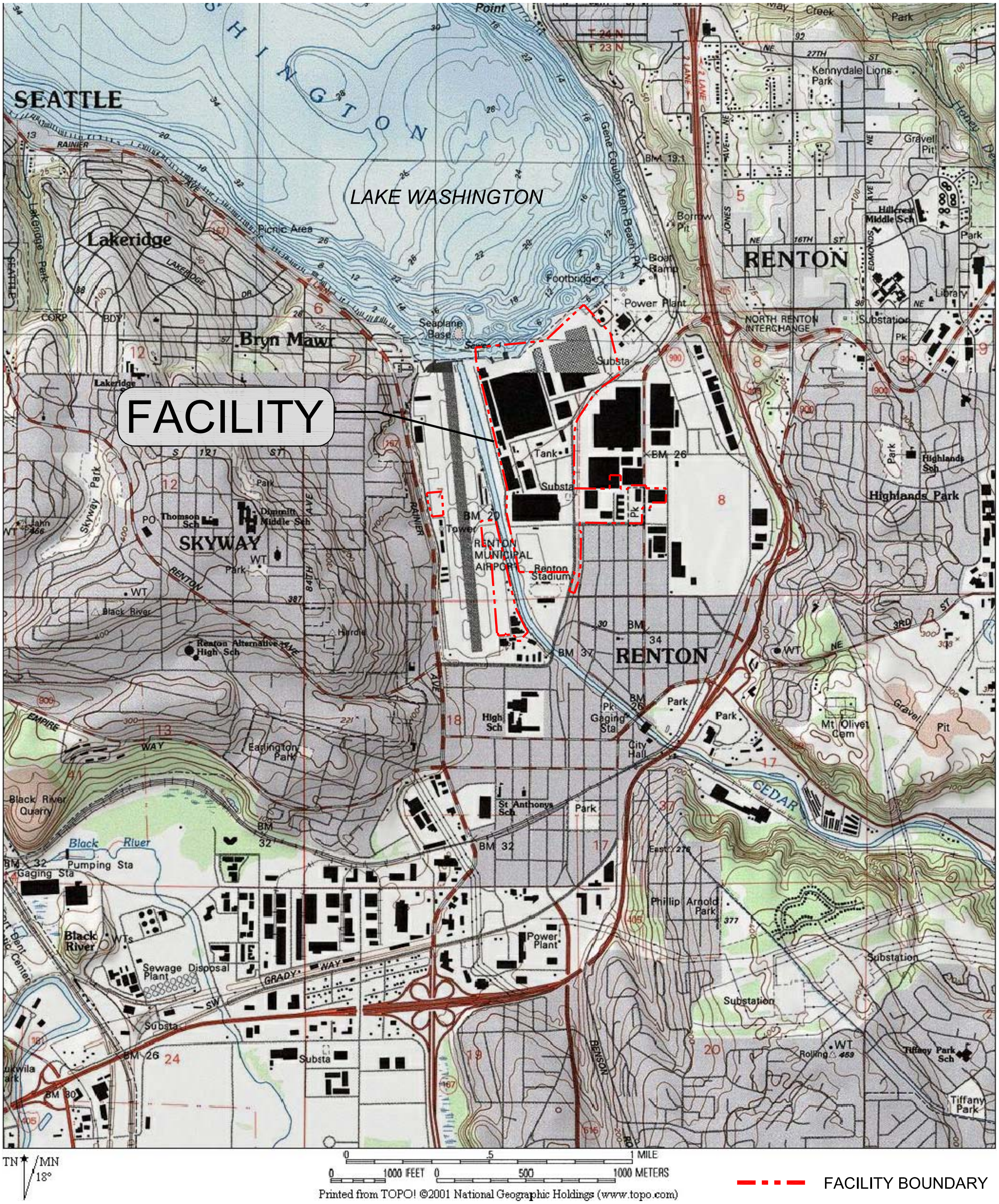
FIGURES



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BOEING FACILITY LOCATION
Boeing Renton Facility
Renton, Washington

By: APS
Date: 08/21/12
Project No. 8888
Figure 1

Plot Date: 08/21/12 - 3:55pm, Plotted by: adam.stenberg
Drawing Path: S:\8888_2006\055_Final CAP\CAD\, Drawing Name: BoeingRentonSiteMap_082112.dwg

APPENDIX A

Boeing Renton Safety Dashboard Card

BOEING RENTON
8th Street and Logan Ave N, Renton, WA 98055

STANDARD WORK PRACTICES

Health and Safety is **EVERYONE'S** responsibility and **NUMBER ONE PRIORITY**

- Regulatory compliance is **MANDATORY** – No work will begin and/or work will immediately stop unless the answer to the following question is a positive **"YES"** – AM I IN COMPLIANCE WITH ALL REGULATORY, FACILITY, PROJECT, AND HEALTH AND SAFETY REQUIREMENTS?

- All incidents and regulatory inspections must be reported immediately

    - **Incident definition**: Any event condition, or action (including near misses) that affects the safety of personnel, does not follow rules and guidelines for work implementation and regulatory compliance onsite
- Incident examples:
    - Spilled liquid in an uncontrolled environment
    - Working without correct/complete permit in place
    - Performing hot works without a "Hot Works Permit"

Before starting work, **HAVE YOU?** :

1. Reviewed the Health and Safety Plan prior to performing work?
2. Performed a Health and Safety "Tail Gate Meeting" and filled out the sign-in form prior to starting work?
3. Reviewed scope of work documents, permits, and other related items prior to performing work?
4. Provided correct Personal Protective Equipment (PPE) for the work to be performed?
5. Followed Lock Out/Tag Out Procedures for equipment?

IF YOU ARE UNSURE OF SAFETY PRACTICES FOR THE PARTICULAR WORK INVOLVED – GET CLARIFICATION PRIOR TO STARTING WORK

Working with subcontractors:

- Review Health and Safety Plan with subcontractor
- Review site "Incident Reporting Procedures"
- Perform "Tail Gate Safety Meeting" with subcontractor

SAFETY AND REGULATORY COMPLIANCE IS MY PRIORITY AND I MUST TAKE THE NECESSARY STEPS TO PROVIDE THIS SERVICE

I AM RESPONSIBLE AND I HAVE THE AUTHORITY TO STOP WORK IF THE TASK DOES NOT MEET THE SAFETY AND REGULATORY REQUIREMENTS

SAFETY DASHBOARD CARD

EMERGENCY AND INCIDENT REPORTING PROCEDURES

EMERGENCY PHONE NUMBER:

(206) 655-2222 Fire, Ambulance, Police, Spill Reporting

If using a cell phone to call be prepared to supply the site and work location address

SITE ADDRESS:

737 Logan Avenue North, Renton, WA 98055

WORK LOCATION:

Describe using building number and row/column designation

A WORKER SHOULD BE STATIONED SO THAT EMERGENCY RESPONSE PERSONNEL CAN BE DIRECTED TO THE WORK SITE

AN EMERGENCY IS AN UNCONTROLLED SITUATION, AN INJURY THAT IS MAJOR OR LIFE THREATENING, FIRE, OR ANYTHING THAT REQUIRES IMMEDIATE ASSISTANCE.

EMERGENCY REPORTING:

1. Contact Emergency Response (fire, ambulance, police) at (206) 655-2222
2. Follow Incident Reporting procedures listed below

INCIDENT REPORTING:

Respond to the incident and get it under control. Contact the following by e-mail and brief phone message (**MUST DO BOTH**):

Name	Email Address	Phone Number	Position
Fred Wallace	**fred.j.wallace@boeing.com**	**(206) 930-0461 cell**	**Boeing Field Engineer**
Jennifer Parsons	**jennifer.a.parsons@boeing.com**	**(206) 715-7981 cell**	**Boeing Field Engineer**
Carl Bach	**carl.m.bach@boeing.com**	**(206) 898-0438 cell**	**Boeing Project Manager**
Raymond T Power	**raymond.t.power@boeing.com**	**(425) 495-5030 cell**	**Boeing Site Focal**
Natasya Gray	**natasya.gray@amec.com**	**(206) 375-0211 cell**	**Consultant Manager**
John Long	**john.long@amec.om**	**(206) 342-1779**	**Consultant Contact**

When leaving the voice message or email state the following:

1. **Date:** The date the incident occurred
2. **Time:** The approximate time the incident occurred
3. **Location:** Where the incident occurred, i.e.; Admin Compound…

After the incident is under control, the sequence of events will be recorded, including probable cause, people who responded to the incident, the extents of the incident, and relevant dates and times

APPENDIX B

Project Health and Safety Field Meeting Form

PROJECT HEALTH AND SAFETY FIELD MEETING FORM

Date: ____________ Time: ____________ Project No.: 8888

Project Name: Boeing Renton Engineering Design Report

Location: Boeing Renton, Washington

Meeting Conducted by: ____________

Topics Discussed:

Physical Hazards: slips, trips, falls, heavy equipment, utilities, drilling

Chemical Hazards: ____________

Personal Protection: Level D PPE (includes hard hat, safety glasses, hearing protection, steel-toed shoes and high visibility vest)

Decontamination: Alconox wash, DI rinse, steam clean drilling equipment; wash hands before eating

Special Site Considerations: ____________

Emergency Information: Call Boeing Renton Emergency Dispatch 206-655-2222

Hospital Location: Valley Medical Center, 400 S 43rd Street, Renton

Attendees

Name/Company (printed)	Signature

Meeting Conducted by: ____________

Signature

APPENDIX C

Job Safety Analysis Sheets

JOB SAFETY ANALYSIS

JSA #

Project Name:	Boeing Renton On-Call Sampling	Project No:	8888	Date:	3/18/2013
Task:	Soil Sampling During Push Probe Investigation	Task Location:	Renton, WA		

For this Project and Task, this document is a Certification of Hazard Assessment

Completed by:	B. Haderlie	Reviewed by:	J. Long
Notes:			

Task	Hazard	Risk Control Method
Mobilization To Site	Driving accidents	Reference Driving/Mobilization JSA
Set Up Work Site	Auto / truck and heavy equipment traffic	Notify attendant or site manager / owner of work activities and location.
		Barricade off work location if feasible.
		High visibility clothing.
	UV exposure	Wear correct PPE (neck to toe clothing & sun block as needed)
	Hand Scrapes/Injuries	Use appropriate type of wrench (socket), don't force, anticipate path of slipped tool and keep body path clear.
		Wear gloves
		Make sure work area is solid and free of obstructions
Soil Boring / Drilling		Set-up adequate exclusion zone – only trained, inducted and authorized personnel within this area
	Struck by, caught by	Stay clear of rotating auger / equipment – no hands, feet, loose clothes, or any body part to be near rotating equipment. Rotation to stop for sampling etc. Avoid exposure to burst hazard from pressurized hydraulic lines
	Impact by suspended loads	Do not walk under suspended loads
	Hearing damage from high noise levels	USE HEARING PROTECTION (EAR MUFFS OR EAR PLUGS) IF normal conversation difficult to hear at 3 feet
	Vapors and airborne particulates	MONITOR AIR CONCENTRATIONS per air monitoring plan
		Stop work if hazardous conditions identified – reassess and take the necessary precautions.
		Wear appropriate PPE including face shield / safety glasses, dust masks or respirators, long sleeve shirts and pants.
	Slip, trip & fall	Keep work area tidy and clean – including the removal of excess cuttings.
		Keep work surfaces dry where possible
		Wear appropriate PPE including non-slip soles or rubber boots if working on wet or slick surfaces
		Stay aware of footing and do not run
	Diesel Exhaust	Monitor per air monitoring plan
	Heat / cold stress	Take regular breaks on hot days or if feeling faint or overexerted
		Consume adequate food / beverages (water / sports drink)

		If possible, adjust work schedule to avoid temperature extremes
	Biological hazards: insects, vegetation	Open enclosures slowly, do not put hands inside enclosures where view is obstructed
		Survey site for presence of biological hazards and maintain safe distance
	Hazard from Striking Underground Services	Call local 1-call utility locator at least 2 days in advance of field work.
		Augment 1-call with professional utility locator and/or facility plans check to locate and identify all services in potential drilling area.
		Develop and review checklist of all potential utilities serving site and structures, and positively locate them.
		Due diligence review of active and historic utility lines and subsurface structures with site representatives.
		For any un-located utilities, hand excavate or air knife to potential depth in suspected utility areas.
		Hand excavate or air knife to potential depth when within 5 feet of know utility lines.
		Observe initial 4 feet of drilling cuttings for utility bedding material .
	UV exposure	Wear correct PPE (neck to toe clothing & sun block, as needed)
	Lifting heavy equipment	Do not lift or move heavy equipment without assistance
		Use proper bending / lifting techniques by lifting with arms and legs and not with back. Keep back straight while lifting
		Take breaks if feeling faint or over exerted
	Muscle strain injury	Use correct manual lifting methods.
		Driller to manage soil sampling.
Soil Sampling	Handling contaminated materials / soils / groundwater	Wear appropriate PPE including nitrile gloves, safety glasses and neck to toe clothing.
	Sharp sampling tools	Use correct tools for opening split spoon sampler / push tubes, don’t use excessive force and keep body parts clear of tool path if it slips.
	Vapors	Monitor per air monitoring plan
		Work upwind of sampling area if possible

JOB SAFETY ANALYSIS

JSA #

Project Name:	Boeing Renton	Project No:	8888	Date:	8/22/13
Task:	Excavation, Soil Sampling, Backfill	Task Location:	Renton, WA		

For this Project and Task, this document is a Certification of Hazard Assessment

Completed by:	Trevor Louviere	Reviewed by:	
Notes:			

Task	**Hazard**	**Risk Control Method**
Mobilization To Site	Driving accidents	Review and implement Mobilization JSA
Set Up Work Site	Auto / truck and loader traffic	Coordinate work activities and locations with responsible site representative(s).
		Barricade off work location if feasible.
		Wear high visibility clothing while in operational areas.
Excavation	Uneven/unstable ground	Visually examine site prior to entry and review work areas with responsible site representatives.
	Heavy Equipment Operations	Work location to be barricaded off.
	Struck by:	Wear high visibility clothing while in operational areas.
		Make eye contact with operator and get positive directions before approaching equipment; stay outside the equipment swing radius.
		Alert operators to new personnel in the area, and use proper hand signals before maneuvering.
	Strike of under-ground utilities:	Properly locate utilities with 1-call 800-424-5555 and private locator. Deenergize and lock out lines where feasible. If additional utilities are suspected, work with facility to locate them.
		Examine initial 3 feet of excavations for utility backfill.
		Have subcontractor hand excavate or air knife within 3 feet of identified underground utilities.
		Operators must use spotters and be cautious when maneuvering equipment within 15 feet of overhead utility lines, and maintain safe distances at all time.
	Slip, trip & fall	Keep work area clean and organized—remove or flag trip hazards.
		Keep work surfaces dry where possible.
		Wear appropriate PPE including non-slip soles if working on wet or slick surfaces.
		Stay aware of footing and do not run.
	Trench hazards	Keep away from edge of excavated areas; protect edges with barricade if left unattended or accessible to non-excavation personnel.
		Do not enter excavations 4 feet or deeper without shoring, means of egress every 25 feet, and daily excavation inspection by a competent person.
	Heat / cold stress	Take regular breaks on hot days or if feeling faint or overexerted.
		Consume adequate food / beverages (water / sports drink).
		If possible, adjust work schedule to avoid temperature extremes.
	Biological hazards: insects, vegetation	Open enclosures slowly, do not put hands inside enclosures where view is obstructed.
		Survey vegetation and old structures for presence of biological hazards and maintain safe distance.
	UV exposure	Wear correct PPE (neck to toe clothing & sun block, as needed).
	Lifting heavy equipment	Do not lift or move heavy equipment without assistance.
		Use proper bending / lifting techniques by lifting with arms and legs and not with back. Keep back straight while lifting.

		Take breaks if feeling faint or over exerted.
	Muscle strain injury	Use correct manual lifting methods.
	Noise	Wear hearing protection (ear muffs or plugs) if normal conversation levels are difficult to hear at 3 feet distance.
	Dust/vapors	Stay upwind or crosswind when possible. Implement air monitoring plan in HASP.
Soil Sampling	Handling contaminated equipment or media	Inspect tools and sampled media for visual or olfactory cues to indicate contamination.
		Wear appropriate PPE including outer garments for dust protection, chemical resistant gloves, safety glasses, long sleeve shirts and pants, respiratory protection when indicated by the HASP.

APPENDIX D

MSDSs for Hazardous Substances Found at Site

ALCONOX MSDS

Section 1 : MANUFACTURER INFORMATION

Product name: Alconox

Supplier: Same as manufacturer.

Manufacturer: Alconox, Inc.
30 Glenn St.
Suite 309
White Plains, NY 10603.

Manufacturer emergency phone number: 800-255-3924.
813-248-0585 (outside of the United States).

Manufacturer: Alconox, Inc.
30 Glenn St.
Suite 309
White Plains, NY 10603.

Supplier MSDS date: 2005/03/09

D.O.T. Classification: Not regulated.

Section 2 : HAZARDOUS INGREDIENTS

C.A.S.	CONCENTRATION %	Ingredient Name	T.L.V.	LD/50	LC/50
25155-30-0	10-30	SODIUM DODECYLBENZENESULFONATE	NOT AVAILABLE	438 MG/KG RAT ORAL 1330 MG/KG MOUSE ORAL	NOT AVAILABLE
497-19-8	7-13	SODIUM CARBONATE	NOT AVAILABLE	4090 MG/KG RAT ORAL 6600 MG/KG MOUSE ORAL	2300 MG/M3/2H RAT INHALATION 1200 MG/M3/2H MOUSE INHALATION
7722-88-5	10-30	TETRASODIUM PYROPHOSPHATE	5 MG/M3	4000 MG/KG RAT ORAL 2980 MG/KG MOUSE ORAL	NOT AVAILABLE
7758-29-4	10-30	SODIUM PHOSPHATE	NOT AVAILABLE	3120 MG/KG RAT ORAL 3100 MG/KG MOUSE ORAL >4640 MG/KG RABBIT DERMAL	NOT AVAILABLE

Section 2A : ADDITIONAL INGREDIENT INFORMATION

Note: (supplier).
CAS# 497-19-8: LD50 4020 mg/kg - rat oral.
CAS# 7758-29-4: LD50 3100 mg/kg - rat oral.

Section 3 : PHYSICAL / CHEMICAL CHARACTERISTICS

Physical state: Solid

Appearance & odor: Almost odourless.
White granular powder.

Odor threshold (ppm): Not available.

Vapour pressure (mmHg): Not applicable.

Vapour density (air=1): Not applicable.

By weight: Not available.

Evaporation rate (butyl acetate = 1): Not applicable.

Boiling point (°C): Not applicable.

Freezing point (°C): Not applicable.

pH: (1% aqueous solution).
9.5

Specific gravity @ 20 °C: (water = 1).
0.85 - 1.10

Solubility in water (%): 100 - > 10% w/w

Coefficient of water\oil dist.: Not available.

VOC: None

Section 4 : FIRE AND EXPLOSION HAZARD DATA

Flammability: Not flammable.

Conditions of flammability: Surrounding fire.

Extinguishing media: Carbon dioxide, dry chemical, foam.
Water
Water fog.

Special procedures: Self-contained breathing apparatus required.
Firefighters should wear the usual protective gear.

Auto-ignition temperature: Not available.

Flash point (°C), method: None

Lower flammability limit (% vol): Not applicable.

Upper flammability limit (% vol): Not applicable.

Not available.

Sensitivity to mechanical impact: Not applicable.

Hazardous combustion products: Oxides of carbon (COx).
Hydrocarbons.

Rate of burning: Not available.

Explosive power: None

Section 5 : REACTIVITY DATA

Chemical stability:	Stable under normal conditions.
Conditions of instability:	None known.
Hazardous polymerization:	Will not occur.
Incompatible substances:	Strong acids. Strong oxidizers.
Hazardous decomposition products:	See hazardous combustion products.

Section 6 : HEALTH HAZARD DATA

Route of entry:	Skin contact, eye contact, inhalation and ingestion.
Effects of Acute Exposure	
Eye contact:	May cause irritation.
Skin contact:	Prolonged contact may cause irritation.
Inhalation:	Airborne particles may cause irritation.
Ingestion:	May cause vomiting and diarrhea. May cause abdominal pain. May cause gastric distress.
Effects of chronic exposure:	Contains an ingredient which may be corrosive.
LD50 of product, species & route:	> 5000 mg/kg rat oral.
LC50 of product, species & route:	Not available for mixture, see the ingredients section.
Exposure limit of material:	Not available for mixture, see the ingredients section.
Sensitization to product:	Not available.
Carcinogenic effects:	Not listed as a carcinogen.
Reproductive effects:	Not available.
Teratogenicity:	Not available.
Mutagenicity:	Not available.
Synergistic materials:	Not available.
Medical conditions aggravated by exposure:	Not available.
First Aid	
Skin contact:	Remove contaminated clothing. Wash thoroughly with soap and water. Seek medical attention if irritation persists.
Eye contact:	Check for and remove contact lenses. Flush eyes with clear, running water for 15 minutes while holding eyelids open: if irritation persists, consult a physician.
Inhalation:	Remove victim to fresh air. Seek medical attention if symptoms persist.
Ingestion:	Dilute with two glasses of water. Never give anything by mouth to an unconscious person. Do not induce vomiting, seek immediate medical attention.

Section 7 : PRECAUTIONS FOR SAFE HANDLING AND USE

Leak/Spill: Contain the spill.
Recover uncontaminated material for re-use.
Wear appropriate protective equipment.
Contaminated material should be swept or shoveled into appropriate waste container for disposal.

Waste disposal: In accordance with municipal, provincial and federal regulations.

Handling procedures and equipment: Protect against physical damage.
Avoid breathing dust.
Wash thoroughly after handling.
Keep out of reach of children.
Avoid contact with skin, eyes and clothing.
Launder contaminated clothing prior to reuse.

Storage requirements: Keep containers closed when not in use.
Store away from strong acids or oxidizers.
Store in a cool, dry and well ventilated area.

Section 8 : CONTROL MEASURES

Precautionary Measures

Gloves/Type:
Neoprene or rubber gloves.

Respiratory/Type:
If exposure limit is exceeded, wear a NIOSH approved respirator.

Eye/Type:
Safety glasses with side-shields.

Footwear/Type: Safety shoes per local regulations.

Clothing/Type: As required to prevent skin contact.

Other/Type: Eye wash facility should be in close proximity.
Emergency shower should be in close proximity.

Ventilation requirements: Local exhaust at points of emission.

Material Safety Data Sheet
Instant FAME/Instant Anaerobe Methods
Methanol

SECTION 1 – CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

MSDS Name: Methanol
MSDS Preparation Date: 06/19/2009
MSDS Reviewed Date: 05/05/2011
Synonyms or Generic ID for Methanol: Carbinol; Methyl alcohol; Methyl hydroxide; Monohydroxymethane; Wood alcohol; Wood naptha; Wood spirits; Columbian spirits; Methanol.
Chemical Family: Methanol Family
Formula: CH_3OH
Molecular Weight: N/A
PIN (UN#/ NA#): UN1230
Company Identification:
Microbial ID.
125 Sandy Drive
Newark, DE 19713
For Information, call: (800)276-8068, (302)737-4297
For Domestic CHEMTREC assistance, call: 800-424-9300
For International CHEMTREC assistance, call: 703-527-3887

SECTION 2 – COMPOSITION, INFORMATION ON INGREDIENTS

67-56-1	Methanol	<99%	200-659-6	Irritant, Flammable

NFPA Rating: (estimated) Health: 1; Flammability: 3; Instability: 0

State: Liquid	Appearance: colorless	Odor: Alcohol-like, weak odor
Boiling Point: 64.7°C@760mmHg	pH: Not available	Specific Gravity: 7910g/cm3@20°C
Vapor Pressure (mm Hg): 128mmHg @20°C		Vapor Density (AIR=1): 1.11
Flash Point: 12°C		Solubility in Water: miscible

SECTION 3 – HAZARDS IDENTIFICATION

Appearance: Colorless liquid, Flash Point: 12°C, 53.6°F.

Danger! Poison! May be fatal or cause blindness if swallowed. Vapor harmful. **Flammable liquid and vapor.** Harmful if swallowed, inhaled, or absorbed through the skin. Causes eye, skin, and respiratory tract irritation. May cause central nervous system depression. Cannot be made non-poisonous.
Target Organs: Eyes, nervous system, optic nerve.

Potential Health Effects
Eye: May cause painful sensitization to light. Methanol is a mild to moderate eye irritant. Inhalation, ingestion or skin absorption of methanol can cause significant disturbance in vision, including blindness.
Skin: Causes moderate skin irritation. May be absorbed through the skin in harmful amounts. Prolonged and or repeated contact may cause defatting of skin and dermatitis. Methanol can be absorbed through the skin, producing systemic effects that include visual disturbances.
Ingestion: May be fatal or cause blindness if swallowed. Aspiration hazard. Cannot be made non-poisonous. May cause gastrointestinal irritation with nausea, vomiting and diarrhea. May cause systematic toxicity with acidosis. May cause central nervous system depression, characterized by excitement, followed by headache, dizziness, drowsiness, and nausea. Advanced stages may cause collapse, unconsciousness, coma, and possible death due to failed respiratory failure. May cause cardiopulmonary system effects.

Inhalation: Methanol is toxic and can very readily form extremely high vapor concentrations at room temperature. Inhalation is the most common route of occupational exposure. At first, methanol causes CNS depression with nausea, headache, vomiting, dizziness and incoordination. A time period with no obvious symptoms follows (typically 8-24 hrs). This latent period is followed by metabolic acidosis and severe visual effects which may include reduced reactivity and/or increased sensitivity to light, blurred, doubl and/or snowy vision, and blindness. Depending on the severity of exposure and the promptness of treatment, survivors may recover completely or may have permanent blindness, vision disturbances and/or nervous system effects.
Chronic: Prolonged or repeated skin contact may cause dermatitis. Chronic exposure may cause effects similar to those of acute exposure. Methanol is only very slowly eliminated from the body. Because of this slow elimination, methanol should be regarded as a cumulative poison. Though a single exposure may cause no effect, daily exposures may result in the accumulation of a harmful amount. Methanol has produced fetotoxicity in rats and teratogenicity in mice exposed by inhalation to high concentrations that did not produce significant maternal toxicity.

SECTION 4 – FIRST AID MEASURES

Eyes: In case of contact, immediately flush eyes with plenty of water for a t least 15 minutes. Get medical aid.
Skin: In case of contact, immediately flush skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Get medical aid immediately. Wash clothing before reuse.
Ingestion: Potential for aspiration if swallowed. Get medical aid immediately. Do not induce vomiting unless directed to do so by medical personnel. Never give anything by mouth to an unconscious person. If vomiting occurs naturally, have victim lean forward.
Inhalation: If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical aid.
Notes to Physician: Effects may be delayed.
Antidote: Ethanol may inhibit methanol metabolism.

SECTION 5 – FIRE FIGHTING MEASURES

General Information: Ethanol may inhibit methanol metabolism. As in any fire, wear a self-contained breathing apparatus in pressure-demand, MSHA/NIOSH (approved or equivalent), and full protective gear. During a fire, irritating and highly toxic gases may be generated by thermal decomposition or combustion. Use water spray to keep fire-exposed containers cool. Water may be ineffective. Material is lighter than water and a fire may be spread by the use of water. Vapors are heavier than air and may travel to a source of ignition and flash back. Vapors can spread along the ground and collect in low or confined areas.
Extinguishing Media: For small fires, use dry chemical, carbon dioxide, water spray or alcohol-resistant foam. Water may be ineffective. For large fires, use water spray, fog or alcohol-resistant foam. Do NOT use straight streams of water.
Flash Point: 12 deg C (53.60 deg F)
Autoignition Temperature: 455 deg C (851.00 deg F)
Explosion Limits, Lower:6.0 vol %
Upper: 31.00 vol %
NFPA Rating: (estimated) Health: 1; Flammability: 3; Instability: 0

SECTION 6 – ACCIDENTAL RELEASE MEASURES

General Information: Use proper personal protective equipment as indicated in Section 8.
Spills/Leaks: Use water spray to disperse the gas/vapor. Remove all sources of ignition. Absorb spill using an absorbent, non-combustible material such as earth, sand, or vermiculite. Do not use combustible materials such as sawdust. Use a spark-proof tool. Provide ventilation. A vapor suppressing foam may be used to reduce vapors. Water spray may reduce vapor but may not prevent ignition in closed spaces.

SECTION 7-HANDLING AND STORAGE

Handling: Wash thoroughly after handling. Remove contaminated clothing and wash before reuse. Ground and bond containers when transferring material. Use spark-proof tools and explosion proof equipment. Avoid contact with eyes, skin, and clothing. Empty containers retain product residue, (liquid and/or vapor), and can be dangerous. Keep container tightly closed. Do not ingest or inhale. Do not pressurize, cut, weld, braze, solder, drill, grind, or expose empty containers to heat, sparks or open flames. Use only with adequate ventilation. Keep away from heat, sparks and flame. Avoid use in confined spaces.
Storage: Keep away from heat, sparks, and flame. Keep away from sources of ignition. Store in a cool, dry, well-ventilated area away from incompatible substances. Flammables-area. Keep containers tightly closed.

SECTION 8 – EXPOSURE CONTROL/ PERSONAL PROTECTION

Engineering Controls: Use explosion-proof ventilation equipment. Facilities storing or utilizing this material should be equipped with an eyewash facility and a safety shower. Use adequate general or local exhaust ventilation to keep airborne concentrations below the permissible exposure limits.

Chemical Name	ACGIH	NIOSH	OSHA – Final PELs
Methanol	200 ppm TWA; 250 ppm STEL; Skin - potential significant contribution to overall exposure by the cutaneous route	200 ppm TWA; 260 mg/m3 TWA 6000 ppm IDLH	200 ppm TWA; 260 mg/m3 TWA

OSHA Vacated PELs: Methanol: 200 ppm TWA; 260 mg/m3 TWA
Personal Protective Equipment
Eyes: Wear chemical splash goggles.
Skin: Wear butyl rubber gloves, apron, and/or clothing.
Clothing: Wear appropriate protective clothing to prevent skin exposure.
Respirators: Follow the OSHA respirator regulations found in 29 CFR 1910.134 or European Standard EN 149. Use a NIOSH/MSHA or European Standard EN 149 approved respirator if exposure limits are exceeded or if irritation or other symptoms are experienced.

SECTION 9 – PHYSICAL AND CHEMICAL PROPERTIES

Physical State: Clear liquid
Appearance: clear, colorless - APHA: 10 max
Odor: alcohol-like - weak odor
pH: Not available.
Vapor Pressure: 128 mm Hg @ 20 deg C
Vapor Density: 1.11 (Air=1)
Evaporation Rate:5.2 (Ether=1)
Viscosity: 0.55 cP 20 deg C
Boiling Point: 64.7 deg C @ 760 mmHg
Freezing/Melting Point:-98 deg C
Decomposition Temperature: Not available.
Solubility: miscible
Specific Gravity/Density:.7910 g/cm3 @ 20°C
Molecular Formula:CH_4O
Molecular Weight:32.04

SECTON 10 – STABILITY AND REACTIVITY

Chemical Stability: Stable under normal temperatures and pressures.
Conditions to Avoid: High temperatures, ignition sources, confined spaces.
Incompatibilities with Other Materials: Oxidizing agents, reducing agents, acids, alkali metals, potassium, sodium, metals as powders (e.g. hafnium, raney nickel), acid anhydrides, acid chlorides, powdered aluminum, powdered magnesium.
Hazardous Decomposition Products: Carbon monoxide, irritating and toxic fumes and gases, carbon dioxide, formaldehyde.
Hazardous Polymerization: Will not occur.

SECTION 11 – TOXICOLOGICAL INFORMATION

RTECS#:
CAS# 67-56-1: PC1400000
LD50/LC50:
CAS# 67-56-1:
- Draize test, rabbit, eye: 40 mg Moderate;
- Draize test, rabbit, eye: 100 mg/24H Moderate;
- Draize test, rabbit, skin: 20 mg/24H Moderate;
- Inhalation, rabbit: LC50 = 81000 mg/m3/14H;
- Inhalation, rat: LC50 = 64000 ppm/4H;
- Oral, mouse: LD50 = 7300 mg/kg;
- Oral, rabbit: LD50 = 14200 mg/kg;
- Oral, rat: LD50 = 5600 mg/kg;
- Skin, rabbit: LD50 = 15800 mg/kg;

Human LDLo Oral: 143 mg/kg; Human LDLo Oral: 428 mg/kg; Human TCLo Inhalation; 300 ppm caused visual field changes & headache; Monkey LDLo Skin: 393 mg/kg. Methanol is significantly less toxic to most experimental animals than humans, because most animal species metabolize methanol differently. Non-primate species do not ordinarily show symptoms of metabolic acidosis or the visual effects which have been observed in primates and humans.
Carcinogenicity:
CAS# 67-56-1: Not listed by ACGIH, IARC, NTP, or CA Prop 65.

Epidemiology: No information found
Teratogenicity: There is no human information available. Methanol is considered to be a potential developmental hazard based on animal data. In animal experiments, methanol has caused fetotoxic or teratogenic effects without maternal toxicity.
Reproductive Effects: See actual entry in RTECS for complete information.
Mutagenicity: See actual entry in RTECS for complete information.
Neurotoxicity: ACGIH cites neuropathy, vision and CNS under TLV basis.

SECTION 12 – ECOLOGICAL INFORMATION

Ecotoxicity: Fish: Fathead Minnow: 29.4 g/L; 96 Hr; LC50 (unspecified)Fish: Goldfish: 250 ppm; 11 Hr; resulted in deathFish: Rainbow trout: 8000 mg/L; 48 Hr; LC50 (unspecified)Fish: Rainbow trout: LC50 = 13-68 mg/L; 96 Hr.; 12 degrees CFish: Fathead Minnow: LC50 = 29400 mg/L; 96 Hr.; 25 degrees C, pH 7.63Fish: Rainbow trout: LC50 = 8000 mg/L; 48 Hr.; UnspecifiedBacteria: Phytobacterium phosphoreum: EC50 = 51,000-320,000 mg/L; 30 minutes; Microtox test No data available.
Environmental: Dangerous to aquatic life in high concentrations. Aquatic toxicity rating: TLm 96>1000 ppm. May be dangerous if it enters water intakes. Methyl alcohol is expected to biodegrade in soil and water very rapidly. This product will show high soil mobility and will be degraded from the ambient atmosphere by the reaction with photochemically produced hyroxyl radicals with an estimated half-life of 17.8 days. Bioconcentration factor for fish (golden ide) < 10. Based on a log Kow of -0.77, the BCF value for methanol can be estimated to be 0.2.
Physical: No information available.
Other: No information available.

SECTION 13 – DISPOSAL CONSIDERATIONS

Chemical waste generators must determine whether a discarded chemical is classified as a hazardous waste. US EPA guidelines for the classification determination are listed in 40 CFR Parts 261.3. Additionally, waste generators must consult state and local hazardous waste regulations to ensure complete and accurate classification.

RCRA P-Series: None listed.

RCRA U-Series:

CAS# 67-56-1: waste number U154 (Ignitable waste).

SECTION 14 – TRANSPORT INFORMATION

	US DOT	CANADA TDG
Shipping Name:	Methanol	Methanol
Hazard Class:	3	3
UN Number:	UN1230	UN1230
Packing Group:	II	II
Additional Information		Flash Point 12°C

SECTION 15 – REGULATORY INFORMATION

US FEDERAL

TSCA

CAS# 67-56-1 is listed on the TSCA inventory.

Health & Safety Reporting List

None of the chemicals are on the Health & Safety Reporting List.

Chemical Test Rules

None of the chemicals in this product are under a Chemical Test Rule.

Section 12b

None of the chemicals are listed under TSCA Section 12b.

TSCA Significant New Use Rule

None of the chemicals in this material have a SNUR under TSCA.

CERCLA Hazardous Substances and corresponding RQs

CAS# 67-56-1: 5000 lb final RQ; 2270 kg final RQ

SARA Section 302 Extremely Hazardous Substances

None of the chemicals in this product have a TPQ.

SARA Codes

CAS # 67-56-1: immediate, fire.

Section 313

This material contains Methanol (CAS# 67-56-1, > 99%),which is subject to the reporting requirements of Section 313 of SARA Title III and 40 CFR Part 373.

Clean Air Act:

CAS# 67-56-1 is listed as a hazardous air pollutant (HAP).
This material does not contain any Class 1 Ozone depletors.
This material does not contain any Class 2 Ozone depletors.

Clean Water Act:

None of the chemicals in this product are listed as Hazardous Substances under the CWA.
None of the chemicals in this product are listed as Priority Pollutants under the CWA.
None of the chemicals in this product are listed as Toxic Pollutants under the CWA.

OSHA:

None of the chemicals in this product are considered highly hazardous by OSHA.

STATE

CAS# 67-56-1 can be found on the following state right to know lists: California, New Jersey, Pennsylvania, Minnesota, Massachusetts.

California Prop 65
California No Significant Risk Level: None of the chemicals in this product are listed.

European/International Regulations

European Labeling in Accordance with EC Directives
Hazard Symbols:
T F
Risk Phrases:
R 11 Highly flammable.
R 23/24/25 Toxic by inhalation, in contact with skin and if swallowed.
R 39/23/24/25 Toxic : danger of very serious irreversible effects through inhalation, in contact with skin and if swallowed.

Safety Phrases:
S 16 Keep away from sources of ignition - No smoking.
S 36/37 Wear suitable protective clothing and gloves.
S 45 In case of accident or if you feel unwell, seek medical advice immediately (show the label where possible).
S 7 Keep container tightly closed.

WGK (Water Danger/Protection)
CAS# 67-56-1: 1
Canada - DSL/NDSL
CAS# 67-56-1 is listed on Canada's DSL List.
Canada - WHMIS
This product has a WHMIS classification of B2, D1B, D2B.
This product has been classified in accordance with the hazard criteria of the Controlled Products Regulations and the MSDS contains all of the information required by those regulations.
Canadian Ingredient Disclosure List
CAS# 67-56-1 is listed on the Canadian Ingredient Disclosure List.

SECTION 16 – Other Information

This Material Safety Data Sheet has been prepared in accordance with 29 CFR 1910.1200 and contains information believed to be accurate and complete at the date of preparation. The statements contained herein are offered for informational purposes only and are based upon technical data. MIDI Inc. believes them to be accurate but does not purport to be all-inclusive. The above-stated product is intended for use only by persons having the necessary technical skills and facilities for handling the product at their discretion and risk. Since conditions and manner of use are outside our control, we (MIDI Inc.) make no warranty of merchantability or any such warranty, express or implied with respect to information and we assume no liability resulting from the above product or its use. Users should make their own investigations to determine suitability of information and product for their particular purposes.

MSDS Number: **A0446** * * * * * *Effective Date: **02/01/07*** * * * * * *Supercedes: **05/20/04***

MSDS *Material Safety Data Sheet*

From: Mallinckrodt Baker, Inc.
222 Red School Lane
Phillipsburg, NJ 08865

Mallinckrodt CHEMICALS J.T.Baker

24 Hour Emergency Telephone 908-859-2151
CHEMTREC: 1-800-424-9300

National Response in Canada
CANUTEC: 613-996-6666

Outside U.S. and Canada
Chemtrec: 703-527-3887

NOTE: CHEMTREC, CANUTEC and National Response Center emergency numbers to be used only in the event of chemical emergencies involving a spill, leak, fire, exposure or accident involving chemicals.

All non-emergency questions should be directed to Customer Service (1-800-582-2537) for assistance.

ACETONE

1. Product Identification

Synonyms: Dimethylketone; 2-propanone; dimethylketal
CAS No.: 67-64-1
Molecular Weight: 58.08
Chemical Formula: (CH3)2CO
Product Codes:
J.T. Baker: 5008, 5018, 5356, 5580, 5965, 5975, 9001, 9002, 9003, 9004, 9005, 9006, 9007, 9008, 9009, 9010, 9015, 9024, 9036, 9125, 9254, 9271, A134, V655
Mallinckrodt: 0018, 2432, 2435, 2437, 2438, 2440, 2443, 2850, H451, H580, H981

2. Composition/Information on Ingredients

Ingredient	CAS No	Percent	Hazardous
Acetone	67-64-1	99 - 100%	Yes

3. Hazards Identification

Emergency Overview

DANGER! EXTREMELY FLAMMABLE LIQUID AND VAPOR. VAPOR MAY CAUSE FLASH FIRE. HARMFUL IF SWALLOWED OR INHALED. CAUSES IRRITATION TO SKIN, EYES AND RESPIRATORY TRACT. AFFECTS CENTRAL NERVOUS SYSTEM.

SAF-T-DATA$^{(tm)}$ Ratings (Provided here for your convenience)

Health Rating: 2 - Moderate
Flammability Rating: 3 - Severe (Flammable)
Reactivity Rating: 0 - None
Contact Rating: 3 - Severe
Lab Protective Equip: GOGGLES & SHIELD; LAB COAT & APRON; VENT HOOD; PROPER GLOVES;

CLASS B EXTINGUISHER
Storage Color Code: Red (Flammable)

Potential Health Effects

Inhalation:
Inhalation of vapors irritates the respiratory tract. May cause coughing, dizziness, dullness, and headache. Higher concentrations can produce central nervous system depression, narcosis, and unconsciousness.
Ingestion:
Swallowing small amounts is not likely to produce harmful effects. Ingestion of larger amounts may produce abdominal pain, nausea and vomiting. Aspiration into lungs can produce severe lung damage and is a medical emergency. Other symptoms are expected to parallel inhalation.
Skin Contact:
Irritating due to defatting action on skin. Causes redness, pain, drying and cracking of the skin.
Eye Contact:
Vapors are irritating to the eyes. Splashes may cause severe irritation, with stinging, tearing, redness and pain.
Chronic Exposure:
Prolonged or repeated skin contact may produce severe irritation or dermatitis.
Aggravation of Pre-existing Conditions:
Use of alcoholic beverages enhances toxic effects. Exposure may increase the toxic potential of chlorinated hydrocarbons, such as chloroform, trichloroethane.

4. First Aid Measures

Inhalation:
Remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical attention.
Ingestion:
Aspiration hazard. If swallowed, vomiting may occur spontaneously, but DO NOT INDUCE. If vomiting occurs, keep head below hips to prevent aspiration into lungs. Never give anything by mouth to an unconscious person. Call a physician immediately.
Skin Contact:
Immediately flush skin with plenty of water for at least 15 minutes. Remove contaminated clothing and shoes. Get medical attention. Wash clothing before reuse. Thoroughly clean shoes before reuse.
Eye Contact:
Immediately flush eyes with plenty of water for at least 15 minutes, lifting upper and lower eyelids occasionally. Get medical attention.

5. Fire Fighting Measures

Fire:
Flash point: -20C (-4F) CC
Autoignition temperature: 465C (869F)
Flammable limits in air % by volume:
lel: 2.5; uel: 12.8
Extremely Flammable Liquid and Vapor! Vapor may cause flash fire.
Explosion:
Above flash point, vapor-air mixtures are explosive within flammable limits noted above. Vapors can flow along surfaces to distant ignition source and flash back. Contact with strong oxidizers may cause fire. Sealed containers may rupture when heated. This material may produce a floating fire hazard. Sensitive to static discharge.
Fire Extinguishing Media:
Dry chemical, alcohol foam or carbon dioxide. Water may be ineffective. Water spray may be used to keep fire exposed containers cool, dilute spills to nonflammable mixtures, protect personnel attempting to stop leak and

disperse vapors.
Special Information:
In the event of a fire, wear full protective clothing and NIOSH-approved self-contained breathing apparatus with full facepiece operated in the pressure demand or other positive pressure mode.

6. Accidental Release Measures

Ventilate area of leak or spill. Remove all sources of ignition. Wear appropriate personal protective equipment as specified in Section 8. Isolate hazard area. Keep unnecessary and unprotected personnel from entering. Contain and recover liquid when possible. Use non-sparking tools and equipment. Collect liquid in an appropriate container or absorb with an inert material (e. g., vermiculite, dry sand, earth), and place in a chemical waste container. Do not use combustible materials, such as saw dust. Do not flush to sewer! If a leak or spill has not ignited, use water spray to disperse the vapors, to protect personnel attempting to stop leak, and to flush spills away from exposures. US Regulations (CERCLA) require reporting spills and releases to soil, water and air in excess of reportable quantities. The toll free number for the US Coast Guard National Response Center is (800) 424-8802.

J. T. Baker SOLUSORB® solvent adsorbent is recommended for spills of this product.

7. Handling and Storage

Protect against physical damage. Store in a cool, dry well-ventilated location, away from any area where the fire hazard may be acute. Outside or detached storage is preferred. Separate from incompatibles. Containers should be bonded and grounded for transfers to avoid static sparks. Storage and use areas should be No Smoking areas. Use non-sparking type tools and equipment, including explosion proof ventilation. Containers of this material may be hazardous when empty since they retain product residues (vapors, liquid); observe all warnings and precautions listed for the product.

8. Exposure Controls/Personal Protection

Airborne Exposure Limits:
Acetone:
-OSHA Permissible Exposure Limit (PEL):
1000 ppm (TWA)

-ACGIH Threshold Limit Value (TLV):
500 ppm (TWA), 750 ppm (STEL) A4 - not classifiable as a human carcinogen
Ventilation System:
A system of local and/or general exhaust is recommended to keep employee exposures below the Airborne Exposure Limits. Local exhaust ventilation is generally preferred because it can control the emissions of the contaminant at its source, preventing dispersion of it into the general work area. Please refer to the ACGIH document, *Industrial Ventilation, A Manual of Recommended Practices*, most recent edition, for details.
Personal Respirators (NIOSH Approved):
If the exposure limit is exceeded and engineering controls are not feasible, a half-face organic vapor respirator may be worn for up to ten times the exposure limit, or the maximum use concentration specified by the appropriate regulatory agency or respirator supplier, whichever is lowest. A full-face piece organic vapor respirator may be worn up to 50 times the exposure limit, or the maximum use concentration specified by the appropriate regulatory agency or respirator supplier, whichever is lowest. For emergencies or instances where the exposure levels are not known, use a full-face piece positive-pressure, air-supplied respirator. WARNING: Air-purifying respirators do not protect workers in oxygen-deficient atmospheres.
Skin Protection:
Wear impervious protective clothing, including boots, gloves, lab coat, apron or coveralls, as appropriate, to

prevent skin contact.
Eye Protection:
Use chemical safety goggles and/or a full face shield where splashing is possible. Maintain eye wash fountain and quick-drench facilities in work area.

9. Physical and Chemical Properties

Appearance:
Clear, colorless, volatile liquid.
Odor:
Fragrant, mint-like
Solubility:
Miscible in all proportions in water.
Specific Gravity:
0.79 @ 20C/4C
pH:
No information found.
% Volatiles by volume @ 21C (70F):
100
Boiling Point:
56.5C (133F) @ 760 mm Hg
Melting Point:
-95C (-139F)
Vapor Density (Air=1):
2.0
Vapor Pressure (mm Hg):
400 @ 39.5C (104F)
Evaporation Rate (BuAc=1):
ca. 7.7

---

10. Stability and Reactivity

Stability:
Stable under ordinary conditions of use and storage.
Hazardous Decomposition Products:
Carbon dioxide and carbon monoxide may form when heated to decomposition.
Hazardous Polymerization:
Will not occur.
Incompatibilities:
Concentrated nitric and sulfuric acid mixtures, oxidizing materials, chloroform, alkalis, chlorine compounds, acids, potassium t-butoxide.
Conditions to Avoid:
Heat, flames, ignition sources and incompatibles.

11. Toxicological Information

Oral rat LD50: 5800 mg/kg; Inhalation rat LC50: 50,100mg/m3; Irritation eye rabbit, Standard Draize, 20 mg severe; investigated as a tumorigen, mutagen, reproductive effector.

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--------\Cancer Lists\------------------------------------------------------
                                             ---NTP Carcinogen---
Ingredient                                   Known    Anticipated    IARC Category
------------------------------------         -----    -----------    -------------
```

Acetone (67-64-1)	No	No	None

12. Ecological Information

Environmental Fate:
When released into the soil, this material is expected to readily biodegrade. When released into the soil, this material is expected to leach into groundwater. When released into the soil, this material is expected to quickly evaporate. When released into water, this material is expected to readily biodegrade. When released to water, this material is expected to quickly evaporate. This material has a log octanol-water partition coefficient of less than 3.0. This material is not expected to significantly bioaccumulate. When released into the air, this material may be moderately degraded by reaction with photochemically produced hydroxyl radicals. When released into the air, this material may be moderately degraded by photolysis. When released into the air, this material is expected to be readily removed from the atmosphere by wet deposition.
Environmental Toxicity:
This material is not expected to be toxic to aquatic life. The LC50/96-hour values for fish are over 100 mg/l.

13. Disposal Considerations

Whatever cannot be saved for recovery or recycling should be handled as hazardous waste and sent to a RCRA approved incinerator or disposed in a RCRA approved waste facility. Processing, use or contamination of this product may change the waste management options. State and local disposal regulations may differ from federal disposal regulations. Dispose of container and unused contents in accordance with federal, state and local requirements.

14. Transport Information

Domestic (Land, D.O.T.)

Proper Shipping Name: ACETONE
Hazard Class: 3
UN/NA: UN1090
Packing Group: II
Information reported for product/size: 188L

International (Water, I.M.O.)

Proper Shipping Name: ACETONE
Hazard Class: 3
UN/NA: UN1090
Packing Group: II
Information reported for product/size: 188L

15. Regulatory Information

--------\Chemical Inventory Status - Part 1\---------------------------------

Ingredient	TSCA	EC	Japan	Australia
Acetone (67-64-1)	Yes	Yes	Yes	Yes

--------\Chemical Inventory Status - Part 2\---------------------------------

		--Canada--		
Ingredient	Korea	DSL	NDSL	Phil.
Acetone (67-64-1)	Yes	Yes	No	Yes

--------\Federal, State & International Regulations - Part 1\----------------

Ingredient	-SARA 302- RQ	 TPQ	------SARA 313------ List	 Chemical Catg.
Acetone (67-64-1)	No	No	Yes	No

--------\Federal, State & International Regulations - Part 2\----------------

Ingredient	CERCLA	-RCRA- 261.33	-TSCA- 8(d)
Acetone (67-64-1)	5000	U002	No

Chemical Weapons Convention: No TSCA 12(b): No CDTA: Yes
SARA 311/312: Acute: Yes Chronic: No Fire: Yes Pressure: No
Reactivity: No (Pure / Liquid)

Australian Hazchem Code: 2[Y]E
Poison Schedule: None allocated.
WHMIS:
This MSDS has been prepared according to the hazard criteria of the Controlled Products Regulations (CPR) and the MSDS contains all of the information required by the CPR.

16. Other Information

NFPA Ratings: Health: **1** Flammability: **3** Reactivity: **0**
Label Hazard Warning:
DANGER! EXTREMELY FLAMMABLE LIQUID AND VAPOR. VAPOR MAY CAUSE FLASH FIRE. HARMFUL IF SWALLOWED OR INHALED. CAUSES IRRITATION TO SKIN, EYES AND RESPIRATORY TRACT. AFFECTS CENTRAL NERVOUS SYSTEM.
Label Precautions:
Keep away from heat, sparks and flame.
Keep container closed.
Use only with adequate ventilation.
Wash thoroughly after handling.
Avoid breathing vapor.
Avoid contact with eyes, skin and clothing.
Label First Aid:
Aspiration hazard. If swallowed, vomiting may occur spontaneously, but DO NOT INDUCE. If vomiting occurs, keep head below hips to prevent aspiration into lungs. Never give anything by mouth to an unconscious person. Call a physician immediately. If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. In case of contact, immediately flush eyes or skin with plenty of water for at least 15 minutes. Remove contaminated clothing and shoes. Wash clothing before reuse. In all cases, get medical attention.
Product Use:
Laboratory Reagent.
Revision Information:
No Changes.
Disclaimer:
****

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****

Prepared by: Environmental Health & Safety
Phone Number: (314) 654-1600 (U.S.A.)

MSDS Number: **S3458** * * * * * *Effective Date:* ***02/21/07*** * * * * * *Supercedes:* ***07/06/06***

MSDS *Material Safety Data Sheet*

From: Mallinckrodt Baker, Inc.
222 Red School Lane
Phillipsburg, NJ 08865

Mallinckrodt CHEMICALS
J.T.Baker

24 Hour Emergency Telephone 908-859-2151
CHEMTREC 1-800-424-9300

National Response in Canada
CANUTEC: 613-996-6666

Outside U.S. and Canada
Chemtrec: 703-527-3887

NOTE: CHEMTREC, CANUTEC and National Response Center emergency numbers to be used only in the event of chemical emergencies involving a spill, leak, fire, exposure or accident involving chemicals.

All non-emergency questions should be directed to Customer Service (1-800-582-2537) for assistance.

SODIUM CYANIDE

1. Product Identification

Synonyms: Hydrocyanic acid, sodium salt; Cyanogran
CAS No.: 143-33-9
Molecular Weight: 49.01
Chemical Formula: NaCN
Product Codes:
J.T. Baker: 3662, 3663
Mallinckrodt: 7616

2. Composition/Information on Ingredients

Ingredient	CAS No	Percent	Hazardous
Sodium Cyanide	143-33-9	90 - 100%	Yes

3. Hazards Identification

Emergency Overview

DANGER! MAY BE FATAL IF SWALLOWED, INHALED OR ABSORBED THROUGH SKIN. CONTACT WITH ACIDS LIBERATES POISONOUS GAS. CAUSES BURNS TO SKIN, EYES, AND RESPIRATORY TRACT. AFFECTS BLOOD, CARDIOVASCULAR SYSTEM, CENTRAL NERVOUS SYSTEM AND THYROID.

SAF-T-DATA$^{(tm)}$ Ratings (Provided here for your convenience)

Health Rating: 3 - Severe (Poison)
Flammability Rating: 0 - None
Reactivity Rating: 2 - Moderate
Contact Rating: 3 - Severe (Life)
Lab Protective Equip: GOGGLES & SHIELD; LAB COAT & APRON; VENT HOOD; PROPER GLOVES
Storage Color Code: Blue (Health)

Potential Health Effects

In most cases, cyanide poisoning causes a deceptively healthy pink to red skin color. However, if a physical injury or lack of oxygen is involved, the skin color may be bluish. Reddening of the eyes and pupil dilation are symptoms of cyanide poisoning. Cyanosis (blue discoloration of the skin) tends to be associated with severe cyanide poisonings.

Inhalation:
Corrosive to the respiratory tract. The substance inhibits cellular respiration and may cause blood, central nervous system, and thyroid changes. May cause headache, weakness, dizziness, labored breathing nausea and vomiting, which can be followed by weak and irregular heart beat, unconsciousness, convulsions, coma and death.

Ingestion:
Highly Toxic! Corrosive to the gastro-intestinal tract with burning in the mouth and esophagus, and abdominal pain. Larger doses may produce sudden loss of consciousness and prompt death from respiratory arrest. Smaller but still lethal doses may prolong the illness for one or more hours. Bitter almonds odor may be noted on the breath or vomitus. Other symptoms may be similar to those noted for inhalation exposure.

Skin Contact:
Corrosive. May cause severe pain and skin burns. Solutions are corrosive to the skin and eyes, and may cause deep ulcers which heal slowly. May be absorbed through the skin, with symptoms similar to those noted for inhalation.

Eye Contact:
Corrosive. Symptoms may include redness, pain, blurred vision, and eye damage.

Chronic Exposure:
Prolonged or repeated skin exposure may cause a "cyanide" rash and nasal sores.

Aggravation of Pre-existing Conditions:
Workers using cyanides should have a preplacement and periodic medical exam. Those with history of central nervous system, thyroid, skin, heart or lung diseases may be more susceptible to the effects of this substance.

4. First Aid Measures

IN CASE OF CYANIDE POISONING, start first aid treatment immediately, then get medical attention. A cyanide antidote kit (amyl nitrite, sodium nitrite and sodium thiosulfate) should be available in any cyanide work area. Actions to be taken in case of cyanide poisoning should be planned and practiced before beginning work with cyanides. Oxygen and amyl nitrite can be given by a first responder before medical help arrives. Allow victim to inhale amyl nitrite for 15-30 seconds per minute until sodium nitrite and sodium thiosulfate can be administered intravenously (see Note to Physician). A new amyl nitrite ampule should be used every 3 minutes. If conscious but symptoms (nausea, difficult breathing, dizziness, etc.) are evident, give oxygen. If consciousness is impaired (non-responsiveness, slurred speech, confusion, drowsiness) or the patient is unconscious but breathing, give oxygen and amyl nitrite by means of a respirator. If not breathing, give oxygen and amyl nitrite immediately by means of a positive pressure respirator (artificial respiration).

Inhalation:
If inhaled, remove to fresh air. Administer antidote kit and oxygen per pre-planned instructions if symptoms occur. Keep patient warm and at rest. Do not give mouth to mouth resuscitation.

Ingestion:
If ingested, antidote kit and oxygen should be administered per above. If the patient is conscious, immediately give the patient activated charcoal slurry. Never give anything by mouth to an unconscious person. Do not induce vomiting as it could interfere with resuscitator use.

Skin Contact:
Immediately flush skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Get medical attention immediately. Wash clothing before reuse. Thoroughly clean shoes before reuse. Administer antidote kit and oxygen per preplanned instructions if symptoms occur.

Eye Contact:
Immediately flush eyes with plenty of water for at least 15 minutes, lifting lower and upper eyelids occasionally. Get medical attention immediately.

Note to Physician:
If patient does not respond to amyl nitrite, inject intravenously with 10mL of a 3% solution of sodium nitrite at a rate of not more than 2.5 to 5 mL per minute.Once nitrite administration is complete, follow directly with 50 mL of a 25% solution of sodium thiosulfate at the same rate by the same route. Give victim oxygen and keep under observation. If exposure was severe, watch victim for 24-48 hours. If signs of cyanide poisoning persist or reappear, repeat nitrite and thiosulfate injections 1 hour later in 1/2 the original doses. Cyanocabalamin (B12), 1 mg intramuscularly, may speed recovery. Moderate cyanide exposures need be treated only by supportive measures such as bed rest and oxygen.

5. Fire Fighting Measures

Fire:
Not combustible, but upon decomposition or contact with acids, this material releases

highly flammable and toxic hydrogen cyanide gas.

Explosion:

Not considered an explosion hazard, but upon heating with chlorates or nitrites to 450C (842F) may cause an explosion. Violent explosion occurs if melted with nitrite salt. Sealed containers may rupture when heated.

Fire Extinguishing Media:

Use any means suitable for extinguishing surrounding fire. Do Not use carbon dioxide. Carbon dioxide can react with this material in the presence of moisture to produce hydrogen cyanide. Water spray may be used to keep fire exposed containers cool. Reacts slowly with water to form hydrogen cyanide.

Special Information:

In the event of a fire, wear full protective clothing and NIOSH-approved self-contained breathing apparatus with full facepiece operated in the pressure demand or other positive pressure mode.

6. Accidental Release Measures

Spills: Ventilate area of leak or spill. Allow only qualified personnel to handle spill. Clean-up personnel require protective clothing and respiratory protection from vapors. Collect material and place in a closed container for recovery or disposal. Do not flush to sewer! Decontaminate liquid or solid residues in spill area with sodium or calcium hypochlorite solution.

US Regulations (CERCLA) require reporting spills and releases to soil, water and air in excess of reportable quantities. The toll free number for the US Coast Guard National Response Center is (800) 424-8802.

7. Handling and Storage

Keep in a tightly closed container, stored in a cool, dry, ventilated area. Protect against physical damage. Separate from incompatibles. Workers must carefully follow good hygienic practices, including no eating, drinking, or smoking in workplace. Proper use and maintenance of protective equipment is essential. Workers using cyanide need preplacement and annual medical exams. Special training should be given to workers using cyanide. Containers of this material may be hazardous when empty since they retain product residues (dust, solids); observe all warnings and precautions listed for the product. Do not store near combustibles or flammables because subsequent fire fighting with water could lead to cyanide solution runoff. Do not store under sprinkler systems. All persons with the potential for cyanide poisoning should be trained to provide immediate First Aid using oxygen and amyl nitrite. A cyanide anitdote kit (amyl nitrite, sodium nitrite, and sodium thiosulfate) should be readily available in cyanide workplaces. The antidotes should be checked annually to ensure they are still within their shelf-lives. Identification of community hospital resources and emergency medical squads in order to equip and train them on handling cyanide emergencies is essential.

8. Exposure Controls/Personal Protection

Airborne Exposure Limits:
-OSHA Permissible Exposure Limit (PEL):
5 mg/m3 skin (TWA) (as CN)
-ACGIH Threshold Limit Value (TLV):
5 mg/m3 (STEL) Ceiling, skin, as CN

Ventilation System:
A system of local and/or general exhaust is recommended to keep employee exposures below the Airborne Exposure Limits. Local exhaust ventilation is generally preferred because it can control the emissions of the contaminant at its source, preventing dispersion of it into the general work area. Please refer to the ACGIH document, *Industrial Ventilation, A Manual of Recommended Practices*, most recent edition, for details.

Personal Respirators (NIOSH Approved):
If the exposure limit is exceeded and engineering controls are not feasible, wear a supplied air, full-facepiece respirator, airlined hood, or full-facepiece self-contained breathing apparatus. Breathing air quality must meet the requirements of the OSHA respiratory protection standard (29CFR1910.134).

Skin Protection:
Wear impervious protective clothing, including boots, gloves, lab coat, apron or coveralls, as appropriate, to prevent skin contact.

Eye Protection:
Use chemical safety goggles and/or full face shield where dusting or splashing of solutions is possible. Maintain eye wash fountain and quick-drench facilities in work area.

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9. Physical and Chemical Properties

Appearance:
White deliquescent granular solid.

Odor:
Almond odor. Bitter almonds.

Solubility:
48 g/100 cc @ 10C (50F)

Specific Gravity:
1.60 @ 25C/4C

pH:
Aqueous solutions are strongly alkaline.

% Volatiles by volume @ 21C (70F):
0

Boiling Point:
1496C (2725F)

Melting Point:
564C (1047F)

Vapor Density (Air=1):
No information found.

Vapor Pressure (mm Hg):

1 @ 817C (1503F)
Evaporation Rate (BuAc=1):
No information found.

10. Stability and Reactivity

Stability:
Very stable when dry. Moisture will cause slow decomposition, releasing poisonous hydrogen cyanide gas.
Hazardous Decomposition Products:
Emits toxic fumes of cyanide and oxides of nitrogen when heated to decomposition.
Hazardous Polymerization:
Will not occur.
Incompatibilities:
Acid. nitrates, nitrites, chlorates, fluorine, magnesium, and strong oxidizers. Reacts with acids to liberate toxic and flammable hydrogen cyanide gas. Water or weak alkaline solutions can produce dangerous amounts of hydrogen cyanide in confined areas. Reacts with carbon dioxide in air to form hydrogen cyanide gas.
Conditions to Avoid:
Heat, moisture, incompatibles.

11. Toxicological Information

Oral rat LD50: 6440 ug/kg. Investigated as a tumorigen, mutagen, reproductive effector.

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--------\Cancer Lists\------------------------------------------------------
                                      ---NTP Carcinogen---
Ingredient                             Known    Anticipated    IARC Category
------------------------------------   -----    -----------    -------------
Sodium Cyanide (143-33-9)               No          No             None
```

12. Ecological Information

Environmental Fate:
No information found.
Environmental Toxicity:
This material is expected to be very toxic to aquatic life. This material is expected to be very toxic to terrestrial life.

13. Disposal Considerations

Cyanides must be oxidized to harmless waste before disposal. An alkaline solution (pH about 10) is treated with chlorine or commercial bleach in excess to decompose cyanide. When cyanide-free, it can be neutralized. Whatever cannot be saved for recovery or recycling should be handled as hazardous waste and sent to a RCRA approved waste facility. Processing, use or contamination of this product may change the waste management options. State and local disposal regulations may differ from federal disposal regulations. Dispose of container and unused contents in accordance with federal, state and local requirements.

14. Transport Information

Domestic (Land, D.O.T.)

Proper Shipping Name: SODIUM CYANIDE, SOLID
Hazard Class: 6.1
UN/NA: UN1689
Packing Group: I

Information reported for product/size:
International (Water, I.M.O.)

Proper Shipping Name: SODIUM CYANIDE, SOLID
Hazard Class: 6.1
UN/NA: UN1689
Packing Group: I

Information reported for product/size:
International (Air, I.C.A.O.)

Proper Shipping Name: SODIUM CYANIDE, SOLID
Hazard Class: 6.1
UN/NA: UN1689
Packing Group: I

Information reported for product/size:

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15. Regulatory Information

```
--------\Chemical Inventory Status - Part 1\---------------------------------
Ingredient                                       TSCA  EC   Japan  Australia
-----------------------------------------------  ----  ---  -----  ---------
Sodium Cyanide (143-33-9)                         Yes  Yes   Yes      Yes

--------\Chemical Inventory Status - Part 2\---------------------------------
                                                       --Canada--
Ingredient                                       Korea  DSL   NDSL  Phil.
-----------------------------------------------  -----  ---   ----  -----
```

```
  Sodium Cyanide (143-33-9)                       Yes    Yes   No     Yes

  --------\Federal, State & International Regulations - Part 1\----------------
                                            -SARA 302-     ------SARA 313------
  Ingredient                                RQ    TPQ     List  Chemical Catg.
  -----------------------------------------  ---   -----   ----  --------------
  Sodium Cyanide (143-33-9)                  10    100     No    Cyanide comp

  --------\Federal, State & International Regulations - Part 2\----------------
                                                       -RCRA-    -TSCA-
  Ingredient                                 CERCLA    261.33     8(d)
  -----------------------------------------  ------    ------    ------
  Sodium Cyanide (143-33-9)                  10        P106       No


Chemical Weapons Convention:  Yes    TSCA 12(b):  No     CDTA:  Yes
SARA 311/312:  Acute: Yes      Chronic: Yes  Fire: No  Pressure: No
Reactivity: No          (Pure / Solid)
```

Australian Hazchem Code: 4X
Poison Schedule: S7
WHMIS:
This MSDS has been prepared according to the hazard criteria of the Controlled Products Regulations (CPR) and the MSDS contains all of the information required by the CPR.

16. Other Information

NFPA Ratings: Health: **3** Flammability: **0** Reactivity: **1**
Label Hazard Warning:
DANGER! MAY BE FATAL IF SWALLOWED, INHALED OR ABSORBED THROUGH SKIN. CONTACT WITH ACIDS LIBERATES POISONOUS GAS. CAUSES BURNS TO SKIN, EYES, AND RESPIRATORY TRACT. AFFECTS BLOOD, CARDIOVASCULAR SYSTEM, CENTRAL NERVOUS SYSTEM AND THYROID.
Label Precautions:
Do not breathe dust.
Do not get in eyes, on skin, or on clothing.
Keep container closed.
Use only with adequate ventilation.
Wash thoroughly after handling.
Label First Aid:
IN ALL CASES, GET MEDICAL ATTENTION IMMEDIATELY. KEEP A CYANIDE ANTIDOTE KIT (amyl nitrite, sodium nitrite and sodium thiosulfate) in area of product use or storage. First-aiders must take precautions to avoid contact with cyanide substance. If ingested, administer antidote kit and oxygen per pre-planned instructions. If the patient is conscious, immediately give the patient activated charcoal slurry. Never give anything by mouth to an unconscious person. Do not induce vomiting as it could interfere with resuscitator use. If inhaled, remove to fresh air. Administer antidote kit and oxygen per pre-planned instructions if symptoms occur. Keep patient warm and at rest. Do not give mouth to mouth resuscitation. In case of contact, immediately flush eyes or skin with plenty of

water for at least 15 minutes while removing contaminated clothing and shoes. Wash clothing before reuse. Administer antidote kit and oxygen per preplanned instructions if symptoms occur.

Product Use:

Laboratory Reagent.

Revision Information:

No Changes.

Disclaimer:

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Mallinckrodt Baker, Inc. provides the information contained herein in good faith but makes no representation as to its comprehensiveness or accuracy. This document is intended only as a guide to the appropriate precautionary handling of the material by a properly trained person using this product. Individuals receiving the information must exercise their independent judgment in determining its appropriateness for a particular purpose. MALLINCKRODT BAKER, INC. MAKES NO REPRESENTATIONS OR WARRANTIES, EITHER EXPRESS OR IMPLIED, INCLUDING WITHOUT LIMITATION ANY WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE WITH RESPECT TO THE INFORMATION SET FORTH HEREIN OR THE PRODUCT TO WHICH THE INFORMATION REFERS. ACCORDINGLY, MALLINCKRODT BAKER, INC. WILL NOT BE RESPONSIBLE FOR DAMAGES RESULTING FROM USE OF OR RELIANCE UPON THIS INFORMATION.

****

Prepared by: Environmental Health & Safety
Phone Number: (314) 654-1600 (U.S.A.)

MSDS Number: **M4420** * * * * * *Effective Date:* ***10/06/05*** * * * * * *Supercedes:* ***05/14/03***

MSDS *Material Safety Data Sheet*

From: Mallinckrodt Baker, Inc.
222 Red School Lane
Phillipsburg, NJ 08865

J.T.Baker

24 Hour Emergency Telephone: 908-859-2151
CHEMTREC: 1-800-424-9300

National Response in Canada
CANUTEC: 613-996-6666

Outside U.S. And Canada
Chemtrec: 703-527-3887

NOTE: CHEMTREC, CANUTEC and National Response Center emergency numbers to be used only in the event of chemical emergencies involving a spill, leak, fire, exposure or accident involving chemicals.

All non-emergency questions should be directed to Customer Service (1-800-582-2537) for assistance

METHYLENE CHLORIDE

1. Product Identification

Synonyms: MC; Dichloromethane (DCM); Methylene dichloride; Methylene bichloride; Methane dichloride
CAS No.: 75-09-2
Molecular Weight: 84.93
Chemical Formula: CH2Cl2
Product Codes: 9235, 9264, 9266, 9295, 9315, 9324, 9329, 9330, 9348, 9350, 9965, Q480

2. Composition/Information on Ingredients

Ingredient	CAS No	Percent	Hazardous
Methylene Chloride	75-09-2	> 99%	Yes

3. Hazards Identification

Emergency Overview

WARNING! HARMFUL IF SWALLOWED, INHALED OR ABSORBED THROUGH SKIN. AFFECTS CENTRAL NERVOUS SYSTEM, LIVER, CARDIOVASCULAR SYSTEM, AND BLOOD. CAUSES IRRITATION TO SKIN, EYES AND RESPIRATORY TRACT. SUSPECT CANCER HAZARD. MAY CAUSE CANCER. Risk of cancer depends on level and duration of exposure.

SAF-T-DATA$^{(tm)}$ Ratings (Provided here for your convenience)

Health Rating: 3 - Severe (Cancer Causing)
Flammability Rating: 1 - Slight
Reactivity Rating: 2 - Moderate
Contact Rating: 3 - Severe
Lab Protective Equip: GOGGLES & SHIELD; LAB COAT & APRON; VENT HOOD; PROPER GLOVES
Storage Color Code: Blue (Health)

Potential Health Effects

Inhalation:
Causes irritation to respiratory tract. Has a strong narcotic effect with symptoms of mental confusion, light-headedness, fatigue, nausea, vomiting and headache. Causes formation of carbon monoxide in blood which affects cardiovascular system and central nervous system. Continued exposure may cause increased light-headedness, staggering, unconsciousness, and even death. Exposure may make the symptoms of angina (chest pains) worse.

Ingestion:
May cause irritation of the gastrointestinal tract with vomiting. If vomiting results in aspiration, chemical pneumonia could follow. Absorption through gastrointestinal tract may produce symptoms of central nervous system depression ranging from light headedness to unconsciousness.

Skin Contact:
Causes irritation, redness and pain. Prolonged contact can cause burns. Liquid degreases the skin. May be absorbed through skin.

Eye Contact:
Vapors can cause eye irritation. Contact can produce pain, inflammation and temporal eye damage.

Chronic Exposure:
Can cause headache, mental confusion, depression, liver effects, kidney effects, bronchitis, loss of appetite, nausea, lack of balance, and visual disturbances. Can cause dermatitis upon prolonged skin contact. Methylene chloride may cause cancer in humans.

Aggravation of Pre-existing Conditions:
Persons with pre-existing skin disorders, eye problems, impaired liver, kidney, respiratory or cardiovascular function may be more susceptible to the effects of this substance.

4. First Aid Measures

Inhalation:
Remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical attention.

Ingestion:
If swallowed, DO NOT INDUCE VOMITING. Give large quantities of water. Never give anything by mouth to an unconscious person. Get medical attention immediately.

Skin Contact:
Immediately flush skin with plenty of soap and water for at least 15 minutes while removing contaminated clothing and shoes. Get medical attention. Wash clothing before reuse. Thoroughly clean shoes before reuse.

Eye Contact:
Immediately flush eyes with plenty of water for at least 15 minutes, lifting lower and upper eyelids occasionally. Get medical attention immediately.

5. Fire Fighting Measures

Fire:
Autoignition temperature: 556C (1033F)
Flammable limits in air % by volume:
lel: 12; uel: 23
Forms flammable vapor-air mixtures above 100C (212F).

Explosion:
Concentrated can be ignited by a high intensity ignition source. Vapor may form flammable mixture in atmosphere that contains a high percentage of oxygen. Sealed containers may rupture when heated.

Fire Extinguishing Media:

Dry chemical, foam or carbon dioxide. Water spray may be used to keep fire exposed containers cool.

Special Information:

In the event of a fire, wear full protective clothing and NIOSH-approved self-contained breathing apparatus with full facepiece operated in the pressure demand or other positive pressure mode. Combustion by-products include phosgene and hydrogen chloride gases. Structural firefighters' clothing provides only limited protection to the combustion products of this material.

6. Accidental Release Measures

Ventilate area of leak or spill. Remove all sources of ignition. Wear appropriate personal protective equipment as specified in Section 8. Isolate hazard area. Keep unnecessary and unprotected personnel from entering. Contain and recover liquid when possible. Use non-sparking tools and equipment. Collect liquid in an appropriate container or absorb with an inert material (e. g., vermiculite, dry sand, earth), and place in a chemical waste container. Do not use combustible materials, such as saw dust. Do not flush to sewer! US Regulations (CERCLA) require reporting spills and releases to soil, water and air in excess of reportable quantities. The toll free number for the US Coast Guard National Response Center is (800) 424-8802.

7. Handling and Storage

Keep in a tightly closed container, stored in a cool, dry, ventilated area. Protect against physical damage. Isolate from any source of heat or ignition. Outside or detached storage is recommended. Containers of this material may be hazardous when empty since they retain product residues (vapors, liquid); observe all warnings and precautions listed for the product. To minimize decomposition, all storage containers should be galvanized or lined with a phenolic coating. This material may corrode plastic and rubber. Wear special protective equipment (Sec. 8) for maintenance break-in or where exposures may exceed established exposure levels. Wash hands, face, forearms and neck when exiting restricted areas. Shower, dispose of outer clothing, change to clean garments at the end of the day. Avoid cross-contamination of street clothes. Wash hands before eating and do not eat, drink, or smoke in workplace. Odor Threshold: 205 - 307 ppm. The odor threshold only serves as a warning of exposure; not smelling it does not mean you are not being exposed.

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8. Exposure Controls/Personal Protection

Airborne Exposure Limits:

Methylene Chloride (Dichloromethane):
- OSHA Permissible Exposure Limit (PEL) -
25 ppm (TWA), 125 ppm (STEL), 12.5 ppm (8-hour TWA - Action Level)
- ACGIH Threshold Limit Value (TLV) -
50 ppm (TWA), A3 - suspected human carcinogen.

Ventilation System:

A system of local and/or general exhaust is recommended to keep employee exposures below the Airborne Exposure Limits. Local exhaust ventilation is generally preferred because it can control the emissions of the contaminant at its source, preventing dispersion of it into the general work area. Please refer to the ACGIH document, *Industrial Ventilation, A Manual of Recommended Practices*, most recent edition, for details.

Personal Respirators (NIOSH Approved):

If the exposure limit is exceeded, wear a supplied air, full-facepiece respirator, airlined hood, or full-facepiece self-contained breathing apparatus. The cartridges recommended for this material have a predicted service of less than 30 minutes at concentrations of ten times (10x) the exposure limits. Actual service life will vary considerbly, depending on concentration levels, temperature, humidity, and work rate. This substance has poor warning properties.

Skin Protection:

Wear impervious protective clothing, including boots, gloves, lab coat, apron or coveralls, as appropriate, to prevent skin contact. Neoprene is a recommended material for personal protective equipment. Natural rubber and polyvinyl chloride ARE NOT recommended materials for personal protective equipment.

Eye Protection:

Use chemical safety goggles and/or a full face shield where splashing is possible. Maintain eye wash fountain and quick-drench facilities in work area.

Other Control Measures:

Do not use closed circuit rebreathing system employing soda lime or other carbon dioxide absorber because of formation of toxic compounds capable of producing cranial nerve paralysis. See OSHA Standard for medical surveillance, record keeping, and reporting requirements for methylene chloride (29 CFR 1910.1052).

9. Physical and Chemical Properties

Appearance:

Clear, colorless liquid.

Odor:

Chloroform-like odor.

Solubility:

1.32 gm/100 gm water @ 20C.

Specific Gravity:

1.318 @ 25C

pH:

No information found.

% Volatiles by volume @ 21C (70F):

100

Boiling Point:

39.8C (104F)

Melting Point:

-97C (-143F)

Vapor Density (Air=1):

2.9

Vapor Pressure (mm Hg):

350 @ 20C (68F)

Evaporation Rate (BuAc=1):

27.5

10. Stability and Reactivity

Stability:

Stable under ordinary conditions of use and storage.

Hazardous Decomposition Products:

Emits highly toxic fumes of phosgene when heated to decomposition. Decomposes in a flame or hot surface to form toxic gas phosgene and corrosive mists of hydrochloric acid. Carbon dioxide and carbon monoxide may form when heated to decomposition.

Hazardous Polymerization:

Will not occur.

Incompatibilities:

Strong oxidizers, strong caustics, plastics, rubber, nitric acid, water + heat, and chemically active metals, such as aluminum and magnesium powder, sodium, potassium, and lithium. Avoid contact with open flames and electrical arcs. Liquid methylene chloride will attack some forms of plastics, rubber, and coatings.

Conditions to Avoid:

Moisture, heat, flames, ignition sources and incompatibles.

11. Toxicological Information

Toxicological Data:
Dichloromethane: Oral rat LD50: 1600 mg/kg; inhalation rat LC50: 52 gm/m3; investigated as a tumorigen, mutagen, reproductive effector.
Reproductive Toxicity:
Dichloromethane has been linked to spontaneous abortions in humans.

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--------\Cancer Lists\------------------------------------------------------
                                              ---NTP Carcinogen---
Ingredient                                    Known    Anticipated    IARC Category
------------------------------------          -----    -----------    -------------
Methylene Chloride (75-09-2)                   No          Yes             2B
```

12. Ecological Information

Environmental Fate:
When released into the soil, this material may leach into groundwater. When released into the soil, this material is expected to quickly evaporate. When released into water, this material may biodegrade to a moderate extent. When released to water, this material is expected to quickly evaporate. This material has a log octanol-water partition coefficient of less than 3.0. This material is not expected to significantly bioaccumulate. When released into the air, this material may be moderately degraded by reaction with photochemically produced hydroxyl radicals. When released into the air, this material is expected to have a half-life of greater than 30 days. When released into the air, this material may be removed from the atmosphere to a moderate extent by wet deposition.
Environmental Toxicity:
The LC50/96-hour values for fish are over 100 mg/l. This material is not expected to be toxic to aquatic life.

13. Disposal Considerations

Whatever cannot be saved for recovery or recycling should be handled as hazardous waste and sent to a RCRA approved incinerator or disposed in a RCRA approved waste facility. Processing, use or contamination of this product may change the waste management options. State and local disposal regulations may differ from federal disposal regulations. Dispose of container and unused contents in accordance with federal, state and local requirements.

14. Transport Information

Domestic (Land, D.O.T.)

Proper Shipping Name: DICHLOROMETHANE
Hazard Class: 6.1
UN/NA: UN1593
Packing Group: III
Information reported for product/size: 52L

International (Water, I.M.O.)

Proper Shipping Name: DICHLOROMETHANE
Hazard Class: 6.1
UN/NA: UN1593
Packing Group: III
Information reported for product/size: 52L

International (Air, I.C.A.O.)

Proper Shipping Name: DICHLOROMETHANE
Hazard Class: 6.1

UN/NA: UN1593
Packing Group: III
Information reported for product/size: 52L

15. Regulatory Information

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--------\Chemical Inventory Status - Part 1\---------------------------------
 Ingredient                                       TSCA  EC   Japan  Australia
 -----------------------------------------------  ----  ---  -----  ---------
 Methylene Chloride (75-09-2)                      Yes  Yes   Yes      Yes

--------\Chemical Inventory Status - Part 2\---------------------------------
                                                            --Canada--
 Ingredient                                       Korea  DSL   NDSL  Phil.
 -----------------------------------------------  -----  ---   ----  -----
 Methylene Chloride (75-09-2)                      Yes   Yes   No     Yes

--------\Federal, State & International Regulations - Part 1\----------------
                                            -SARA 302-    ------SARA 313------
 Ingredient                                 RQ    TPQ     List  Chemical Catg.
 -----------------------------------------  ---   -----   ----  --------------
 Methylene Chloride (75-09-2)               No    No      Yes         No

--------\Federal, State & International Regulations - Part 2\----------------
                                                          -RCRA-    -TSCA-
 Ingredient                                 CERCLA        261.33     8(d)
 -----------------------------------------  ------        ------    ------
 Methylene Chloride (75-09-2)               1000          U080       No


Chemical Weapons Convention:  No     TSCA 12(b):  No     CDTA:  No
SARA 311/312:  Acute: Yes      Chronic: Yes  Fire: No  Pressure: No
Reactivity: No          (Pure / Liquid)
```

WARNING:
THIS PRODUCT CONTAINS A CHEMICAL(S) KNOWN TO THE STATE OF CALIFORNIA TO CAUSE CANCER.

Australian Hazchem Code: 2Z
Poison Schedule: S5
WHMIS:
This MSDS has been prepared according to the hazard criteria of the Controlled Products Regulations (CPR) and the MSDS contains all of the information required by the CPR. .

16. Other Information

NFPA Ratings: Health: **2** Flammability: **1** Reactivity: **0**
Label Hazard Warning:
WARNING! HARMFUL IF SWALLOWED, INHALED OR ABSORBED THROUGH SKIN. AFFECTS CENTRAL NERVOUS SYSTEM, LIVER, CARDIOVASCULAR SYSTEM, AND BLOOD. CAUSES IRRITATION TO SKIN, EYES AND RESPIRATORY TRACT. SUSPECT CANCER HAZARD. MAY CAUSE CANCER. Risk of cancer depends on level and duration of exposure.
Label Precautions:
Do not breathe vapor.
Keep container closed.
Use only with adequate ventilation.
Wash thoroughly after handling.
Keep away from heat and flame.
Do not get in eyes, on skin, or on clothing.
Label First Aid:
If swallowed, DO NOT INDUCE VOMITING. Give large quantities of water. Never give anything by mouth to an unconscious person. If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is

difficult, give oxygen. In case of contact, immediately flush eyes or skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Wash clothing before reuse. In all cases, get medical attention.

Product Use:

Laboratory Reagent.

Revision Information:

MSDS Section(s) changed since last revision of document include: 14.

Disclaimer:

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Mallinckrodt Baker, Inc. provides the information contained herein in good faith but makes no representation as to its comprehensiveness or accuracy. This document is intended only as a guide to the appropriate precautionary handling of the material by a properly trained person using this product. Individuals receiving the information must exercise their independent judgment in determining its appropriateness for a particular purpose. MALLINCKRODT BAKER, INC. MAKES NO REPRESENTATIONS OR WARRANTIES, EITHER EXPRESS OR IMPLIED, INCLUDING WITHOUT LIMITATION ANY WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE WITH RESPECT TO THE INFORMATION SET FORTH HEREIN OR THE PRODUCT TO WHICH THE INFORMATION REFERS. ACCORDINGLY, MALLINCKRODT BAKER, INC. WILL NOT BE RESPONSIBLE FOR DAMAGES RESULTING FROM USE OF OR RELIANCE UPON THIS INFORMATION.

****

Prepared by: Environmental Health & Safety
Phone Number: (314) 654-1600 (U.S.A.)

Material Safety Data Sheet
2-Methylnaphthalene, 95-97%

ACC# 97103

Section 1 - Chemical Product and Company Identification

MSDS Name: 2-Methylnaphthalene, 95-97%
Catalog Numbers: AC127170000, AC127170050, AC127175000
Synonyms:
Company Identification:

Acros Organics N.V.
One Reagent Lane
Fair Lawn, NJ 07410

For information in North America, call: 800-ACROS-01
For emergencies in the US, call CHEMTREC: 800-424-9300

Section 2 - Composition, Information on Ingredients

CAS#	Chemical Name	Percent	EINECS/ELINCS
91-57-6	2-Methylnaphthalene	95-97.0	202-078-3

Section 3 - Hazards Identification

EMERGENCY OVERVIEW

Appearance: Not available.
Caution! May cause allergic skin reaction. Causes eye irritation. Causes skin irritation. May be harmful if swallowed. May cause respiratory and digestive tract irritation.
Target Organs: None.

Potential Health Effects
Eye: Causes eye irritation.
Skin: Causes skin irritation. May cause photosensitive skin reactions in certain individuals.
Ingestion: May be harmful if swallowed.
Inhalation: Inhalation of dust may cause respiratory tract irritation.
Chronic: No information found.

Section 4 - First Aid Measures

Eyes: Flush eyes with plenty of water for at least 15 minutes, occasionally lifting the upper and lower eyelids. Get medical aid immediately.
Skin: Get medical aid. Flush skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes.
Ingestion: If victim is conscious and alert, give 2-4 cupfuls of milk or water. Never give

anything by mouth to an unconscious person. Get medical aid immediately.
Inhalation: Remove from exposure and move to fresh air immediately. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical aid.
Notes to Physician: Treat symptomatically and supportively.

Section 5 - Fire Fighting Measures

General Information: As in any fire, wear a self-contained breathing apparatus in pressure-demand, MSHA/NIOSH (approved or equivalent), and full protective gear. Dusts at sufficient concentrations can form explosive mixtures with air. During a fire, irritating and highly toxic gases may be generated by thermal decomposition or combustion.
Extinguishing Media: Use water spray, dry chemical, carbon dioxide, or chemical foam.
Flash Point: Not available
Autoignition Temperature: Not available.
Explosion Limits, Lower: Not available.
Upper: Not available.
NFPA Rating: (estimated) Health: 1; Flammability: 1; Instability: 0

Section 6 - Accidental Release Measures

General Information: Use proper personal protective equipment as indicated in Section 8.
Spills/Leaks: Sweep up, then place into a suitable container for disposal. Avoid generating dusty conditions. Provide ventilation.

Section 7 - Handling and Storage

Handling: Wash thoroughly after handling. Remove contaminated clothing and wash before reuse. Minimize dust generation and accumulation. Avoid contact with eyes, skin, and clothing. Keep container tightly closed. Avoid ingestion and inhalation.
Storage: Keep container closed when not in use. Store in a tightly closed container. Store in a cool, dry, well-ventilated area away from incompatible substances.

Section 8 - Exposure Controls, Personal Protection

Engineering Controls: Use adequate ventilation to keep airborne concentrations low.
Exposure Limits

Chemical Name	ACGIH	NIOSH	OSHA - Final PELs
2-Methylnaphthalene	none listed	none listed	none listed

OSHA Vacated PELs: 2-Methylnaphthalene: No OSHA Vacated PELs are listed for this chemical.
Personal Protective Equipment
Eyes: Wear appropriate protective eyeglasses or chemical safety goggles as described by OSHA's eye and face protection regulations in 29 CFR 1910.133 or European Standard

EN166.
Skin: Wear appropriate protective gloves to prevent skin exposure.
Clothing: Wear appropriate protective clothing to prevent skin exposure.
Respirators: Follow the OSHA respirator regulations found in 29 CFR 1910.134 or European Standard EN 149. Use a NIOSH/MSHA or European Standard EN 149 approved respirator if exposure limits are exceeded or if irritation or other symptoms are experienced.

Section 9 - Physical and Chemical Properties

Physical State: Solid
Appearance: Not available.
Odor: None reported
pH: Not available.
Vapor Pressure: < 1 mm Hg @25c
Vapor Density: Not available.
Evaporation Rate: Not available.
Viscosity: Not available.
Boiling Point: 241.1 deg C
Freezing/Melting Point:37-38c
Decomposition Temperature: Not available.
Solubility: Insoluble.
Specific Gravity/Density:1.0000g/cm3
Molecular Formula:$C_{11}H_{10}$
Molecular Weight:142.20

Section 10 - Stability and Reactivity

Chemical Stability: Stable under normal temperatures and pressures.
Conditions to Avoid: Incompatible materials, dust generation, strong oxidants.
Incompatibilities with Other Materials: Strong oxidizing agents.
Hazardous Decomposition Products: Carbon monoxide, irritating and toxic fumes and gases, carbon dioxide.
Hazardous Polymerization: Has not been reported.

Section 11 - Toxicological Information

RTECS#:
CAS# 91-57-6: QJ9635000
LD50/LC50:
CAS# 91-57-6:
    Oral, rat: LD50 = 1630 mg/kg;

.

Carcinogenicity:
CAS# 91-57-6: Not listed by ACGIH, IARC, NTP, or CA Prop 65.

Epidemiology: No information available.

Teratogenicity: No information available.
Reproductive Effects: No information available.
Mutagenicity: No information available.
Neurotoxicity: No information available.
Other Studies:

Section 12 - Ecological Information

No information available.

Section 13 - Disposal Considerations

Chemical waste generators must determine whether a discarded chemical is classified as a hazardous waste. US EPA guidelines for the classification determination are listed in 40 CFR Parts 261.3. Additionally, waste generators must consult state and local hazardous waste regulations to ensure complete and accurate classification.
RCRA P-Series: None listed.
RCRA U-Series: None listed.

Section 14 - Transport Information

	US DOT	Canada TDG
Shipping Name:	ENVIRONMENTALLY HAZARDOUS SUBSTANCES, SOLID, N.O.S.	No information available.
Hazard Class:	9	
UN Number:	UN3077	
Packing Group:	III	

Section 15 - Regulatory Information

US FEDERAL

TSCA
CAS# 91-57-6 is listed on the TSCA inventory.
Health & Safety Reporting List
None of the chemicals are on the Health & Safety Reporting List.
Chemical Test Rules
None of the chemicals in this product are under a Chemical Test Rule.
Section 12b
None of the chemicals are listed under TSCA Section 12b.
TSCA Significant New Use Rule
None of the chemicals in this material have a SNUR under TSCA.
CERCLA Hazardous Substances and corresponding RQs
None of the chemicals in this material have an RQ.
SARA Section 302 Extremely Hazardous Substances
None of the chemicals in this product have a TPQ.
SARA Codes

CAS # 91-57-6: immediate.

Section 313 No chemicals are reportable under Section 313.

Clean Air Act:

This material does not contain any hazardous air pollutants.
This material does not contain any Class 1 Ozone depletors.
This material does not contain any Class 2 Ozone depletors.

Clean Water Act:

None of the chemicals in this product are listed as Hazardous Substances under the CWA.
None of the chemicals in this product are listed as Priority Pollutants under the CWA.
None of the chemicals in this product are listed as Toxic Pollutants under the CWA.

OSHA:

None of the chemicals in this product are considered highly hazardous by OSHA.

STATE

CAS# 91-57-6 is not present on state lists from CA, PA, MN, MA, FL, or NJ.

California Prop 65

California No Significant Risk Level: None of the chemicals in this product are listed.

European/International Regulations

European Labeling in Accordance with EC Directives

Hazard Symbols:

XN

Risk Phrases:

R 22 Harmful if swallowed.

Safety Phrases:

WGK (Water Danger/Protection)

CAS# 91-57-6: No information available.

Canada - DSL/NDSL

CAS# 91-57-6 is listed on Canada's DSL List.

Canada - WHMIS

WHMIS: Not available.

This product has been classified in accordance with the hazard criteria of the Controlled Products Regulations and the MSDS contains all of the information required by those regulations.

Canadian Ingredient Disclosure List

Section 16 - Additional Information

MSDS Creation Date: 7/15/1998
Revision #3 Date: 10/03/2005

The information above is believed to be accurate and represents the best information currently available to us. However, we make no warranty of merchantability or any other warranty, express or implied, with respect to such information, and we assume no liability resulting from its use. Users should make their own investigations to determine the suitability of the information for their particular purposes. In no event shall Fisher be liable for any claims, losses, or damages of any third party or for lost profits or any special, indirect, incidental, consequential or exemplary damages, howsoever arising, even if Fisher has been advised of the possibility of such damages.

MSDS Number: **T0767** * * * * * *Effective Date:* ***08/16/05*** * * * * * *Supercedes:* ***05/08/03***

MSDS *Material Safety Data Sheet*

24 Hour Emergency Telephone 908-859-2151
CHEMTREC: 1-800-424-9300

National Response in Canada
CANUTEC: 613-996-6666

Outside U.S. and Canada
Chemtrec: 703-527-3887

NOTE: CHEMTREC, CANUTEC and National Response Center emergency numbers to be used only in the event of chemical emergencies involving a spill, leak, fire, exposure or accident involving chemicals.

From: Mallinckrodt Baker, Inc.
222 Red School Lane
Phillipsburg, NJ 08865

Mallinckrodt CHEMICALS J.T.Baker

All non-emergency questions should be directed to Customer Service (1-800-582-2537) for assistance.

TETRACHLOROETHYLENE

1. Product Identification

Synonyms: ethylene tetrachloride; tetrachloroethene; perchloroethylene; carbon bichloride; carbon dichloride
CAS No.: 127-18-4
Molecular Weight: 165.83
Chemical Formula: $Cl_2C:CCl_2$
Product Codes:
J.T. Baker: 9218, 9360, 9453, 9465, 9469
Mallinckrodt: 1933, 8058

2. Composition/Information on Ingredients

Ingredient	CAS No	Percent	Hazardous
Tetrachloroethylene	127-18-4	99 - 100%	Yes

3. Hazards Identification

Emergency Overview

WARNING! HARMFUL IF SWALLOWED, INHALED OR ABSORBED THROUGH SKIN. CAUSES IRRITATION TO SKIN, EYES AND RESPIRATORY TRACT. AFFECTS CENTRAL NERVOUS SYSTEM, LIVER AND KIDNEYS. SUSPECT CANCER HAZARD. MAY CAUSE CANCER. Risk of cancer depends on level and duration of exposure.

SAF-T-DATA$^{(tm)}$ Ratings (Provided here for your convenience)

Health Rating: 2 - Moderate (Poison)
Flammability Rating: 0 - None
Reactivity Rating: 1 - Slight
Contact Rating: 2 - Moderate (Life)
Lab Protective Equip: GOGGLES; LAB COAT; VENT HOOD; PROPER GLOVES

Storage Color Code: Blue (Health)

Potential Health Effects

Inhalation:
Irritating to the upper respiratory tract. Giddiness, headache, intoxication, nausea and vomiting may follow the inhalation of large amounts while massive amounts can cause breathing arrest, liver and kidney damage, and death. Concentrations of 600 ppm and more can affect the central nervous system after a few minutes.
Ingestion:
Not highly toxic by this route because of low water solubility. Used as an oral dosage for hookworm (1 to 4 ml). Causes abdominal pain, nausea, diarrhea, headache, and dizziness.
Skin Contact:
Causes irritation to skin. Symptoms include redness, itching, and pain. May be absorbed through the skin with possible systemic effects.
Eye Contact:
Causes irritation, redness, and pain.
Chronic Exposure:
May cause liver, kidney or central nervous system damage after repeated or prolonged exposures. Suspected cancer risk from animal studies.
Aggravation of Pre-existing Conditions:
Persons with pre-existing skin disorders or eye problems or impaired liver or kidney function may be more susceptible to the effects of the substance. The use of alcoholic beverages enhances the toxic effects.

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4. First Aid Measures

Inhalation:
Remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Call a physician.
Ingestion:
Aspiration hazard. If swallowed, DO NOT INDUCE VOMITING. Give large quantities of water. Never give anything by mouth to an unconscious person. Get medical attention immediately.
Skin Contact:
Wash skin with soap or mild detergent and water for at least 15 minutes while removing contaminated clothing and shoes. Wash clothing before reuse. Call a physician.
Eye Contact:
Immediately flush eyes with plenty of water for at least 15 minutes, lifting lower and upper eyelids occasionally. Get medical attention immediately.

Note to Physician:
Do not administer adrenaline or epinephrine to a victim of chlorinated solvent poisoning.

5. Fire Fighting Measures

Fire:
Not considered to be a fire hazard but becomes hazardous in a fire situation because of vapor generation and possible degradation to phosgene (highly toxic) and hydrogen chloride (corrosive). Vapors are heavier than air and collect in low-lying areas.
Explosion:
Not considered to be an explosion hazard. Containers may explode when involved in a fire.
Fire Extinguishing Media:
Use any means suitable for extinguishing surrounding fire. Water spray may be used to keep fire exposed containers cool.
Special Information:

In the event of a fire, wear full protective clothing and NIOSH-approved self-contained breathing apparatus with full facepiece operated in the pressure demand or other positive pressure mode.

6. Accidental Release Measures

Ventilate area of leak or spill. Wear appropriate personal protective equipment as specified in Section 8. Isolate hazard area. Keep unnecessary and unprotected personnel from entering. Contain and recover liquid when possible. Neutralize with alkaline material (soda ash, lime), then absorb with an inert material (e. g., vermiculite, dry sand, earth), and place in a chemical waste container. Do not use combustible materials, such as saw dust. Do not flush to sewer! US Regulations (CERCLA) require reporting spills and releases to soil, water and air in excess of reportable quantities. The toll free number for the US Coast Guard National Response Center is (800) 424-8802.

7. Handling and Storage

Store in a cool, dry, ventilated area away from sources of heat or ignition. Isolate from flammable materials. Protect from direct sunlight. Wear special protective equipment (Sec. 8) for maintenance break-in or where exposures may exceed established exposure levels. Wash hands, face, forearms and neck when exiting restricted areas. Shower, dispose of outer clothing, change to clean garments at the end of the day. Avoid cross-contamination of street clothes. Wash hands before eating and do not eat, drink, or smoke in workplace. Containers of this material may be hazardous when empty since they retain product residues (vapors, liquid); observe all warnings and precautions listed for the product.

8. Exposure Controls/Personal Protection

Airborne Exposure Limits:
-OSHA Permissible Exposure Limit (PEL):
100 ppm (TWA), 200 ppm (ceiling),
300 ppm/5min/3-hour (max)

-ACGIH Threshold Limit Value (TLV):
25 ppm (TWA), 100 ppm (STEL); listed as A3, animal carcinogen

Ventilation System:
A system of local and/or general exhaust is recommended to keep employee exposures below the Airborne Exposure Limits. Local exhaust ventilation is generally preferred because it can control the emissions of the contaminant at its source, preventing dispersion of it into the general work area. Please refer to the ACGIH document, *Industrial Ventilation, A Manual of Recommended Practices*, most recent edition, for details.

Personal Respirators (NIOSH Approved):
If the exposure limit is exceeded, wear a supplied air, full-facepiece respirator, airlined hood, or full-facepiece self-contained breathing apparatus.

Skin Protection:
Wear impervious protective clothing, including boots, gloves, lab coat, apron or coveralls, as appropriate, to prevent skin contact.

Eye Protection:
Use chemical safety goggles and/or full face shield where dusting or splashing of solutions is possible. Maintain eye wash fountain and quick-drench facilities in work area.

9. Physical and Chemical Properties

Appearance:

Clear, colorless liquid.
Odor:
Ethereal odor.
Solubility:
0.015 g in 100 g of water.
Specific Gravity:
1.62 @ 20C/4C
pH:
No information found.
% Volatiles by volume @ 21C (70F):
100
Boiling Point:
121C (250F)
Melting Point:
-19C (-2F)
Vapor Density (Air=1):
5.7
Vapor Pressure (mm Hg):
18 @ 25C (77F)
Evaporation Rate (BuAc=1):
0.33 (trichloroethylene = 1)

10. Stability and Reactivity

Stability:
Stable under ordinary conditions of use and storage. Slowly decomposed by light. Deteriorates rapidly in warm, moist climates.
Hazardous Decomposition Products:
Carbon dioxide and carbon monoxide may form when heated to decomposition. Hydrogen chloride gas and phosgene gas may be formed upon heating. Decomposes with moisture to yield trichloroacetic acid and hydrochloric acid.
Hazardous Polymerization:
Will not occur.
Incompatibilities:
Strong acids, strong oxidizers, strong alkalis, especially NaOH, KOH; finely divided metals, especially zinc, barium, lithium. Slowly corrodes aluminum, iron and zinc.
Conditions to Avoid:
Moisture, light, heat and incompatibles.

11. Toxicological Information

Oral rat LD50: 2629 mg/kg; inhalation rat LC50: 4100 ppm/6H; investigated as a tumorigen, mutagen, reproductive effector.

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--------\Cancer Lists\------------------------------------------------------
                                                ---NTP Carcinogen---
Ingredient                                      Known    Anticipated    IARC Category
------------------------------------            -----    -----------    -------------
Tetrachloroethylene (127-18-4)                   No         Yes              2A
```

12. Ecological Information

Environmental Fate:
When released into the soil, this material is expected to quickly evaporate. When released into the soil, this

material may leach into groundwater. When released into the soil, this material may biodegrade to a moderate extent. When released to water, this material is expected to quickly evaporate. When released into water, this material is not expected to biodegrade. This material is not expected to significantly bioaccumulate. When released into the air, this material may be moderately degraded by reaction with photochemically produced hydroxyl radicals.

Environmental Toxicity:

The LC50/96-hour values for fish are between 1 and 10 mg/l. The LC50/96-hour values for fish are between 10 and 100 mg/l. This material is expected to be toxic to aquatic life.

13. Disposal Considerations

Whatever cannot be saved for recovery or recycling should be handled as hazardous waste and sent to a RCRA approved incinerator or disposed in a RCRA approved waste facility. Processing, use or contamination of this product may change the waste management options. State and local disposal regulations may differ from federal disposal regulations. Dispose of container and unused contents in accordance with federal, state and local requirements.

14. Transport Information

Domestic (Land, D.O.T.)

Proper Shipping Name: TETRACHLOROETHYLENE
Hazard Class: 6.1
UN/NA: UN1897
Packing Group: III
Information reported for product/size: 20L

International (Water, I.M.O.)

Proper Shipping Name: TETRACHLOROETHYLENE
Hazard Class: 6.1
UN/NA: UN1897
Packing Group: III
Information reported for product/size: 20L

15. Regulatory Information

```
--------\Chemical Inventory Status - Part 1\---------------------------------
Ingredient                                       TSCA  EC   Japan  Australia
-----------------------------------------------  ----  ---  -----  ---------
Tetrachloroethylene (127-18-4)                    Yes  Yes   Yes      Yes

--------\Chemical Inventory Status - Part 2\---------------------------------
                                                        --Canada--
Ingredient                                       Korea  DSL   NDSL  Phil.
-----------------------------------------------  -----  ---   ----  -----
Tetrachloroethylene (127-18-4)                    Yes   Yes   No     Yes

--------\Federal, State & International Regulations - Part 1\----------------
                                           -SARA 302-    ------SARA 313------
Ingredient                                 RQ    TPQ     List  Chemical Catg.
-----------------------------------------  ---   -----   ----  --------------
Tetrachloroethylene (127-18-4)             No    No      Yes         No

--------\Federal, State & International Regulations - Part 2\----------------
                                                      -RCRA-    -TSCA-
Ingredient                                 CERCLA     261.33    8(d)
-----------------------------------------  ------     ------    ------
```

```
  Tetrachloroethylene (127-18-4)           100        U210       No

Chemical Weapons Convention:  No     TSCA 12(b):  No     CDTA:  No
SARA 311/312:  Acute: Yes      Chronic: Yes  Fire: No  Pressure: No
Reactivity: No          (Pure / Liquid)
```

WARNING:
THIS PRODUCT CONTAINS A CHEMICAL(S) KNOWN TO THE STATE OF CALIFORNIA TO CAUSE CANCER.

Australian Hazchem Code: 2[Z]
Poison Schedule: None allocated.
WHMIS:
This MSDS has been prepared according to the hazard criteria of the Controlled Products Regulations (CPR) and the MSDS contains all of the information required by the CPR.

16. Other Information

NFPA Ratings: Health: **2** Flammability: **0** Reactivity: **0**
Label Hazard Warning:
WARNING! HARMFUL IF SWALLOWED, INHALED OR ABSORBED THROUGH SKIN. CAUSES IRRITATION TO SKIN, EYES AND RESPIRATORY TRACT. AFFECTS CENTRAL NERVOUS SYSTEM, LIVER AND KIDNEYS. SUSPECT CANCER HAZARD. MAY CAUSE CANCER. Risk of cancer depends on level and duration of exposure.
Label Precautions:
Do not get in eyes, on skin, or on clothing.
Do not breathe vapor or mist.
Keep container closed.
Use only with adequate ventilation.
Wash thoroughly after handling.
Label First Aid:
If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. If swallowed, DO NOT INDUCE VOMITING. Give large quantities of water. Never give anything by mouth to an unconscious person. In case of contact, immediately flush eyes or skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Wash clothing before reuse. In all cases call a physician.
Product Use:
Laboratory Reagent.
Revision Information:
MSDS Section(s) changed since last revision of document include: 3, 11.
Disclaimer:
****

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Prepared by: Environmental Health & Safety

Phone Number: (314) 654-1600 (U.S.A.)

MATERIAL SAFETY DATA SHEET

Revision Date: 03/02/2004

SECTION 1 PRODUCT AND COMPANY IDENTIFICATION

PRODUCT: Shell Jet-A
MSDS NUMBER: 52130E - 11
PRODUCT CODE(S): 23500

MANUFACTURER ADDRESS:Shell Oil Products US, P. O. Box 4453, Houston, TX. 77210-4453

TELEPHONE NUMBERS
Spill Information: (877) 242-7400
Health Information: (877) 504-9351
MSDS Assistance Number: (877) 276-7285

SECTION 2 PRODUCT/INGREDIENTS

CAS#	CONCENTRATION	INGREDIENTS
Mixture	100 %weight	Jet Fuel
8008-20-6	96.6 - 99.98 %weight	Kerosene
91-20-3	0 - 2.99 %weight	Naphthalene
7704-34-9	0 - 0.29 %weight	Sulfur
71-43-2	0.01 - 0.08 %weight	Benzene

SECTION 3 HAZARDS IDENTIFICATION

EMERGENCY OVERVIEW
Appearance & Odor: Clear, white liquid. Kerosene odor.
Health Hazards: May cause skin irritation. May be harmful or fatal if swallowed. Do not induce vomiting. May cause aspiration pneumonitis. May cause CNS depression.
NFPA Rating (Health, Fire, Reactivity): 2, 2, 0
Hazard Rating:Least - 0 Slight - 1 Moderate - 2 High - 3 Extreme - 4

Inhalation:
In applications where vapors (caused by high temperature) or mists (caused by mixing or spraying) are created, breathing may cause a mild burning sensation in the nose, throat and lungs. Breathing of high vapor concentrations may cause CNS depression, evidenced by dizziness, light-headedness, headache, nausea, drowsiness, and loss of coordination. Continued inhalation may result in unconsciousness.

Eye Irritation:
May cause slight irritation of the eyes. If irritation occurs, a temporary burning sensation, minor redness, swelling, and/or blurred vision may result.

Skin Contact:
May be irritating to the skin causing a burning sensation, redness and/or swelling. Other adverse effects not expected from brief skin contact.

Ingestion:
This material may be harmful or fatal if swallowed. Ingestion may result in vomiting; aspiration (breathing) of vomitus into lungs must be avoided as even small quantities may result in aspiration pneumonitis. Generally considered to have a low order of acute oral toxicity.
Other Health Effects:
Carcinogenic in animal tests. It is probable that the material causes cancer in laboratory animals.

Refer to Section 11, Toxicological Information, for specific information on the following effects:
Genotoxicity, Immunotoxicity

Primary Target Organs:
The following organs and/or organ systems may be damaged by overexposure to this material and/or its components:
Eye, Blood/Blood Forming Organs, Kidney, Liver, Skin
Signs and Symptoms:
Irritation as noted above. Aspiration pneumonitis may be evidenced by coughing, labored breathing and cyanosis (bluish skin); in severe cases death may occur. Damage to blood-forming organs may be evidenced by: a) easy fatigability and pallor (RBC effect), b) decreased resistance to infection (WBC effect), c) excessive bruising and bleeding (platelet effect). Kidney damage may be indicated by changes in urine output or appearance, pain upon urination or in the lower back or general edema (swelling from fluid retention). Liver damage may be indicated by loss of appetite, jaundice (yellowish skin and eye color), fatigue and sometimes pain and swelling in the upper right abdomen.

For additional health information, refer to section 11.

SECTION 4 FIRST AID MEASURES

Inhalation:
Move victim to fresh air and provide oxygen if breathing is difficult. Get medical attention. If the victim has difficulty breathing or tightness of the chest, is dizzy, vomiting or unresponsive, give 100% oxygen with rescue breathing or CPR as required and transport to the nearest medical facility.

Skin:
Remove contaminated clothing. Wipe off excess material from exposed area. Flush with large amounts of water for at least 15 minutes and follow by washing with soap if available. If redness, swelling, pain and/or blisters occur, transport to the nearest medical facility for additional treatment.

Eye:
Flush eyes with plenty of water while holding eyelids open. Rest eyes for 30 minutes. If redness, burning, blurred vision or swelling occur, transport to nearest medical facility for additional treatment.

Ingestion:
DO NOT induce vomiting. DO NOT take internally. In general no treatment is necessary unless large quantities are swallowed, however, get medical advice. Have victim rinse mouth out with water, then drink sips of water to remove taste from mouth. If vomiting occurs spontaneously, keep head below hips to prevent aspiration.

Note to Physician:
If more than 2.0ml/kg body weight has been ingested and vomiting has not occurred, emesis should be induced with supervision. Keep victim's head below hips to prevent aspiration. If symptoms such as loss of gag reflex, convulsions, or unconsciousness occur before emesis, gastric lavage using a cuffed endotracheal tube should be considered.

SECTION 5 FIRE FIGHTING MEASURES

Flash Point [Method]: >100 °F/>37.78 °C [Closed Cup]
Flammability in Air: 0.7 - 5 %volume

Extinguishing Media:
Material will float and can be re-ignited on surface of water. Use water fog, 'alcohol foam', dry chemical or carbon dioxide (CO2) to extinguish flames. Do not use a direct stream of water.

Fire Fighting Instructions:
CAUTION! COMBUSTIBLE. Clear fire area of all non-emergency personnel. Do not enter confined fire space without full bunker gear (helmet with face shield, bunker coats, gloves and rubber boots), including a positive pressure, NIOSH approved, self-contained breathing apparatus. Cool surrounding equipment, fire-exposed containers and structures with water. Container areas exposed to direct flame contact should be cooled with large quantities of water (500 gallons water per minute flame impingement exposure) to prevent weakening of container structure.

SECTION 6 ACCIDENTAL RELEASE MEASURES

Protective Measures:
CAUTION! COMBUSTIBLE. Eliminate potential sources of ignition. Handling equipment must be bonded and grounded to prevent sparking.

Wear appropriate personal protective equipment when cleaning up spills. Refer to Section 8.

Spill Management:
Shut off source of leak if safe to do so. Dike and contain spill.

FOR LARGE SPILLS: Remove with vacuum truck or pump to storage/salvage vessels.

FOR SMALL SPILLS: Soak up residue with an absorbent such as clay, sand or other suitable material. Place in non-leaking container and seal tightly for proper disposal. Remove contaminated soil to remove contaminated trace residues. Dispose of in same manner as material.

Reporting:
U.S. regulations require reporting releases of this material to the environment which exceed the reportable quantity to the National Response Center at (800)424-8802.
CWA: This product is an oil as defined under Section 311 of EPA's Clean Water Act (CWA). Spills into or leading to surface waters that cause a sheen must be reported to the National Response Center, 1-800-424-8802.

SECTION 7 HANDLING AND STORAGE

Precautionary Measures:
CAUTION! COMBUSTIBLE. Avoid heat, open flames, including pilot lights, and strong oxidizing agents. Use explosion-proof ventilation to prevent vapor accumulation. Ground all handling equipment to prevent sparking. Avoid contact with eyes, skin and clothing. Wash thoroughly after handling.

Handling:
Surfaces that are sufficiently hot may ignite liquid material.

Storage:
Keep liquid and vapor away from heat, sparks and flame. Extinguish pilot lights, cigarettes and turn off other sources of ignition prior to use and until all vapors have dissipated. Use explosion-proof ventilation indoors and in laboratory settings.

Container Warnings:
Keep containers closed when not in use. Containers, even those that have been emptied, can contain explosive vapors. Do not cut, drill, grind, weld or perform similar operations on or near containers.

SECTION 8 EXPOSURE CONTROLS/PERSONAL PROTECTION

Kerosene ACGIH TLV TWA: 200 mg/m3
Kerosene OSHA PEL TWA: 100 ppmv
Naphthalene ACGIH TLV TWA: 10 ppmm STEL: 15 ppmm
Naphthalene OSHA PEL TWA: 10 ppmv
Naphthalene OSHA PEL - 1989(revoked) TWA: 10 ppmv STEL: 15 ppmv

EXPOSURE CONTROLS
Adequate explosion-proof ventilation to control airborne concentrations.

PERSONAL PROTECTION
Personal protective equipment (PPE) selections vary based on potential exposure conditions such as handling practices, concentration and ventilation. Information on the selection of eye, skin and respiratory protection for use with this material is provided below.

Eye Protection:
Chemical Goggles - If liquid contact is likely., or Safety glasses with side shields

Skin Protection:
Use protective clothing which is chemically resistant to this material. Selection of protective clothing depends on potential exposure conditions and may include gloves, boots, suits and other items. The selection(s) should take into account such factors as job task, type of exposure and durability requirements.

Published literature, test data and/or glove and clothing manufacturers indicate the best protection is provided by:
Neoprene, or Nitrile Rubber

Respiratory Protection:
If engineering controls do not maintain airborne concentrations to a level which is adequate to protect worker health, an approved respirator must be worn. Respirator selection, use and maintenance should be in accordance with the requirements of the OSHA Respiratory Protection Standard, 29 CFR 1910.134.

Types of respirator(s) to be considered in the selection process include:
Supplied-Air Respirator. Air-Purifying Respirator for Organic Vapors.
Self-contained breathing apparatus for use in environments with unknown concentrations or emergency situations.

SECTION 9 PHYSICAL AND CHEMICAL PROPERTIES

Appearance & Odor: Clear, white liquid. Kerosene odor.
Substance Chemical Family: Petroleum Hydrocarbon
Appearance: Clear, white liquid.

Boiling Point: > 320 °F

Flammability in Air: 0.7 - 5 %volume

Flash Point: > 100 °F [Closed Cup]

Solubility (in Water): Negligible

Specific Gravity: 0.8 - 0.82

Stability: Stable

Vapor Density: > 1

Viscosity: 1.3 - 2.4 @ 40 °C

SECTION 10 REACTIVITY AND STABILITY

Stability:
Material is stable under normal conditions.

Conditions to Avoid:
Avoid heat and open flames.

Materials to Avoid:
Avoid contact with strong oxidizing agents.

Hazardous Decomposition Products:
Thermal decomposition products are highly dependent on combustion conditions. A complex mixture of airborne solids, liquids and gases will evolve when this material undergoes pyrolysis or combustion. Hydrogen Sulfide and other unidentified organic compounds may be formed upon combustion.

SECTION 11 TOXICOLOGICAL INFORMATION

Acute Toxicity
  Dermal LD50 > 2 g/kg(Rabbit) OSHA: Non-Toxic Based on similar material(s)
  Eye Irritation 2.0 [Rabbit, 1 hour(s)] OSHA: Non-Irritating Based on similar material(s)
  Oral LD50 > 5 g/kg(Rat) OSHA: Non-Toxic Based on similar material(s)
  Skin Irritation 5.5 [Rabbit] OSHA: Irritating Based on similar material(s)
Carcinogenicity Classification
Jet Fuel
  NTP: No IARC: Not Classifiable (3) ACGIH: A3 OSHA: No
Naphthalene
  NTP: Yes IARC: Possible Carcinogen (2B) ACGIH: A4 OSHA: No

Toxic Effects - JET A
Carcinogenicity
Long-term skin painting of kerosene and related materials caused malignant skin tumors with long latency periods (appearing late in the animals lives) in mice. Mechanistic studies suggest that these tumors are a secondary effect related to prolonged skin injury and irritation. A two-year inhalation study in rats found that naphthalene caused tumors in the lining of the nose (olfactory epithelial neuroblastoma) and respiratory tract (respiratory

epithelial adenoma) of both male and female animals.

Eye
Animal studies indicate that long-term exposure to high doses of naphthalene can cause the formation of lens opacities (cataracts). Case reports suggest that oral, dermal and inhalation exposure may cause similar effects in humans. However, large-scale studies in exposed workers have failed to confirm this.

Genotoxicity
The vast majority of genotoxicity tests conducted on kerosene and related petroleum streams have not indicated genetic toxicity or mutagenicity. However, a few exceptions have been reported. One kerosene-like material was found to be mutagenic in the L5178Y mouse lymphoma assay with metabolic activation (a test-tube procedure) and to cause chromosome damage in the in vivo (live animal) rat cytogenetics assay. Jet Fuel A was reported to produce chromosome damage in at least one rat study.

Blood/Blood Forming Organs
Hemolytic anemia is the most frequent manifestation of naphthalene exposure in humans with secondary effects reported including jaundice, neurological damage, and respiratory difficulty.

Immunotoxicity
Dermal and inhalation exposure to JP-8 jet fuel have been shown to reduce or inhibit certain indictors of immune function in mice. Some studies also show evidence of functional immune suppression such as a decreased sensitization (allergic) response and decreased response to a viral challenge.

Kidney
Nephropathy (kidney damage) caused by kerosene inhalation appears to be male rat specific (accumulation of alpha-2-u globulin) and is probably not relevant to humans. Renal toxicity has been reported in case studies of humans who ingested naphthalene.

Liver
Tissue damage was observed in some organs of rabbits following repeated skin exposure to related petroleum materials. Microscopic changes seen in the liver (mottled necrosis and centrilobular degeneration), kidney and bladder (hyperplasia) were considered to be secondary to (caused by) the severe skin irritancy.

Skin
Prolonged and repeated high level dermal (skin) exposure to a middle-distillate material in rabbits results in severe irritation and histopathologic(microscopic tissue changes) including inflammatory cell infiltration, acanthosis (thickening), fibrosis, hyperkeratosis (hardening) and scab formation. All changes appear to be related to chronic irritation.

SECTION 12 ECOLOGICAL INFORMATION

Environmental Impact Summary:
There is no ecological data available for this product.

SECTION 13 DISPOSAL CONSIDERATIONS

RCRA Information:

Under RCRA, it is the responsibility of the user of the material to determine, at the time of the disposal, whether the material meets RCRA criteria for hazardous waste. This is because material uses, transformations, mixtures, processes, etc. may affect the classification. Refer to the latest EPA, state and local regulations regarding proper disposal.

SECTION 14 TRANSPORT INFORMATION

US Department of Transportation Classification

Proper Shipping Name: Fuel, Aviation, Turbine Engine
Identification Number: UN1863
Hazard Class/Division: 3 (Flammable Liquid)
Packing Group: III
Hazardous Substance/Material RQ: Naphthalene / 100 lbs

Oil: This product is an oil under 49CFR (DOT) Part 130. If shipped by rail or highway in a tank with a capacity of 3500 gallons or more, it is subject to these requirements. Mixtures or solutions containing 10% or more of this product may also be subject to this rule.
Emergency Response Guide # 128

International Air Transport Association

Hazard Class/Division: 3 (Flammable Liquid)
Identification Number: UN1863
Packing Group: III
Proper Shipping Name: Fuel, Aviation, Turbine Engine

International Maritime Organization Classification

Hazard Class/Division: 3 (Flammable Liquid)
Identification Number: UN1863
Packing Group: III
Proper Shipping Name: Fuel, Aviation, Turbine Engine

SECTION 15 REGULATORY INFORMATION

FEDERAL REGULATORY STATUS

OSHA Classification:
Product is hazardous according to the OSHA Hazard Communication Standard, 29 CFR 1910.1200.
Comprehensive Environmental Release, Compensation & Liability Act (CERCLA):
Benzene RQ 10 lbs Reportable Spill => 11111 lbs or 1666 gal

Clean Air Act (CAA):
This material is classified as a Hazardous Air Pollutant under the Clean Air Act (CAA).

Ozone Depleting Substances (40 CFR 82 Clean Air Act):
This material does not contain nor was it directly manufactured with any Class I or Class II ozone depleting substances.

Superfund Amendment & Reauthorization Act (SARA) Title III:

There are no components in this product on the SARA 302 list.

SARA Hazard Categories (311/312):
Immediate Health:YES Delayed Health:YES Fire:YES Pressure:NO
Reactivity:NO

SARA Toxic Release Inventory (TRI) (313):
Naphthalene

Toxic Substances Control Act (TSCA) Status:
This material is listed on the EPA/TSCA Inventory of Chemical Substances.

Other Chemical Inventories:
Australian AICS, Canadian DSL, Chinese Inventory, European EINECS, Japan ENCS, Korean Inventory, Philippines PICCS,

State Regulation
The following chemicals are specifically listed by individual states; other product specific health and safety data in other sections of the MSDS may also be applicable for state requirements. For details on your regulatory requirements you should contact the appropriate agency in your state.

California Safe Drinking Water and Toxic Enforcement Act (Proposition 65).

WARNING: This product contains a chemical(s) known to the State of California to cause cancer.

WARNING: This product contains a chemical(s) known to the State of California to cause birth defects or other reproductive harm.

New Jersey Right-To-Know Chemical List:
Naphthalene (1322) 0 - 2.99 %weight

Pennsylvania Right-To-Know Chemical List:
Benzene (71-43-2) 0.01 - 0.08 %weight Spec Haz Sub/Env Hazardous
Naphthalene (91-20-3) 0 - 2.99 %weight Environmental Hazard

SECTION 16 OTHER INFORMATION

Revision#: 11
Revision Date: 03/02/2004
Revisions since last change (discussion): This Material Safety Data Sheet (MSDS) has been newly reviewed to fully comply with the guidance contained in the ANSI MSDS standard (ANSI Z400.1-1998). We encourage you to take the opportunity to read the MSDS and review the information contained therein.

SECTION 17 LABEL INFORMATION

READ AND UNDERSTAND MATERIAL SAFETY DATA SHEET BEFORE HANDLING OR DISPOSING OF PRODUCT. THIS LABEL COMPLIES WITH THE REQUIREMENTS OF THE OSHA HAZARD COMMUNICATION STANDARD (29 CFR 1910.1200) FOR USE IN THE WORKPLACE. THIS LABEL IS NOT INTENDED TO BE USED WITH PACKAGING INTENDED FOR SALE TO CONSUMERS AND MAY NOT CONFORM WITH THE REQUIREMENTS OF THE CONSUMER PRODUCT SAFETY ACT OR OTHER RELATED REGULATORY REQUIREMENTS.

PRODUCT CODE(S): 23500

Shell Jet-A

CAUTION!

OVEREXPOSURE TO VAPORS CAN CAUSE CNS DEPRESSION. MAY CAUSE SKIN IRRITATION. ASPIRATION HAZARD IF SWALLOWED - CAN ENTER LUNGS AND CAUSE DAMAGE. PROLONGED OR REPEATED SKIN CONTACT MAY CAUSE OIL ACNE OR DERMATITIS.

MATERIAL AND/OR COMPONENTS THAT HAVE BEEN SHOWN TO CAUSE CANCER INCLUDE:
Naphthalene,Naphthalene

MAY CAUSE DAMAGE TO: Eye, Blood/Blood Forming Organs, Kidney, Liver, Skin

Refer to Section 11, Toxicological Information, for specific information on the following effects:
Genotoxicity, Immunotoxicity

Precautionary Measures:
Avoid contact with skin and clothing. Avoid heat and open flames. Avoid breathing of vapors, fumes, or mist. Do not take internally. Use only with adequate ventilation. Keep container closed when not in use. Wash thoroughly after handling.

FIRST AID

Inhalation: Move victim to fresh air and provide oxygen if breathing is difficult. Get medical attention. DO NOT attempt to rescue victim unless proper respiratory protection is worn. If the victim has difficulty breathing or tightness of the chest, is dizzy, vomiting or unresponsive, give 100% oxygen with rescue breathing or CPR as required and transport to the nearest medical facility.
Skin Contact: Wipe off excess material from exposed area. Remove contaminated clothing. Flush with large amounts of water for at least 15 minutes and follow by washing with soap if available. If redness, swelling, pain and/or blisters occur, transport to the nearest medical facility for additional treatment.
Eye Contact: Flush eyes with plenty of water while holding eyelids open. Rest eyes for 30 minutes. If redness, burning, blurred vision or swelling occur, transport to nearest medical facility for additional treatment.
Ingestion: DO NOT induce vomiting. DO NOT take internally. If vomiting occurs spontaneously, keep head below hips to prevent aspiration. Have victim rinse mouth out with water, then drink sips of water to remove taste from mouth. In general no treatment is necessary unless large quantities are swallowed, however, get medical advice.

FIRE

In case of fire, Use water fog, 'alcohol foam', dry chemical or carbon dioxide (CO2) to extinguish flames. Do not use a direct stream of water. Material will float and can be re-ignited on surface of water.

SPILL OR LEAK
Dike and contain spill.
FOR LARGE SPILLS: Remove with vacuum truck or pump to storage/salvage vessels.

FOR SMALL SPILLS: Soak up residue with an absorbent such as clay, sand or other suitable material. Place in non-leaking container and seal tightly for proper disposal.

CONTAINS: Kerosene, 8008-20-6; Naphthalene, 91-20-3; Sulfur, 7704-34-9; Benzene, 71-43-2

NFPA Rating (Health, Fire, Reactivity): 2, 2, 0

TRANSPORTATION
US Department of Transportation Classification

Proper Shipping Name: Fuel, Aviation, Turbine Engine
Identification Number: UN1863
Hazard Class/Division: 3 (Flammable Liquid)
Packing Group: III
Hazardous Substance/Material RQ: Naphthalene / 100 lbs

Oil: This product is an oil under 49CFR (DOT) Part 130. If shipped by rail or highway in a tank with a capacity of 3500 gallons or more, it is subject to these requirements. Mixtures or solutions containing 10% or more of this product may also be subject to this rule.
Emergency Response Guide # 128

California Safe Drinking Water and Toxic Enforcement Act (Proposition 65).

WARNING: This product contains a chemical(s) known to the State of California to cause cancer.

WARNING: This product contains a chemical(s) known to the State of California to cause birth defects or other reproductive harm.

Name and Address
Shell Oil Products US
P. O. Box 4453
Houston, TX 77210-4453

ADMINISTRATIVE INFORMATION
MANUFACTURER ADDRESS: Shell Oil Products US, P. O. Box 4453, Houston, TX. 77210-4453
Company Product Stewardship & Regulatory Compliance Contact: David Snyder
Phone Number: (281) 874-7728

THE INFORMATION CONTAINED IN THIS DATA SHEET IS BASED ON THE DATA AVAILABLE TO US AT THIS TIME, AND IS BELIEVED TO BE ACCURATE BASED UPON THAT : IT IS PROVIDED INDEPENDENTLY OF ANY SALE OF THE PRODUCT, FOR PURPOSE OF HAZARD COMMUNICATION. IT IS NOT INTENDED TO CONSTITUTE PRODUCT PERFORMANCE INFORMATION, AND NO EXPRESS OR IMPLIED WARRANTY OF ANY KIND IS MADE WITH RESPECT TO THE PRODUCT, UNDERLYING DATA OR THE INFORMATION CONTAINED HEREIN. YOU ARE URGED TO OBTAIN DATA SHEETS FOR ALL PRODUCTS YOU BUY, PROCESS, USE OR DISTRIBUTE, AND ARE ENCOURAGED TO ADVISE THOSE WHO MAY COME IN CONTACT WITH SUCH PRODUCTS OF THE INFORMATION CONTAINED HEREIN.

TO DETERMINE THE APPLICABILITY OR EFFECT OF ANY LAW OR REGULATION WITH RESPECT TO THE PRODUCT, YOU SHOULD CONSULT WITH YOUR LEGAL ADVISOR OR THE APPROPRIATE GOVERNMENT AGENCY. WE WILL NOT PROVIDE ADVICE ON SUCH MATTERS, OR BE RESPONSIBLE FOR ANY INJURY FROM THE USE OF THE PRODUCT DESCRIBED HEREIN. THE UNDERLYING DATA, AND THE INFORMATION PROVIDED HEREIN AS A RESULT OF THAT DATA, IS THE PROPERTY OF SHELL OIL PRODUCTS US AND IS NOT TO BE THE SUBJECT OF SALE OR EXCHANGE WITHOUT THE EXPRESS WRITTEN CONSENT OF SHELL OIL PRODUCTS US.

43316-28163-100R-03/02/2004

MATERIAL SAFETY DATA SHEET

BENZENE (AMOCO/TOTAL)

MSDS No. 11697000 ANSI/ENGLISH

1.0 CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

PRODUCT NAME: BENZENE (AMOCO/TOTAL)

MANUFACTURER/SUPPLIER:

Amoco Oil Company
200 East Randolph Drive
Chicago, Illinois 60601 U.S.A.

EMERGENCY HEALTH INFORMATION:
1 (800) 447-8735

EMERGENCY SPILL INFORMATION:
1 (800) 424-9300 CHEMTREC (USA)

OTHER PRODUCT SAFETY INFORMATION:
(312) 856-3907

2.0 COMPOSITION/INFORMATION ON INGREDIENTS

Component	CAS#	Range % by Wt.
Benzene	71-43-2	99.80
Toluene	108-88-3	0.20

(See Section 8.0, "Exposure Controls/Personal Protection", for exposure guidelines)

3.0 HAZARDS IDENTIFICATION

EMERGENCY OVERVIEW: Danger! Extremely flammable. Causes eye and skin irritation. Inhalation causes headaches, dizziness, drowsiness, and nausea, and may lead to unconsciousness. Harmful or fatal if liquid is aspirated into lungs. Danger! Contains Benzene. Cancer hazard. Can cause blood disorders. Harmful when absorbed through the skin.

POTENTIAL HEALTH EFFECTS:

EYE CONTACT: Causes mild eye irritation.

SKIN CONTACT: Causes mild skin irritation. Causes skin irritation on prolonged or repeated contact. Harmful when absorbed through the skin.

INHALATION: Cancer hazard. Can cause blood disorders. Inhalation causes headaches, dizziness, drowsiness, and nausea, and may lead to unconsciousness. See "Toxicological Information" section (Section 11.0).

INGESTION: Harmful or fatal if liquid is aspirated into lungs. See "Toxicological Information" section (Section 11.0).

HMIS CODE: (Health:2) (Flammability:3) (Reactivity:0)

NFPA CODE: (Health:2) (Flammability:3) (Reactivity:0)

4.0 FIRST AID MEASURES

EYE: Flush eyes with plenty of water for at least 15 minutes. Get medical attention if irritation persists.

SKIN: Wash exposed skin with soap and water. Remove contaminated clothing, including shoes, and thoroughly clean and dry before reuse. Get medical attention if irritation develops.

INHALATION: If adverse effects occur, remove to uncontaminated area. Give artificial respiration if not breathing. Get immediate medical attention.

INGESTION: If swallowed, drink plenty of water, do NOT induce vomiting. Get immediate medical attention.

5.0 FIRE FIGHTING MEASURES

FLASHPOINT: 12°F(-11°C)

UEL: 8.0%

LEL: 1.5%

AUTOIGNITION TEMPERATURE: 928°F (498°C)

FLAMMABILITY CLASSIFICATION: Extremely Flammable Liquid.

EXTINGUISHING MEDIA: Agents approved for Class B hazards (e.g., dry chemical, carbon dioxide, foam, steam) or water fog.

UNUSUAL FIRE AND EXPLOSION HAZARDS: Extremely flammable liquid. Vapor may explode if ignited in enclosed area.

FIRE-FIGHTING EQUIPMENT: Firefighters should wear full bunker gear, including a positive pressure self-contained breathing apparatus.

PRECAUTIONS: Keep away from sources of ignition (e.g., heat and open flames). Keep container closed. Use with adequate ventilation.

HAZARDOUS COMBUSTION PRODUCTS: Incomplete burning can produce carbon monoxide and/or carbon dioxide and other harmful products.

6.0 ACCIDENTAL RELEASE MEASURES

Remove or shut off all sources of ignition. Remove mechanically or contain on an absorbent material such as dry sand or earth. Increase ventilation if possible. Wear respirator and spray with water to disperse vapors. Keep out of sewers and waterways.

7.0 HANDLING AND STORAGE

HANDLING: Use with adequate ventilation. Do not breathe vapors. Keep away from ignition sources (e.g., heat, sparks, or open flames). Ground and bond containers when transferring materials. Wash thoroughly after handling. After this container has been emptied, it may contain flammable vapors; observe all warnings and precautions listed for this product.

STORAGE: Store in flammable liquids storage area. Store away from heat, ignition sources, and open flame in accordance with applicable regulations. Keep container closed. Outside storage is recommended.

8.0 EXPOSURE CONTROLS / PERSONAL PROTECTION

EYE: Do not get in eyes. Wear eye protection.

SKIN: Do not get on skin or clothing. Wear protective clothing and gloves.

INHALATION: Do not breathe mist or vapor. If heated and ventilation is inadequate, use supplied-air respirator approved by NIOSH/MSHA.

ENGINEERING CONTROLS: Control airborne concentrations below the exposure guidelines.

EXPOSURE GUIDELINES:

Component	CAS#	Exposure Limits
Benzene	71-43-2	OSHA PEL: 1 ppm OSHA STEL: 5 ppm ACGIH TLV-TWA: 10 ppm
Toluene	108-88-3	OSHA PEL: 100 ppm (1989); 200 ppm (1971) OSHA STEL: 150 ppm (1989); Not established. (1971) OSHA Ceiling: 300 ppm (1971)

ACGIH TLV-TWA: 50 ppm (skin)

9.0 CHEMICAL AND PHYSICAL PROPERTIES

APPEARANCE AND ODOR: Liquid. Colorless. Sweet odor.

pH: Not determined.

VAPOR PRESSURE: 74.6 mm Hg at 20 °C

VAPOR DENSITY: Not determined.

BOILING POINT: 176°F(80°C)

MELTING POINT: 42°F(6°C)

SOLUBILITY IN WATER: Slight, 0.1 to 1.0%.

SPECIFIC GRAVITY (WATER=1): 0.88

10.0 STABILITY AND REACTIVITY

STABILITY: Stable.

CONDITIONS TO AVOID: Keep away from ignition sources (e.g. heat, sparks, and open flames).

MATERIALS TO AVOID: Avoid chlorine, fluorine, and other strong oxidizers.

HAZARDOUS DECOMPOSITION: None identified.

HAZARDOUS POLYMERIZATION: Will not occur.

11.0 TOXICOLOGICAL INFORMATION

ACUTE TOXICITY DATA:

EYE IRRITATION: Testing not conducted. See Other Toxicity Data.

SKIN IRRITATION: Testing not conducted. See Other Toxicity Data.

DERMAL LD50: Testing not conducted. See Other Toxicity Data.

ORAL LD50: 3.8 g/kg (rat).

INHALATION LC50: 10000 ppm (rat)

OTHER TOXICITY DATA: Acute toxicity of benzene results primarily from depression of the central nervous system (CNS). Inhalation of concentrations over 50 ppm can produce headache, lassitude, weariness, dizziness, drowsiness, or excitation. Exposure to very high levels can result in unconsciousness and death.

Long-term overexposure to benzene has been associated with certain types of leukemia in humans. In addition, the International Agency for Research on Cancer (IARC) and OSHA consider benzene to be a human carcinogen. Chronic exposures to benzene at levels of 100 ppm and below have been reported to cause adverse blood effects including anemia. Benzene exposure can occur by inhalation and absorption through the skin.

Inhalation and forced feeding studies of benzene in laboratory animals have produced a carcinogenic response in a variety of organs, including possibly leukemia, other adverse effects on the blood, chromosomal changes and some effects on the immune system. Exposure to benzene at levels up to 300 ppm did not produce birth defects in animal studies; however, exposure to the higher dosage levels (greater than 100 ppm) resulted in a reduction of body weight of the rat pups (fetotoxicity). Changes in the testes have been observed in mice exposed to benzene at 300 ppm, but reproductive performance was not altered in rats exposed to benzene at the same level.

Aspiration of this product into the lungs can cause chemical pneumonia and can be fatal. Aspiration into the lungs can occur while vomiting after ingestion of this product. Do not siphon by mouth.

12.0 ECOLOGICAL INFORMATION

Ecological testing has not been conducted on this product.

13.0 DISPOSAL INFORMATION

Disposal must be in accordance with applicable federal, state, or local regulations. Enclosed-controlled incineration is recommended unless directed otherwise by applicable ordinances. Residues and spilled material are hazardous waste due to ignitability.

14.0 TRANSPORTATION INFORMATION

U.S. DEPT OF TRANSPORTATION

Shipping Name	Benzene
Hazard Class	3
Identification Number	UN1114
Packing Group	II
RQ	RQ

INTERNATIONAL INFORMATION:

Sea (IMO/IMDG)

Shipping Name Not determined.

Air (ICAO/IATA)

Shipping Name Not determined.

European Road/Rail (ADR/RID)

Shipping Name Not determined.

Canadian Transportation of Dangerous Goods

Shipping Name Not determined.

15.0 REGULATORY INFORMATION

CERCLA SECTIONS 102a/103 HAZARDOUS SUBSTANCES (40 CFR Part 302.4): This product is reportable under 40 CFR Part 302.4 because it contains the following substance(s):

Component/CAS Number	Weight %	Component Reportable Quantity (RQ)
Benzene 71-43-2	99.80	10 lbs.

SARA TITLE III SECTION 302 EXTREMELY HAZARDOUS SUBSTANCES (40 CFR Part 355): This product is not regulated under Section 302 of SARA and 40 CFR Part 355.

SARA TITLE III SECTIONS 311/312 HAZARDOUS CATEGORIZATION (40 CFR Part 370): This product is defined as hazardous by OSHA under 29 CFR Part 1910.1200(d).

SARA TITLE III SECTION 313 (40 CFR Part 372): This product contains the following substance(s), which is on the Toxic Chemicals List in 40 CFR Part 372:

Component/CAS Number	Weight Percent
Benzene 71-43-2	99.80

U.S. INVENTORY (TSCA): Listed on inventory.

OSHA HAZARD COMMUNICATION STANDARD: Flammable liquid. Carcinogen. Irritant. CNS Effects. Target organ effects.

EC INVENTORY (EINECS/ELINCS): In compliance.

JAPAN INVENTORY (MITI): Not determined.

AUSTRALIA INVENTORY (AICS): Not determined.

KOREA INVENTORY (ECL): Not determined.

CANADA INVENTORY (DSL): Not determined.

PHILIPPINE INVENTORY (PICCS): Not determined.

16.0 OTHER INFORMATION

Prepared by:

Environment, Health and Safety Department

Issued: November 14, 1995

This material Safety Data Sheet conforms to the requirements of ANSI Z400.1.

This material safety data sheet and the information it contains is offered to you in good faith as accurate. We have reviewed any information contained in this data sheet which we received from sources outside our company. We believe that information to be correct but cannot guarantee its accuracy or completeness. Health and safety precautions in this data sheet may not be adequate for all individuals and/or situations. It is the user's obligation to evaluate and use this product safely and to comply with all applicable laws and regulations. No statement made in this data sheet shall be construed as a permission or recommendation for the use of any product in a manner that might infringe existing patents. No warranty is made, either express or implied.

MSDS Number: **T3913** * * * * * *Effective Date:* ***12/07/07*** * * * * * *Supercedes:* ***10/05/06***

24 Hour Emergency Telephone: 908-859-2151
CHEMTREC: 1-800-424-9300

National Response in Canada
CANUTEC: 613-996-6666

Outside U.S. and Canada
Chemtrec: 703-527-3887

NOTE: CHEMTREC, CANUTEC and National Response Center emergency numbers to be used only in the event of chemical emergencies involving a spill, leak, fire, exposure or accident involving chemicals.

MSDS *Material Safety Data Sheet*

From: Mallinckrodt Baker, Inc.
222 Red School Lane
Phillipsburg, NJ 08865

Mallinckrodt CHEMICALS J.T.Baker

All non-emergency questions should be directed to Customer Service (1-800-582-2537) for assistance.

TOLUENE

1. Product Identification

Synonyms: Methylbenzene; Toluol; Phenylmethane
CAS No.: 108-88-3
Molecular Weight: 92.14
Chemical Formula: C6H5-CH3
Product Codes:
J.T. Baker: 5375, 5812, 9336, 9351, 9364, 9456, 9457, 9459, 9460, 9462, 9466, 9472, 9476
Mallinckrodt: 4483, 8092, 8604, 8608, 8610, 8611, V560

2. Composition/Information on Ingredients

Ingredient	CAS No	Percent	Hazardous
Toluene	108-88-3	100%	Yes

3. Hazards Identification

Emergency Overview

POISON! DANGER! HARMFUL OR FATAL IF SWALLOWED. HARMFUL IF INHALED OR ABSORBED THROUGH SKIN. VAPOR HARMFUL. FLAMMABLE LIQUID AND VAPOR. MAY AFFECT LIVER, KIDNEYS, BLOOD SYSTEM, OR CENTRAL NERVOUS SYSTEM. CAUSES IRRITATION TO SKIN, EYES AND RESPIRATORY TRACT.

SAF-T-DATA$^{(tm)}$ Ratings (Provided here for your convenience)

Health Rating: 2 - Moderate (Life)
Flammability Rating: 3 - Severe (Flammable)
Reactivity Rating: 1 - Slight
Contact Rating: 3 - Severe (Life)
Lab Protective Equip: GOGGLES & SHIELD; LAB COAT & APRON; VENT HOOD; PROPER GLOVES;

CLASS B EXTINGUISHER
Storage Color Code: Red (Flammable)

Potential Health Effects

Inhalation:
Inhalation may cause irritation of the upper respiratory tract. Symptoms of overexposure may include fatigue, confusion, headache, dizziness and drowsiness. Peculiar skin sensations (e. g. pins and needles) or numbness may be produced. Very high concentrations may cause unconsciousness and death.
Ingestion:
Swallowing may cause abdominal spasms and other symptoms that parallel over-exposure from inhalation. Aspiration of material into the lungs can cause chemical pneumonitis, which may be fatal.
Skin Contact:
Causes irritation. May be absorbed through skin.
Eye Contact:
Causes severe eye irritation with redness and pain.
Chronic Exposure:
Reports of chronic poisoning describe anemia, decreased blood cell count and bone marrow hypoplasia. Liver and kidney damage may occur. Repeated or prolonged contact has a defatting action, causing drying, redness, dermatitis. Exposure to toluene may affect the developing fetus.
Aggravation of Pre-existing Conditions:
Persons with pre-existing skin disorders or impaired liver or kidney function may be more susceptible to the effects of this substance. Alcoholic beverage consumption can enhance the toxic effects of this substance.

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4. First Aid Measures

Inhalation:
If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. CALL A PHYSICIAN IMMEDIATELY.
Ingestion:
Aspiration hazard. If swallowed, DO NOT INDUCE VOMITING. Give large quantities of water. Never give anything by mouth to an unconscious person. Get medical attention immediately. If vomiting occurs, keep head below hips to prevent aspiration into lungs.
Skin Contact:
In case of contact, immediately flush skin with plenty of soap and water for at least 15 minutes while removing contaminated clothing and shoes. Wash clothing before reuse. Call a physician immediately.
Eye Contact:
Immediately flush eyes with plenty of water for at least 15 minutes, lifting lower and upper eyelids occasionally. Get medical attention immediately.

5. Fire Fighting Measures

Fire:
Flash point: 7C (45F) CC
Autoignition temperature: 422C (792F)
Flammable limits in air % by volume:
lel: 1.1; uel: 7.1
Flammable liquid and vapor!
Dangerous fire hazard when exposed to heat or flame. Vapors can flow along surfaces to distant ignition source and flash back.
Explosion:
Above flash point, vapor-air mixtures are explosive within flammable limits noted above. Contact with strong oxidizers may cause fire or explosion. Sensitive to static discharge.

Fire Extinguishing Media:
Dry chemical, foam or carbon dioxide. Water may be used to flush spills away from exposures and to dilute spills to non-flammable mixtures.
Special Information:
In the event of a fire, wear full protective clothing and NIOSH-approved self-contained breathing apparatus with full facepiece operated in the pressure demand or other positive pressure mode. Water spray may be used to keep fire exposed containers cool.

6. Accidental Release Measures

Ventilate area of leak or spill. Remove all sources of ignition. Wear appropriate personal protective equipment as specified in Section 8. Isolate hazard area. Keep unnecessary and unprotected personnel from entering. Contain and recover liquid when possible. Use non-sparking tools and equipment. Collect liquid in an appropriate container or absorb with an inert material (e. g., vermiculite, dry sand, earth), and place in a chemical waste container. Do not use combustible materials, such as saw dust. Do not flush to sewer! If a leak or spill has not ignited, use water spray to disperse the vapors, to protect personnel attempting to stop leak, and to flush spills away from exposures. US Regulations (CERCLA) require reporting spills and releases to soil, water and air in excess of reportable quantities. The toll free number for the US Coast Guard National Response Center is (800) 424-8802.

J. T. Baker SOLUSORB® solvent adsorbent is recommended for spills of this product.

7. Handling and Storage

Protect against physical damage. Store in a cool, dry well-ventilated location, away from any area where the fire hazard may be acute. Outside or detached storage is preferred. Separate from incompatibles. Containers should be bonded and grounded for transfers to avoid static sparks. Storage and use areas should be No Smoking areas. Use non-sparking type tools and equipment, including explosion proof ventilation. Containers of this material may be hazardous when empty since they retain product residues (vapors, liquid); observe all warnings and precautions listed for the product.

8. Exposure Controls/Personal Protection

Airborne Exposure Limits:
Toluene:
- OSHA Permissible Exposure Limit (PEL):
200 ppm (TWA); 300 ppm (acceptable ceiling conc.); 500 ppm (maximum conc.).
- ACGIH Threshold Limit Value (TLV):
20 ppm (TWA), A4 - Not Classifiable as a Human Carcinogen.

Ventilation System:
A system of local and/or general exhaust is recommended to keep employee exposures below the Airborne Exposure Limits. Local exhaust ventilation is generally preferred because it can control the emissions of the contaminant at its source, preventing dispersion of it into the general work area. Please refer to the ACGIH document, *Industrial Ventilation, A Manual of Recommended Practices*, most recent edition, for details.
Personal Respirators (NIOSH Approved):
If the exposure limit is exceeded and engineering controls are not feasible, a half-face organic vapor respirator may be worn for up to ten times the exposure limit, or the maximum use concentration specified by the appropriate regulatory agency or respirator supplier, whichever is lowest. A full-face piece organic vapor respirator may be worn up to 50 times the exposure limit, or the maximum use concentration specified by the appropriate regulatory agency or respirator supplier, whichever is lowest. For emergencies or instances where the exposure levels are not known, use a full-face piece positive-pressure, air-supplied respirator. WARNING: Air-purifying respirators do not protect workers in oxygen-deficient atmospheres.

Skin Protection:
Wear impervious protective clothing, including boots, gloves, lab coat, apron or coveralls, as appropriate, to prevent skin contact.
Eye Protection:
Use chemical safety goggles and/or a full face shield where splashing is possible. Maintain eye wash fountain and quick-drench facilities in work area.

9. Physical and Chemical Properties

Appearance:
Clear, colorless liquid.
Odor:
Aromatic benzene-like.
Solubility:
0.05 gm/100gm water @ 20C (68F).
Specific Gravity:
0.86 @ 20C / 4 C
pH:
No information found.
% Volatiles by volume @ 21C (70F):
100
Boiling Point:
111C (232F)
Melting Point:
-95C (-139F)
Vapor Density (Air=1):
3.14
Vapor Pressure (mm Hg):
22 @ 20C (68F)
Evaporation Rate (BuAc=1):
2.24

---

10. Stability and Reactivity

Stability:
Stable under ordinary conditions of use and storage. Containers may burst when heated.
Hazardous Decomposition Products:
Carbon dioxide and carbon monoxide may form when heated to decomposition.
Hazardous Polymerization:
Will not occur.
Incompatibilities:
Heat, flame, strong oxidizers, nitric and sulfuric acids, chlorine, nitrogen tetraoxide; will attack some forms of plastics, rubber, coatings.
Conditions to Avoid:
Heat, flames, ignition sources and incompatibles.

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11. Toxicological Information

Toxicological Data:
Oral rat LD50: 636 mg/kg; skin rabbit LD50: 14100 uL/kg; inhalation rat LC50: 49 gm/m3/4H; Irritation data: skin rabbit, 500 mg, Moderate; eye rabbit, 2 mg/24H, Severe. Investigated as a tumorigen, mutagen, reproductive effector.
Reproductive Toxicity:

Has shown some evidence of reproductive effects in laboratory animals.

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--------\Cancer Lists\------------------------------------------------------
                                              ---NTP Carcinogen---
Ingredient                                    Known    Anticipated    IARC Category
------------------------------------          -----    -----------    -------------
Toluene (108-88-3)                             No          No               3
```

12. Ecological Information

Environmental Fate:
When released into the soil, this material may evaporate to a moderate extent. When released into the soil, this material is expected to leach into groundwater. When released into the soil, this material may biodegrade to a moderate extent. When released into water, this material may evaporate to a moderate extent. When released into water, this material may biodegrade to a moderate extent. When released into the air, this material may be moderately degraded by reaction with photochemically produced hydroxyl radicals. When released into the air, this material is expected to have a half-life of less than 1 day. This material is not expected to significantly bioaccumulate. This material has a log octanol-water partition coefficient of less than 3.0. Bioconcentration factor = 13.2 (eels).
Environmental Toxicity:
This material is expected to be toxic to aquatic life. The LC50/96-hour values for fish are between 10 and 100 mg/l.

13. Disposal Considerations

Whatever cannot be saved for recovery or recycling should be handled as hazardous waste and sent to a RCRA approved incinerator or disposed in a RCRA approved waste facility. Processing, use or contamination of this product may change the waste management options. State and local disposal regulations may differ from federal disposal regulations. Dispose of container and unused contents in accordance with federal, state and local requirements.

14. Transport Information

Domestic (Land, D.O.T.)

Proper Shipping Name: TOLUENE
Hazard Class: 3
UN/NA: UN1294
Packing Group: II
Information reported for product/size: 390LB

International (Water, I.M.O.)

Proper Shipping Name: TOLUENE
Hazard Class: 3
UN/NA: UN1294
Packing Group: II
Information reported for product/size: 390LB

15. Regulatory Information

```
--------\Chemical Inventory Status - Part 1\---------------------------------
Ingredient                                         TSCA  EC   Japan  Australia
```

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 -----------------------------------------------  ----  ---  -----  ---------
 Toluene (108-88-3)                                Yes  Yes   Yes       Yes

 --------\Chemical Inventory Status - Part 2\---------------------------------
                                                          --Canada--
 Ingredient                                        Korea  DSL   NDSL  Phil.
 -----------------------------------------------  -----  ---   ----  -----
 Toluene (108-88-3)                                Yes   Yes    No     Yes

 --------\Federal, State & International Regulations - Part 1\----------------
                                            -SARA 302-     ------SARA 313------
 Ingredient                                 RQ    TPQ     List  Chemical Catg.
 -----------------------------------------  ---   -----   ----  --------------
 Toluene (108-88-3)                         No    No      Yes         No

 --------\Federal, State & International Regulations - Part 2\----------------
                                                       -RCRA-    -TSCA-
 Ingredient                                 CERCLA     261.33     8(d)
 -----------------------------------------  ------     ------    ------
 Toluene (108-88-3)                         1000       U220       No


Chemical Weapons Convention:  No     TSCA 12(b):  No     CDTA:  Yes
SARA 311/312:  Acute: Yes      Chronic: Yes   Fire: Yes Pressure: No
Reactivity: No          (Pure / Liquid)
```

WARNING:

THIS PRODUCT CONTAINS A CHEMICAL(S) KNOWN TO THE STATE OF CALIFORNIA TO CAUSE BIRTH DEFECTS OR OTHER REPRODUCTIVE HARM.

Australian Hazchem Code: 3[Y]E

Poison Schedule: S6

WHMIS:

This MSDS has been prepared according to the hazard criteria of the Controlled Products Regulations (CPR) and the MSDS contains all of the information required by the CPR.

---

16. Other Information

NFPA Ratings: Health: **2** Flammability: **3** Reactivity: **0**

Label Hazard Warning:

POISON! DANGER! HARMFUL OR FATAL IF SWALLOWED. HARMFUL IF INHALED OR ABSORBED THROUGH SKIN. VAPOR HARMFUL. FLAMMABLE LIQUID AND VAPOR. MAY AFFECT LIVER, KIDNEYS, BLOOD SYSTEM, OR CENTRAL NERVOUS SYSTEM. CAUSES IRRITATION TO SKIN, EYES AND RESPIRATORY TRACT.

Label Precautions:

Keep away from heat, sparks and flame.
Keep container closed.
Use only with adequate ventilation.
Wash thoroughly after handling.
Avoid breathing vapor.
Avoid contact with eyes, skin and clothing.

Label First Aid:

Aspiration hazard. If swallowed, DO NOT INDUCE VOMITING. Give large quantities of water. Never give anything by mouth to an unconscious person. If vomiting occurs, keep head below hips to prevent aspiration into lungs. If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. In case of contact, immediately flush eyes or skin with plenty of water for at least 15 minutes. Remove contaminated clothing and shoes. Wash clothing before reuse. In all cases call a physician immediately.

Product Use:

Laboratory Reagent.

Revision Information:

MSDS Section(s) changed since last revision of document include: 8.

Disclaimer:

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****

Prepared by: Environmental Health & Safety
Phone Number: (314) 654-1600 (U.S.A.)

CHEM SERVICE INC -- 0-659 CIS 1,2-DICHLOROETHENE -- 6550-00F037480

MSDS Safety Information

FSC: 6550
MSDS Date: 06/02/1992
MSDS Num: BWJDT
LIIN: 00F037480
Tech Review: 12/06/1994
Product ID: 0-659 CIS 1,2-DICHLOROETHENE
Responsible Party
Cage: 84898
Name: CHEM SERVICE INC
Address: 660 TOWER LN
Box: 3108
City: WEST CHESTER PA 19381-3108 US
Info Phone Number: 215-692-3026/800-452-9994
Emergency Phone Number: 215-692-3026/800-452-9994

Preparer Co. when other than Responsible Party Co.

Cage: 84898
Assigned Ind: N
Name: CHEM SERVICE INC
Box: 3108
City: WEST CHESTER PA 19381

Contractor Summary

Cage: 84898
Name: CHEM SERVICE INC
Box: 3108
City: WEST CHESTER PA 19381 US
Phone: 215-692-3026
Cage: 8Y898
Name: CHEM SERVICE, INC
Address: 660 TOWER LN
Box: 599
City: WEST CHESTER PA 19381 US
Phone: 610-692-3026, 610-692-3026

Ingredients

Cas: 156-59-2
RTECS #: KV9420000
Name: DICHLOROETHENE
Ozone Depleting Chemical: N

Health Hazards Data

Route Of Entry Inds - Inhalation: YES
Skin: YES
Ingestion: YES
Carcinogenicity Inds - NTP: NO
IARC: NO
OSHA: NO
Effects of Exposure: SKIN: MAY BE HARMFUL IF ABSORBED. CAN CAUSE IRRITATION. INHALATION: MAY BE HARMFUL. DUST &/VAPORS CAN CAUSE RESPIRATORY TRACT IRRITATION. CAN BE IRRITATING TO MUCOUS MEMBRANCES. INGESTION: MAY BE HARM FUL. EYES: IRRITATION. EXPOSURE CAN CAUSE LIVER

DAMAGE. NARCOTIC AT HIGH CONCENTRATIONS.
Explanation Of Carcinogenicity: NONE
Signs And Symptions Of Overexposure: IRRITATION, NARCOTIC.
First Aid: EYES: FLUSH CONTINUOUSLY W/WATER FOR 15-20 MINS. SKIN: FLUSH W/WATER FOR 15-20 MINS. IF NOT BURNED, WASH W/SOAP & WATER TO CLEANSE. INHALATION: REMOVE TO FRESH AIR. GIVE CPR/OXYGEN IF NEEDED & CONTINU E LIFE SUPPORT UNTIL MEDICAL ASSISTANCEARRIVES. INGESTION: RINSE MOUTH OUT W/WATER, IF CONSCIOUS. OBTAIN MEDICAL ATTENTION IN ALL CASES.

Handling and Disposal

Spill Release Procedures: EVACUATE AREA. WEAR APPRORPRIATE OSHA REGULATED EQUIPMENT. VENTILATE AREA. ABSORB ON VERMICULITE/SIMILAR MATERIAL. SWEEP UP & PLACE IN APPROPRIATE CONTAINER/HOLD FOR DISPOSAL. WASH CONTAMINATED SURFAC ES TO REMOVE ANY RESIDUES.
Waste Disposal Methods: BURN IN A CHEMICAL INCINERATOR EQUIPPED W/AN AFTERBURNER & SCRUBBER IAW/FEDERAL, STATE & LOCAL REGULATIONS.
Handling And Storage Precautions: STORE IN A COOL DRY PLACE ONLY W/COMPATIBLE CHEMICALS. KEEP TIGHTLY CLOSED. STORE UNDER REFRIGERATION.
Other Precautions: AVOID CONTACT W/SKIN, EYES & CLOTHING. DON'T BREATH VAPORS. CONTACT LENSES SHOULDN'T BE WORN IN THE LABORATORY. ALL CHEMICALS SHOULD BE CONSIDERED HAZARDOUS. AVOID DIRECT PHYSICAL CONTACT.

Fire and Explosion Hazard Information

Flash Point Text: 42.8F
Extinguishing Media: CO2, DRY CHEMICAL POWDER/SPRAY.
Unusual Fire/Explosion Hazard: FLAMMABLE CHEMICAL. VAPORS MAY TRAVEL CONSIDERABLE DISTANCE TO IGNITION SOURCE & FLASH BACK. DECOMPOSITION PRODUCTS ARE CORROSIVE.

Control Measures

Respiratory Protection: WEAR APPROPRIATE OSHA/MSHA APPROVED SAFETY EQUIPMENT.
Ventilation: CHEMICAL SHOULD BE HANDLED ONLY IN A HOOD.
Eye Protection: EYE SHIELDS

Physical/Chemical Properties

B.P. Text: 140F
M.P/F.P Text: -112F
Solubility in Water: INSOLUBLE
Appearance and Odor: COLORLESS LIQUID

Reactivity Data

Stability Indicator: YES
Stability Condition To Avoid: MOISTURE, AIR, LIGHT, HEAT & OTHER IGNITION SOURCES.
Materials To Avoid: STRONG OXIDIZING AGENTS, MAGNESIUM, ALUMINUM.
Hazardous Decomposition Products: TOXIC FUMES
Hazardous Polymerization Indicator: NO

Toxicological Information

Ecological Information

MSDS Transport Information

Regulatory Information

Other Information

HAZCOM Label

Product ID: 0-659 CIS 1,2-DICHLOROETHENE
Cage: 84898
Company Name: CHEM SERVICE INC
PO Box: 3108
City: WEST CHESTER PA
Zipcode: 19381 US
Health Emergency Phone: 215-692-3026/800-452-9994
Date Of Label Review: 12/16/1998
Label Date: 12/16/1998
Hazard And Precautions: SKIN: MAY BE HARMFUL IF ABSORBED. CAN CAUSE IRRITATION. INHALATION: MAY BE HARMFUL. DUST &/VAPORS CAN CAUSE RESPIRATORY TRACT IRRITATION. CAN BE IRRITATING TO MUCOUS MEMBRANCES. INGESTION: MAY BE HARM FUL. EYES: IRRITATION. EXPOSURE CAN CAUSE LIVER DAMAGE. NARCOTIC AT HIGH CONCENTRATIONS.
IRRITATION, NARCOTIC.

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International Chemical Safety Cards

TRICHLOROETHYLENE

ICSC: 0081

TRICHLOROETHYLENE
1,1,2-Trichloroethylene
Trichloroethene
Ethylene trichloride
$C_2HCl_3/ClCH=CCl_2$
Molecular mass: 131.4

CAS # 79-01-6
RTECS # KX4550000
ICSC # 0081
UN # 1710
EC # 602-027-00-9

TYPES OF HAZARD/ EXPOSURE	ACUTE HAZARDS/ SYMPTOMS	PREVENTION	FIRST AID/ FIRE FIGHTING
FIRE	Combustible under specific conditions. See Notes.		In case of fire in the surroundings: all extinguishing agents allowed.
EXPLOSION	Risk of fire and explosion (see Chemical Dangers).		In case of fire: keep drums, etc., cool by spraying with water.
EXPOSURE			
• INHALATION	Dizziness. Drowsiness. Headache. Weakness. Unconsciousness.	Ventilation, local exhaust, or breathing protection.	Fresh air, rest. Artificial respiration if indicated. Refer for medical attention.
• SKIN	Dry skin. Redness.	Protective gloves.	Remove contaminated clothes. Rinse and then wash skin with water and soap.
• EYES	Redness. Pain.	Safety spectacles.	First rinse with plenty of water for several minutes (remove contact lenses if easily possible), then take to a doctor.
• INGESTION	Abdominal pain (further see Inhalation).	Do not eat, drink, or smoke during work. Wash hands before eating.	Rinse mouth. Do NOT induce vomiting. Give plenty of water to drink. Rest.

SPILLAGE DISPOSAL	STORAGE	PACKAGING & LABELLING
Ventilation. Collect leaking and spilled liquid in sealable containers as far as possible. Absorb remaining liquid in sand or inert absorbent and remove to safe place (extra personal protection: self-contained breathing apparatus).	Separated from metals (see Chemical Dangers), strong bases, food and feedstuffs. Dry. Keep in the dark. Ventilation along the floor	Do not transport with food and feedstuffs. IMO: Marine Pollutant Xn symbol R: 40 S: 23-36/37 UN Hazard Class: 6.1 UN Packing Group: III

SEE IMPORTANT INFORMATION ON BACK

Prepared in the context of cooperation between the International Programme on Chemical Safety & the

ICSC: 0081

International Chemical Safety Cards

TRICHLOROETHYLENE

ICSC: 0081

IMPORTANT DATA

PHYSICAL STATE; APPEARANCE:
COLOURLESS LIQUID, WITH CHARACTERISTIC ODOUR.

PHYSICAL DANGERS:
The vapour is heavier than air. As a result of flow, agitation, etc., electrostatic charges can be generated.

CHEMICAL DANGERS:
On contact with hot surfaces or flames this substance decomposes forming toxic and corrosive fumes (phosgene, hydrogen chloride, chlorine). The substance decomposes on contact with strong alkali producing dichloroacetylene, which increases fire hazard. Reacts violently with metals such as lithium, magnesium aluminium, titanium, barium and sodium. Slowly decomposed by light in presence of moisture, with formulation of corrosive hydrochloric acid.

OCCUPATIONAL EXPOSURE LIMITS (OELs):
TLV: 50 ppm; 269 mg/m^3 (STEL): 200 ppm; 1070 mg/m^3 (ACGIH 1992-1993).

ROUTES OF EXPOSURE:
The substance can be absorbed into the body by inhalation, through the skin and by ingestion.

INHALATION RISK:
A harmful contamination of the air can be reached rather quickly on evaporation of this substance at 20°C.

EFFECTS OF SHORT-TERM EXPOSURE:
The substance irritates the eyes and the skin. Swallowing the liquid may cause aspiration into the lungs with the risk of chemical pneumonitis. The substance may cause effects on the central nervous system. Exposure could cause lowering of consciousness.

EFFECTS OF LONG-TERM OR REPEATED EXPOSURE:
Repeated or prolonged contact with skin may cause dermatitis. The substance may have effects on the liver and kidney (see notes).

PHYSICAL PROPERTIES

Boiling point: 87°C
Melting point: -73°C
Relative density (water = 1): 1.5
Solubility in water, g/100 ml at 20°C: 0.1
Vapour pressure, kPa at 20°C: 7.8
Relative vapour density (air = 1): 4.5
Relative density of the vapour/air-mixture at 20°C (air = 1): 1.3
Auto-ignition temperature: 410°C
Explosive limits, vol% in air: 8-10.5
Octanol/water partition coefficient as log Pow: 2.42

ENVIRONMENTAL DATA

This substance may be hazardous to the environment; special attention should be given to water organisms.

NOTES

Combustible vapour/air mixtures difficult to ignite, may be developed under certain conditions. Use of alcoholic beverages enhances the harmful effect. Depending on the degree of exposure, periodic medical examination is indicated. The odour warning when the exposure limit value is exceeded is insufficient. Do NOT use in the vicinity of a fire or a hot surface, or during welding. Technical grades may contain small amounts of carcinogenic stabilizers.

Transport Emergency Card: TEC (R)-723
NFPA Code: H2; F1; R0;

ADDITIONAL INFORMATION

ICSC: 0081 **TRICHLOROETHYLENE**

IMPORTANT LEGAL NOTICE:	Neither the CEC or the IPCS nor any person acting on behalf of the CEC or the IPCS is responsible for the use which might be made of this information. This card contains the collective views of the IPCS Peer Review Committee and may not reflect in all cases all the detailed requirements included in national legislation on the subject. The user should verify compliance of the cards with the relevant legislation in the country of use.

International Chemical Safety Cards

VINYL CHLORIDE

ICSC: 0082

VINYL CHLORIDE
Chloroethene
Chloroethylene
VCM
(cylinder)
$C_2H_3Cl/H_2C=CHCl$
Molecular mass: 62.5

CAS # 75-01-4
RTECS # KU9625000
ICSC # 0082
UN # 1086 (inhibited)
EC # 602-023-00-7

TYPES OF HAZARD/ EXPOSURE	ACUTE HAZARDS/ SYMPTOMS	PREVENTION	FIRST AID/ FIRE FIGHTING
FIRE	Extremely flammable. Gives off irritating or toxic fumes (or gases) in a fire.	NO open flames, NO sparks, and NO smoking.	Shut off supply; if not possible and no risk to surroundings, let the fire burn itself out; in other cases extinguish with powder, carbon dioxide.
EXPLOSION	Gas/air mixtures are explosive. Vinyl chloride monomer vapours are uninhibited and may form polymers in vents or flame arresters of storage tanks, resulting in blockage of vents.	Closed system, ventilation, explosion-proof electrical equipment and lighting. Use non-sparking handtools.	In case of fire: keep cylinder cool by spraying with water. Combat fire from a sheltered position.
EXPOSURE		AVOID ALL CONTACT!	
• **INHALATION**	Dizziness. Drowsiness. Headache. Unconsciousness.	Ventilation, local exhaust, or breathing protection.	Fresh air, rest. Refer for medical attention.
• **SKIN**	ON CONTACT WITH LIQUID: FROSTBITE.	Protective gloves. Cold-insulating gloves. Protective clothing.	ON FROSTBITE: rinse with plenty of water, do NOT remove clothes.
• **EYES**	Redness. Pain.	Safety goggles, or eye protection in combination with breathing protection.	First rinse with plenty of water for several minutes (remove contact lenses if easily possible), then take to a doctor.
• **INGESTION**		Do not eat, drink, or smoke during work. Wash hands before eating.	

SPILLAGE DISPOSAL	STORAGE	PACKAGING & LABELLING
Evacuate danger area! Consult an expert! Ventilation (extra personal protection: complete protective clothing including self-contained	Fireproof. Separated from incompatible materials (see Chemical Danger). Cool.	F symbol T symbol R: 45-13

breathing apparatus).		S: 53-9-16-44 Note: D UN Hazard Class: 2.1

SEE IMPORTANT INFORMATION ON BACK

ICSC: 0082

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International Chemical Safety Cards

VINYL CHLORIDE

ICSC: 0082

IMPORTANT DATA

PHYSICAL STATE; APPEARANCE:
COLOURLESS COMPRESSED LIQUEFIED GAS , WITH CHARACTERISTIC ODOUR.

PHYSICAL DANGERS:
The gas is heavier than air, and may travel along the ground; distant ignition possible.

CHEMICAL DANGERS:
The substance can under specific circumstances form peroxides, initiating explosive polymerization. The substance will polymerize readily due to heating and under the influence of air, light, and on contact with a catalyst, strong oxidizing agents and metals such as copper and aluminium, with fire or explosion hazard. The substance decomposes on burning producing toxic and corrosive fumes (hydrogen chloride and phosgene).

OCCUPATIONAL EXPOSURE LIMITS (OELs):
TLV: 5 ppm; 13 mg/m^3 (ACGIH 1993-1994).

ROUTES OF EXPOSURE:
The substance can be absorbed into the body by inhalation.

INHALATION RISK:
A harmful concentration of this gas in the air will be reached very quickly on loss of containment.

EFFECTS OF SHORT-TERM EXPOSURE:
The substance irritates the eyes. The liquid may cause frostbite. The substance may cause effects on the central nervous system. Exposure could cause lowering of consciousness. Medical observation is indicated.

EFFECTS OF LONG-TERM OR REPEATED EXPOSURE:
The substance may have effects on the liver, blood vessels and connective tissue. This substance is carcinogenic to humans. May cause heritable genetic damage in humans.

PHYSICAL PROPERTIES

Boiling point: -13°C
Melting point: -154°C
Relative density (water = 1): 0.9
Solubility in water: none
Relative vapour density (air = 1): 2.2
Flash point: -78°C c.c.°C
Auto-ignition temperature: 472°C
Explosive limits, vol% in air: 3.6-33
Octanol/water partition coefficient as log Pow: 0.6

ENVIRONMENTAL DATA

NOTES

According to ACGIH this substance belongs to Group A1 indicating confirmed human carcinogen. Contains inhibitors (e.g. phenol). Depending on the degree of exposure, periodic medical examination is indicated. The odour warning when the exposure limit value is exceeded is insufficient. Do NOT use in the vicinity of a fire or a hot surface, or during welding.

Transport Emergency Card: TEC (R)-150
NFPA Code: H 2; F 4; R 2;

ADDITIONAL INFORMATION

ICSC: 0082	**VINYL CHLORIDE**

MATERIAL SAFETY DATA SHEET
Review Date: 04/14/2003

SECTION 1 PRODUCT AND COMPANY IDENTIFICATION

PRODUCT: BR Conventional Gasoline - Not Oxygenated

MSDS NUMBER: 401728M - 2
PRODUCT CODE(S): 26674, 26696, 26721, 26997, 26998, 27030, 27031, 27132, 27133, 27134

MANUFACTURER ADDRESS: Motiva Enterprises LLC, P.O. Box 4540, Houston, TX. 77210-4540

TELEPHONE NUMBERS
Spill Information: (877) 242-7400
Health Information: (877) 504-9351
MSDS Assistance Number: (877) 276-7285

SECTION 2 PRODUCT/INGREDIENTS

CAS#	CONCENTRATION	INGREDIENTS
Mixture	100 %volume	Gasoline
Mixture	0 - 49.99 %volume	Miscellaneous Hydrocarbons
1330-20-7	0 - 24.99 %volume	Xylene, mixed isomers
108-88-3	0 - 24.99 %volume	Toluene
95-63-6	0 - 4.99 %volume	1,2,4-Trimethyl Benzene (Pseudocumene)
100-41-4	0 - 4.49 %volume	Ethyl Benzene
71-43-2	0 - 3.99 %volume	Benzene
110-54-3	0 - 2.99 %volume	Hexane
110-82-7	0 - 0.99 %volume	Cyclohexane
91-20-3	0 - 0.99 %volume	Naphthalene
100-42-5	0 - 0.99 %volume	Styrene

NOTE: Content of Gasoline components will vary; Individual components may be present from trace amounts up to the maximum shown.

SECTION 3 HAZARDS IDENTIFICATION

EMERGENCY OVERVIEW
Appearance & Odor: Bronze color, clear & bright liquid. Hydrocarbon odor.
Health Hazards: Toxic and harmful if inhaled. May be harmful or fatal if swallowed. Do not induce vomiting. May cause aspiration pneumonitis. May cause CNS depression.
Physical Hazards: Material is extremely flammable and heavier than air. Vapors may travel across the ground and reach remote ignition sources causing

a flashback fire danger.
NFPA Rating (Health, Fire, Reactivity): 1, 3, 0
Hazard Rating: Least - 0 Slight - 1 Moderate - 2 High - 3 Extreme - 4

Inhalation:
Toxic and harmful if inhaled. May cause irritation to the nose, throat and respiratory tract. Breathing of high vapor concentrations may cause CNS depression, evidenced by dizziness, light-headedness, headache, nausea, drowsiness, and loss of coordination. Continued inhalation may result in unconsciousness.

Eye Irritation:
May be irritating to the eyes causing a burning sensation, redness, swelling and/or blurred vision.

Skin Contact:
May be irritating to the skin causing a burning sensation, redness and/or swelling. Prolonged or repeated skin contact can cause defatting and drying of the skin which may result in a burning sensation and a dried, cracked appearance.

Ingestion:
This material may be harmful or fatal if swallowed. Ingestion may result in vomiting; aspiration (breathing) of vomitus into lungs must be avoided as even small quantities may result in aspiration pneumonitis. Generally considered to have a low order of acute oral toxicity.

Other Health Effects:
Carcinogenic in animal tests. Gasoline has been tested by API in a long-term inhalation test in mice and rats. There was an increased incidence of liver cancer in female mice. Male rats had a dose related increase in kidney tumors. This effect was due to formation of alpha-2u-globulin in the rats. This material is not formed in humans and is therefore not considered relevant. It is probable that the material causes cancer in laboratory animals. Material may adversely effect male reproductive performance based on testing in laboratory animals.
Refer to Section 11, Toxicological Information, for specific information on the following effects:
Developmental Toxicity, Genotoxicity, Immunotoxicity, Reproductive Toxicity

Primary Target Organs:
The following organs and/or organ systems may be damaged by overexposure to this material and/or its components:
Cardiovascular System, Blood/Blood Forming Organs, Kidney, Liver

Signs and Symptoms:
Irritation as noted above. Aspiration pneumonitis may be evidenced by coughing, labored breathing and cyanosis (bluish skin); in severe cases death may occur. Damage to blood-forming organs may be evidenced by: a) easy fatigability and pallor (RBC effect), b) decreased resistance to infection (WBC effect), c) excessive bruising and bleeding (platelet effect). Kidney damage may be indicated by changes in urine output or appearance, pain upon urination or in the lower back or general edema (swelling from fluid retention). Liver damage may be indicated by loss of appetite, jaundice (yellowish skin and eye color), fatigue and sometimes pain and swelling in the upper right abdomen.

For additional health information, refer to section 11.

SECTION 4 FIRST AID MEASURES

Inhalation:
Move victim to fresh air and provide oxygen if breathing is difficult. Get medical attention. If the victim has difficulty breathing or tightness of the chest, is dizzy, vomiting or unresponsive, give 100% oxygen with rescue breathing or CPR as required and transport to the nearest medical facility.

Skin:
Remove contaminated clothing. Flush with large amounts of water for at least 15 minutes and follow by washing with soap if available. If redness, swelling, pain and/or blisters occur, transport to the nearest medical facility for additional treatment.

Eye:
Flush eyes with large amounts of water for at least 15 minutes. If redness, burning, blurred vision or swelling persist, transport to nearest medical facility for additional treatment.

Ingestion:
DO NOT take internally. Do NOT induce vomiting. If vomiting occurs spontaneously, keep head below hips to prevent aspiration of liquid into lungs. Get medical attention. In general no treatment is necessary unless large quantities are swallowed, however, get medical advice. Have victim rinse mouth out with water, then drink sips of water to remove taste from mouth.

Note to Physician:
If more than 2.0ml/kg body weight has been ingested and vomiting has not occurred, emesis should be induced with supervision. Keep victim's head below hips to prevent aspiration. If symptoms such as loss of gag reflex, convulsions, or unconsciousness occur before emesis, gastric lavage using a cuffed endotracheal tube should be considered.

SECTION 5 FIRE FIGHTING MEASURES

Flash Point [Method]: -40 °F/-40 °C [Tagliabue Closed Cup]
Flammability in Air: 1.3 - 7.6 %volume

Extinguishing Media:
Use water fog, foam, dry chemical or carbon dioxide (CO2) to extinguish flames. Do not use a direct stream of water. Material will float and can be re-ignited on surface of water.

Fire Fighting Instructions:
DANGER! EXTREMELY FLAMMABLE. Clear fire area of all non-emergency personnel. Only enter confined fire space with full bunker gear, including a positive pressure, NIOSH-approved, self-contained breathing apparatus. Cool surrounding equipment, fire-exposed containers and structures with water. Container areas exposed to direct flame contact should be cooled with large quantities of water (500 gallons water per minute flame impingement exposure) to prevent weakening of container structure.

Unusual Fire Hazards:
Vapors are heavier than air accumulating in low areas and traveling along the ground away from the handling site. Do not weld, heat or drill on or near container. However , if emergency situations require drilling, only trained emergency personnel should drill.

SECTION 6 ACCIDENTAL RELEASE MEASURES

Protective Measures:
DANGER! EXTREMELY FLAMMABLE! Eliminate potential sources of ignition. Handling equipment must be bonded and grounded to prevent sparking.

Spill Management:
Dike and contain spill.

FOR LARGE SPILLS: Remove with vacuum truck or pump to storage/salvage vessels.

FOR SMALL SPILLS: Soak up residue with an absorbent such as clay, sand or other suitable material. Place in non-leaking container and seal tightly for proper disposal.

Reporting:
U.S. regulations require reporting releases of this material to the environment which exceed the reportable quantity to the National Response Center at (800)424-8802.
CWA: This product is an oil as defined under Section 311 of EPA's Clean Water Act (CWA). Spills into or leading to surface waters that cause a sheen must be reported to the National Response Center, 1-800-424-8802.

SECTION 7 HANDLING AND STORAGE

Precautionary Measures:
Avoid heat, open flames, including pilot lights, and strong oxidizing agents. Use explosion-proof ventilation to prevent vapor accumulation. Ground all handling equipment to prevent sparking. Do not siphon gasoline by mouth; harmful or fatal if swallowed. Avoid contact with eyes, skin and clothing. Wash thoroughly after handling.

For use as a motor fuel only. Do not use as a cleaning solvent or for other non-motor fuel uses.

Handling:
Surfaces that are sufficiently hot may ignite liquid material. Material is extremely flammable and heavier than air. Vapors may travel across the ground and reach remote ignition sources causing a flashback fire danger.

Keep containers closed when not in use. WARNING! The flow of gasoline through the pump nozzle can produce static electricity, which may cause a fire if gasoline is pumped into an ungrounded container. To avoid static buildup, place approved container on the ground. Do not fill container in vehicle or truck bed. Keep nozzle in contact with container while filling. Do not use automatic pump handle (latch-open) device. Keep all storage vessels closed. Material will ignite when exposed to air. Air trapped within the storage container may be removed by placing dry ice in the container prior to closing. Turn off all battery operated portable electronic devices (examples include: cellular phones, pagers and CD players) before operating gasoline pump. Use only with adequate ventilation.

Storage:
Do not store in open or unlabeled containers. Store in a cool, dry place with adequate ventilation. Keep away from open flames and high temperatures.

Keep liquid and vapor away from heat, sparks and flame. Extinguish pilot lights, cigarettes and turn off other sources of ignition prior to use and until all vapors have dissipated. Use explosion-proof ventilation indoors and in laboratory settings.

Container Warnings:
Keep containers closed when not in use. Containers, even those that have been emptied, can contain explosive vapors. Do not cut, drill, grind, weld or perform similar operations on or near containers.

SECTION 8 EXPOSURE CONTROLS/PERSONAL PROTECTION

Benzene ACGIH TLV TWA: 0.5 ppmv STEL: 2.5 ppmv Notation: Skin
Benzene OSHA PEL TWA: 1 ppmv STEL: 5 ppmv
Cyclohexane ACGIH TLV TWA: 300 ppmv
Cyclohexane OSHA PEL TWA: 300 ppmv
Ethyl Benzene ACGIH TLV TWA: 100 ppmv STEL: 125 ppmv
Ethyl Benzene OSHA PEL TWA: 100 ppmv
Ethyl Benzene OSHA PEL - 1989(revoked) TWA: 100 ppmv STEL: 125 ppmv
Gasoline ACGIH TLV TWA: 300 ppmv STEL: 500 ppmv
Gasoline OSHA PEL - 1989(revoked) TWA: 300 ppmv STEL: 500 ppmv
N-Hexane OSHA PEL TWA: 50 ppmv
N-Hexane OSHA PEL - 1989(revoked) TWA: 50 ppmv
Naphthalene ACGIH TLV TWA: 10 ppmm STEL: 15 ppmm
Naphthalene OSHA PEL TWA: 10 ppmv
Naphthalene OSHA PEL - 1989(revoked) TWA: 10 ppmv STEL: 15 ppmv
Styrene ACGIH TLV TWA: 20 ppmv STEL: 40 ppmv
Styrene OSHA PEL TWA: 100 ppmv Ceiling: 200 ppmv
Styrene OSHA PEL - 1989(revoked) TWA: 50 ppmv STEL: 100 ppmv
Toluene ACGIH TLV TWA: 50 ppmv Notation: Skin
Toluene OSHA PEL TWA: 200 ppmv Ceiling: 300 ppmv
Toluene OSHA PEL - 1989(revoked) TWA: 100 ppmv STEL: 150 ppmv
Toluene SHELL INTERNAL TWA: 50 ppmv
Trimethyl Benzene ACGIH TLV TWA: 25 ppmv
Trimethyl Benzene OSHA PEL - 1989(revoked) TWA: 25 ppmv
Trimethyl Benzene SHELL PEL - 1989(revoked) TWA: 25 ppmv
xylene (o-, m-, p- isomers) OSHA PEL TWA: 100 ppmv
xylene (o-, m-, p- isomers) OSHA PEL - 1989(revoked) TWA: 100 ppmv STEL: 150 ppmv
Xylene (o-, m-, p-isomers) ACGIH TLV TWA: 100 ppmv STEL: 150 ppmv

EXPOSURE CONTROLS
Adequate explosion-proof ventilation indoors and in laboratory settings to control airborne concentrations below the exposure guidelines/limits.

PERSONAL PROTECTION
Personal protective equipment (PPE) selections vary based on potential exposure conditions such as handling practices, concentration and ventilation. Information on the selection of eye, skin and respiratory protection for use with this material is provided below.

Eye Protection:
Chemical Goggles - If liquid contact is likely.

Skin Protection:
Use protective clothing which is chemically resistant to this material. Selection of protective clothing depends on potential exposure conditions and may include gloves, boots, suits and other items. The selection(s) should take into account such factors as job task, type of exposure and durability requirements.

Published literature, test data and/or glove and clothing manufacturers indicate the best protection is provided by:
Neoprene, or Nitrile Rubber, or Polyvinyl Alcohol (PVA)
Respiratory Protection:
If engineering controls do not maintain airborne concentrations to a level which is adequate to protect worker health, an approved respirator must be worn. Respirator selection, use and maintenance should be in accordance with the requirements of the OSHA Respiratory Protection Standard, 29 CFR 1910.134.

Types of respirator(s) to be considered in the selection process include:
Supplied-Air Respirator. Air-Purifying Respirator for Organic Vapors. Self-contained breathing apparatus for use in environments with unknown concentrations or emergency situations.

SECTION 9 PHYSICAL AND CHEMICAL PROPERTIES

Appearance & Odor: Bronze color, clear & bright liquid. Hydrocarbon odor.
Substance Chemical Family: Hydrocarbon
Appearance: Bronze color, clear & bright liquid.

Flammability in Air: 1.3 - 7.6

Flash Point: -40 °F [Tagliabue Closed Cup]

Freezing Point: -72 °F

Solubility (in Water): Negligible

Specific Gravity: 0.72 - 0.76

Stability: Stable

Vapor Density: 3.5

Vapor Pressure: 7 - 14.5 [Reid]

Viscosity: < 1.4 cSt Typical @ 100 °F

Volatility: 100 %weight

SECTION 10 REACTIVITY AND STABILITY

Stability:
Material is stable under normal conditions.

Conditions to Avoid:
Avoid heat, sparks, open flames and other ignition sources.

Materials to Avoid:
Avoid contact with strong oxidizing agents.

Hazardous Decomposition Products:

Thermal decomposition products are highly dependent on combustion conditions. A complex mixture of airborne solids, liquids and gases will evolve when this material undergoes pyrolysis or combustion. Aldehydes, Carbon Monoxide, Carbon Dioxide, Peroxideand other unidentified organic compounds may be formed upon combustion.

SECTION 11 TOXICOLOGICAL INFORMATION

Acute Toxicity
  Dermal LD50 >2 g/kg(Rabbit) OSHA: Non-Toxic Based on similar material(s)
  Eye Irritation Moderate to Severe Irritation [Human] OSHA: Irritating Based on similar material(s)
  Oral LD50 >5 g/kg(Rat) OSHA: Non-Toxic Based on similar material(s)
  Skin Irritation 0.98 [Rabbit, 24 hour(s)] OSHA: Irritating Based on similar material(s)

Carcinogenicity:
Gasoline has been tested by API in a long-term inhalation test in mice and rats. There was an increased incidence of liver cancer in female mice. Male rats had a dose related increase in kidney tumors. This effect was due to formation of alpha-2u-globulin in the rats. This material is not formed in humans and is therefore not considered relevant.
Carcinogenicity Classification
Gasoline
  NTP: No IARC: Possible Carcinogen (2B) ACGIH: A3 OSHA: No
Benzene
  NTP: Yes IARC: Carcinogen (1) ACGIH: A1 OSHA: Yes
Ethyl Benzene
  NTP: No IARC: Possible Carcinogen (2B) ACGIH: A3 OSHA: No
Naphthalene
  NTP: Yes IARC: Possible Carcinogen (2B) ACGIH: A4 OSHA: No
Styrene
  NTP: No IARC: Possible Carcinogen (2B) ACGIH: A4 OSHA: No
Toluene
  NTP: No IARC: Not Classifiable (3) ACGIH: A4 OSHA: No
Carcinogenicity

Chronic inhalation of wholly vaporized gasoline produced kidney tumors in male rats and liver tumors in female mice. The kidney tumors have been shown to develop through a unique mechanism involving Alpha-2u globulin. This protein is not present in humans making the kidney tumors irrelevant to potential human health risks. Origin of the female mouse liver tumors is less understood, leaving their significance for human risks uncertain. Prolonged and repeated exposure to high concentrations (10s to 100s ppm) of benzene may cause serious injury to blood-forming organs, is associated with anemia (depletion of blood cells) and is linked to the later development of acute myelogenous leukemia (AML) in humans. A recent chronic bioassay of ethylbenzene by the NTP produced clear evidence of carcinogenicity in male rats based on kidney tumor increase. Other animal tumors possibly associated with ethylbenzene include testicular adenomas in male rats, kidney tumors in female rats, lung tumors in male mice and liver tumors in female mice. Toluene is not known to be mutagenic or carcinogenic although available human and experimental animal data are limited and insufficient to assess carcinogenic potential. A two-year inhalation study in rats found that naphthalene caused tumors in the lining of the nose (olfactory epithelial neuroblastoma) and respiratory tract (respiratory epithelial adenoma) of both male and female animals. There is also limited evidence of carcinogenic effects in female mice in a similar study.

Cardiovascular System
While there is no evidence that workplace exposure to acceptable levels of toluene vapors (e.g., the TLV) have produced cardiac effects in humans, high concentrations may cause cardiac sensitization and sudden lethality has been reported from habitual sniffing of solvents or glue. Animal studies have confirmed the sensitizing effects. Sensitization may lead to fatal changes in heart rhythms. Hypoxia or injection of adrenalin-like agents may enhance this effect. Thickening of heart blood vessels has been reported in animals exposed to xylene.

Developmental Toxicity
Daily exposure of pregnant rats to unleaded gasoline vapor at concentrations up to 9000 ppm resulted in no detectable maternal or developmental toxicity. Numerous studies of benzene in experimental animals have failed to detect teratogenic effects (birth defects) even at doses of benzene toxic to the mothers. There is some evidence of fetal toxicity, but not malformations, in mice and rabbits exposed to 500 ppm and higher concentrations of benzene vapor during gestation. Ethylbenzene caused birth defects in rats but not rabbits at doses that produced toxic effects in the mothers. n-Hexane produced fetal toxicity, reduced fetal weight, in mice at maternally toxic doses. Developmental toxicity studies of xylenes showed embryolethal/toxic and teratogenic effects with maternal toxicity. Many case studies involving abuse during pregnancy implicate toluene as a developmental toxicant. Studies in laboratory animals have shown developmental effects comparable to those reported in humans, but the effects were generally associated with maternal toxicity.

Genotoxicity
Unleaded gasoline was tested for genetic activity in tests using microbial cells, cultured mammalian cells and rats (bone marrow) and was judged to be negative in every case. Benzene has been shown to be non-mutagenic or weakly mutagenic in a variety of in vitro (test tube) systems. It has, however, been found to cause other types of chromosome damage (micronuclei, chromosome breakage, non-dysjunctional events) in both laboratory animals and workers exposed to high doses of benzene. These effects appear to be related to one or more metabolites of benzene, possibly acting in combination. Benzene metabolites can also bind to proteins forming detectable complexes (adducts). There is limited evidence of binding to the genetic material (DNA) itself.

The relationship of these effects to the causation of leukemia or tumors in experimental animals is unknown. Changes in chromosomes of lymphocytes have been identified in some studies of humans exposed to styrene. The significance of these changes is not known, and other such studies have produced negative results. Chromosomal breaks have been reported in the bone marrow cells of rats exposed to styrene by inhalation along with increased frequency of sister chromatid exchanges in alveolar macrophages, bone marrow cells and regenerating liver cells. Ethylbenzene was not mutagenic in a number of in vitro procedures. Naphthalene was non-mutagenic using in vitro (test tube) evaluations, specifically Ames and rat embryo cell transformation assays. Cyclohexane and pseudocumene were also negative in Ames testing. Toluene was negative in the Ames assay and negative for chromosomal aberrations and sister-chromatid exchanges in human lymphocytes and in an in vitro test using hamster cells. Mouse lymphoma test results for toluene were inconclusive.

Blood/Blood Forming Organs
Prolonged and repeated exposure to high concentrations (10s to 100s ppm) of benzene may cause serious injury to blood-forming organs and is associated with anemia (depletion of blood cells). Repeated exposure of rabbits to high cyclohexane vapor concentrations causes a slight increase in blood clotting time. Blood effects were seen in rats following prolonged and repeated oral exposure to a mixture of xylenes containing ethylbenzene.

Immunotoxicity
Various studies of workers exposed to high levels of benzene have found impairment of both humoral (antibody) and cellular immunity, most notably a decrease in levels of circulating leukocytes. Many of these exposures also involve other solvents and chemicals. Animal studies with high benzene doses have reported similar effects.

Kidney
Long-term inhalation of wholly vaporized gasoline caused increased kidney weight and progressive nephropathy (tissue damage) in male rats. In rats exposed orally to a xylene mixture also containing ethylbenzene, males developed hyaline droplet changes and females showed evidence of early chronic nephropathy. Intentional abuse of toluene vapors by 'glue-sniffers' has been associated with damage to the kidneys.

Liver
Inhalation of gasoline vapor increased liver weights, urinary excretion of ascorbic acid, and hepatic enzyme activity in male rats. Liver weight increases were seen in rats dosed orally for 90 days with a xylene mixture also containing ethylbenzene. Reversible liver damage has been reported in persons exposed to toluene by solvent abuse.

Neurotoxicity
Inhalation exposure to high n-hexane concentrations has resulted in peripheral neuropathy in rodents and also in human workers. Rats receiving prolonged and repeated exposure to high doses of xylene have shown hearing loss. Prolonged and repeated exposures to high toluene concentrations (mixed solvent) have resulted in hearing loss in laboratory animals. There have also been reports of hearing damage in humans overexposed to toluene and other solvents, however, these effects and their possible relationship to noise exposure remain uncertain. Intentional inhalation ('glue-sniffing') and resulting overexposure to toluene vapors has been linked to brain injury. Rats exposed repeatedly to high concentrations of styrene vapor also developed hearing deficits.

Reproductive Toxicity
Inhalation of high n-hexane concentrations resulted in testicular and

epididymal lesions in laboratory animals. Animal studies on benzene have shown testicular effects and alteration in reproductive cycles.

Sensitization
Gasoline and component petroleum streams blended to produce it were tested in animal studies and found not to cause skin sensitization.

Systemic Toxicity
Studies on n-hexane in laboratory animals have shown mild, transitory effects on the spleen and blood (white blood cells) and evidence of nasal tract and lung damage. Chronic exposure to vapors of a mixture containing 50% pseudocumene (and possibly contaminated with benzene) caused decreased weight gain and blood changes (lymphopenia and neutrophilia), liver, lung, spleen, kidney, and bone marrow effects in rats. Microscopic changes in the lung, including congestion, hemorrhage, edema, exudation, and leukocyte infiltration were observed in rats and guinea pigs following acute inhalation of styrene. In fatally exposed animals, pulmonary congestion, edema, and necrosis of the kidney and liver were reported. Repeated exposure to high vapor concentrations of cyclohexane caused minor microscopic liver and kidney changes in rabbits. Laboratory animals exposed to prolonged and repeated doses of xylenes by various routes have shown effects in liver, kidneys, lungs, spleen, heart, blood and adrenals.

SECTION 12 ECOLOGICAL INFORMATION

Environmental Impact Summary:
There is no ecological data available for this product.

SECTION 13 DISPOSAL CONSIDERATIONS

RCRA Information:

Under RCRA, it is the responsibility of the user of the material to determine, at the time of the disposal, whether the material meets RCRA criteria for hazardous waste. This is because material uses, transformations, mixtures, processes, etc. may affect the classification. Refer to the latest EPA, state and local regulations regarding proper disposal.

SECTION 14 TRANSPORT INFORMATION

US Department of Transportation Classification

Proper Shipping Name:	Gasoline
Identification Number:	UN1203
Hazard Class/Division:	3 (Flammable Liquid)
Packing Group:	II

Marine Pollutant % of Total:	100 %weight

Marine Pollutant: Marine Polluntant based on the presence of >10% hydrocarbons listed in 49 CFR 172.101, appendix B; main constituents Trimethylbenzene and Naphthalene.

Oil: This product is an oil under 49CFR (DOT) Part 130. If shipped by rail or highway in a tank with a capacity of 3500 gallons or more, it is subject to these requirements. Mixtures or solutions containing 10% or more of this product may also be subject to this rule. Per 49 CFR 130.5, containers of 3500 gallon capacity or greater transported by road or rail are excepted from 49 CFR 172.303(L)(2) if shipping papers contain the word 'OIL'; exceptions are not applicable to shipments by water.

Emergency Response Guide #128

International Air Transport Association

Hazard Class/Division:	3 (Flammable Liquid)
Identification Number:	UN1203
Packing Group:	II
Proper Shipping Name:	Gasoline

International Maritime Organization Classification

Hazard Class/Division:	3 (Flammable Liquid)
Identification Number:	UN1203
Packing Group:	II
Proper Shipping Name:	Gasoline

SECTION 15 REGULATORY INFORMATION

FEDERAL REGULATORY STATUS

OSHA Classification:
Product is hazardous according to the OSHA Hazard Communication Standard, 29 CFR 1910.1200.

Comprehensive Environmental Release, Compensation & Liability Act (CERCLA):
Benzene RQ 10 lbs Reportable Spill => 205 lbs or 34 gal

Ozone Depleting Substances (40 CFR 82 Clean Air Act):
This material does not contain nor was it directly manufactured with any Class I or Class II ozone depleting substances.

Superfund Amendment & Reauthorization Act (SARA) Title III:
There are no components in this product on the SARA 302 list.

SARA Hazard Categories (311/312):
Immediate Health:YES Delayed Health:YES Fire:YES Pressure:NO Reactivity:NO

SARA Toxic Release Inventory (TRI) (313):
Xylene (mixed isomers), 1,2,4-Trimethylbenzene, Toluene, Naphthalene, N-Hexane, Ethylbenzene, Cyclohexane, Benzene, Styrene

Toxic Substances Control Act (TSCA) Status:
All component(s) of this material is(are) listed on the EPA/TSCA Inventory of Chemical Substances.

Other Chemical Inventories:
Australian AICS, Canadian DSL, Chinese Inventory, European EINECS, Japan ENCS, Korean Inventory, Philippines PICCS,

State Regulation
The following chemicals are specifically listed by individual states; other product specific health and safety data in other sections of the MSDS may also be applicable for state requirements. For details on your regulatory requirements you should contact the appropriate agency in your state.

California Safe Drinking Water and Toxic Enforcement Act (Proposition 65).
WARNING: This product contains a chemical(s) known to the State of California to cause cancer.

WARNING: This product contains a chemical(s) known to the State of California to cause birth defects or other reproductive harm.

New Jersey Right-To-Know Chemical List:
Benzene (71-43-2) 0 - 3.99 %volume Carcinogen
Benzene (71-43-2) 0 - 3.99 %volume Mutagen
Benzene, Methyl- (108-88-3) 0 - 24.99 %volume
Cyclohexane (110-82-7) 0 - 0.99 %volume
Ethylbenzene (0851) 0 - 4.49 %volume
Naphthalene (1322) 0 - 0.99 %volume
Styrene (100-42-5) 0 - 0.99 %volume Mutagen
Xylenes (1330-20-7) 0 - 24.99 %volume

Pennsylvania Right-To-Know Chemical List:
Benzene (71-43-2) 0 - 3.99 %volume Spec Haz Sub/Env Hazardous
Benzene, dimethyl- (1330-20-7) 0 - 24.99 %volume Environmental Hazard
Benzene, ethenyl (100-42-5) 0 - 0.99 %volume Environmental Hazard
Benzene, Ethyl- (100-41-4) 0 - 4.49 %volume Environmental Hazard
Benzene, Methyl- (108-88-3) 0 - 24.99 %volume Environmental Hazard
Cyclohexane (110-82-7) 0 - 0.99 %volume Environmental Hazard
Naphthalene (91-20-3) 0 - 0.99 %volume Environmental Hazard

SECTION 16 OTHER INFORMATION

Revision#: 2
Review Date: 04/14/2003
Revision Date: 04/14/2003
Revisions since last change (discussion): This Material Safety Data Sheet (MSDS) has been newly reviewed to fully comply with the guidance contained in the ANSI MSDS standard (ANSI Z400.1-1998). We encourage you to take the opportunity to read the MSDS and review the information contained therein.

SECTION 17 LABEL INFORMATION

READ AND UNDERSTAND MATERIAL SAFETY DATA SHEET BEFORE HANDLING OR DISPOSING OF PRODUCT. THIS LABEL COMPLIES WITH THE REQUIREMENTS OF THE OSHA HAZARD COMMUNICATION STANDARD (29 CFR 1910.1200) FOR USE IN THE WORKPLACE. THIS LABEL IS NOT INTENDED TO BE USED WITH PACKAGING INTENDED FOR SALE TO CONSUMERS AND MAY NOT CONFORM WITH THE REQUIREMENTS OF THE CONSUMER PRODUCT SAFETY ACT OR OTHER RELATED REGULATORY REQUIREMENTS.

PRODUCT CODE(S): 26674, 26696, 26721, 26997, 26998, 27030, 27031, 27132, 27133, 27134

BR Conventional Gasoline - Not Oxygenated

DANGER!

EXTREMELY FLAMMABLE. VAPORS MAY EXPLODE. MAY BE FATAL IF INHALED. OVEREXPOSURE TO VAPORS CAN CAUSE CNS DEPRESSION. MAY CAUSE SKIN AND EYE IRRITATION. ASPIRATION HAZARD IF SWALLOWED - CAN ENTER LUNGS AND CAUSE DAMAGE. CONTAINS BENZENE WHICH IS A CANCER HAZARD - LINKED TO DEVELOPMENT OF ACUTE MYELOGENOUS LEUKEMIA. LONG-TERM EXPOSURE TO GASOLINE VAPORS HAS CAUSED CANCER IN LABORATORY ANIMALS. PROLONGED OR REPEATED SKIN CONTACT MAY CAUSE OIL ACNE OR DERMATITIS.

MAY CAUSE DAMAGE TO: Cardiovascular System, Blood/Blood Forming Organs, Kidney, Liver
Refer to Section 11, Toxicological Information, for specific information on the following effects:
Developmental Toxicity, Genotoxicity, Immunotoxicity, Reproductive Toxicity

Precautionary Measures:
Avoid heat, sparks, open flames and other ignition sources. Avoid breathing of vapors, fumes, or mist. Do not take internally. Use only with adequate ventilation. Avoid contact with eyes, skin and clothing. Keep container closed when not in use. Wash thoroughly after handling.

FIRST AID
Inhalation: Move victim to fresh air and provide oxygen if breathing is difficult. Get medical attention. If the victim has difficulty breathing or tightness of the chest, is dizzy, vomiting or unresponsive, give 100% oxygen with rescue breathing or CPR as required and transport to the nearest medical facility.
Skin Contact: Remove contaminated clothing. Flush with large amounts of water for at least 15 minutes and follow by washing with soap if available. If redness, swelling, pain and/or blisters occur, transport to the nearest medical facility for additional treatment.
Eye Contact: Flush eyes with large amounts of water for at least 15 minutes. If redness, burning, blurred vision or swelling persist, transport to nearest medical facility for additional treatment.
Ingestion: DO NOT take internally. Do NOT induce vomiting. If vomiting occurs spontaneously, keep head below hips to prevent aspiration of liquid into lungs. Get medical attention. Have victim rinse mouth out with water, then drink sips of water to remove taste from mouth. In general no treatment is necessary unless large quantities are swallowed, however, get medical advice.

FIRE

In case of fire, Use water fog, foam, dry chemical or carbon dioxide (CO2) to extinguish flames. Do not use a direct stream of water. Material will

float and can be re-ignited on surface of water.
SPILL OR LEAK
Dike and contain spill.
FOR LARGE SPILLS: Remove with vacuum truck or pump to storage/salvage vessels.

FOR SMALL SPILLS: Soak up residue with an absorbent such as clay, sand or other suitable material. Place in non-leaking container and seal tightly for proper disposal.

CONTAINS: Miscellaneous Hydrocarbons, Mixture; Xylene, mixed isomers, 1330-20-7; Toluene, 108-88-3; 1,2,4-Trimethyl Benzene (Pseudocumene), 95-63-6; Ethyl Benzene, 100-41-4; Benzene, 71-43-2; Hexane, 110-54-3; Cyclohexane, 110-82-7; Naphthalene, 91-20-3; Styrene, 100-42-5

NFPA Rating (Health, Fire, Reactivity): 1, 3, 0

TRANSPORTATION

US Department of Transportation Classification

Proper Shipping Name:	Gasoline
Identification Number:	UN1203
Hazard Class/Division:	3 (Flammable Liquid)
Packing Group:	II

Marine Pollutant % of Total: 100 %weight

Marine Pollutant: Marine Polluntant based on the presence of >10% hydrocarbons listed in 49 CFR 172.101, appendix B; main constituents Trimethylbenzene and Naphthalene.

Oil: This product is an oil under 49CFR (DOT) Part 130. If shipped by rail or highway in a tank with a capacity of 3500 gallons or more, it is subject to these requirements. Mixtures or solutions containing 10% or more of this product may also be subject to this rule. Per 49 CFR 130.5, containers of 3500 gallon capacity or greater transported by road or rail are excepted from 49 CFR 172.303(L)(2) if shipping papers contain the word 'OIL'; exceptions are not applicable to shipments by water.

Emergency Response Guide #128

California Safe Drinking Water and Toxic Enforcement Act (Proposition 65).
WARNING: This product contains a chemical(s) known to the State of California to cause cancer.

WARNING: This product contains a chemical(s) known to the State of California to cause birth defects or other reproductive harm.

CAUTION: Misuse of empty containers can be hazardous. Empty containers can be hazardous if used to store toxic, flammable, or reactive materials. Cutting or welding of empty containers might cause fire, explosion or toxic fumes from residues. Do not pressurize or expose to open flames or heat. Keep container closed and drum bungs in place.

Name and Address
Motiva Enterprises LLC

P.O. Box 4540
Houston, TX 77210-4540

ADMINISTRATIVE INFORMATION
MANUFACTURER ADDRESS: Motiva Enterprises LLC, P.O. Box 4540, Houston, TX. 77210-4540

THE INFORMATION CONTAINED IN THIS DATA SHEET IS BASED ON THE DATA AVAILABLE TO US AT THIS TIME, AND IS BELIEVED TO BE ACCURATE BASED UPON THAT : IT IS PROVIDED INDEPENDENTLY OF ANY SALE OF THE PRODUCT, FOR PURPOSE OF HAZARD COMMUNICATION. IT IS NOT INTENDED TO CONSTITUTE PRODUCT PERFORMANCE INFORMATION, AND NO EXPRESS OR IMPLIED WARRANTY OF ANY KIND IS MADE WITH RESPECT TO THE PRODUCT, UNDERLYING DATA OR THE INFORMATION CONTAINED HEREIN. YOU ARE URGED TO OBTAIN DATA SHEETS FOR ALL PRODUCTS YOU BUY, PROCESS, USE OR DISTRIBUTE, AND ARE ENCOURAGED TO ADVISE THOSE WHO MAY COME IN CONTACT WITH SUCH PRODUCTS OF THE INFORMATION CONTAINED HEREIN.

TO DETERMINE THE APPLICABILITY OR EFFECT OF ANY LAW OR REGULATION WITH RESPECT TO THE PRODUCT, YOU SHOULD CONSULT WITH YOUR LEGAL ADVISOR OR THE APPROPRIATE GOVERNMENT AGENCY. WE WILL NOT PROVIDE ADVICE ON SUCH MATTERS, OR BE RESPONSIBLE FOR ANY INJURY FROM THE USE OF THE PRODUCT DESCRIBED HEREIN. THE UNDERLYING DATA, AND THE INFORMATION PROVIDED HEREIN AS A RESULT OF THAT DATA, IS THE PROPERTY OF MOTIVA ENTERPRISES LLC AND IS NOT TO BE THE SUBJECT OF SALE OR EXCHANGE WITHOUT THE EXPRESS WRITTEN CONSENT OF MOTIVA ENTERPRISES LLC.

43819-12146-100R-01/21/2005

MATERIAL SAFETY DATA SHEET
Revision Date: 04/22/2003

SECTION 1 PRODUCT AND COMPANY IDENTIFICATION

PRODUCT: BR HS Diesel 2 Dyed (.5%s)
MSDS NUMBER: 401476E - 1
PRODUCT CODE(S): 26967

MANUFACTURER ADDRESS:Shell Oil Products US, P. O. Box 4453, Houston, TX. 77210-4453

TELEPHONE NUMBERS
Spill Information: (877) 242-7400
Health Information: (877) 504-9351
MSDS Assistance Number: (877) 276-7285

SECTION 2 PRODUCT/INGREDIENTS

CAS#	CONCENTRATION	INGREDIENTS
Mixture	100 %weight	#2 Diesel
68814-87-9	0 - 99.99 %weight	Full Range Straight Run Middle Distillate
64742-46-7	0 - 99.99 %weight	Hydrotreated Middle Distillate
64741-59-9	0 - 39.99 %weight	Light Catalytic Cracked Distillate
71-43-2	0.01 - 0.64 %weight	Benzene
7704-34-9	0 - 0.49 %weight	Sulfur

NOTE: H2S is a naturally occuring constituent in the petroleum stream and is not added separately to the product.

SECTION 3 HAZARDS IDENTIFICATION

EMERGENCY OVERVIEW
Appearance & Odor: Bright and clear liquid (Tax Exempt Diesels - pale red liquid). Oil-type odor.
Health Hazards: Hydrogen sulfide (H2S), an extremely flammable and toxic gas, may be present. Causes severe skin irritation. Toxic and harmful if inhaled. May be harmful or fatal if swallowed. Do not induce vomiting. May cause aspiration pneumonitis.
Physical Hazards: Combustible Liquid.
NFPA Rating (Health, Fire, Reactivity): 2, 2, 0
Hazard Rating:Least - 0 Slight - 1 Moderate - 2 High - 3 Extreme - 4

Inhalation:
In applications where vapors (caused by high temperature) or mists (caused by mixing or spraying) are created, breathing may cause a mild burning sensation in the nose, throat and lungs. Toxic and harmful if inhaled. Hydrogen

Sulfide (H2S) and other hazardous vapors may evolve and collect in the headspace of storage tanks or other enclosed vessels. Hydrogen Sulfide is an extremely flammable, toxic gas. Inhalation of vapors, mist or fumes (generated at high temperatures) may cause irritation to the nose, throat and respiratory tract.

Eye Irritation:
May cause slight irritation of the eyes. If irritation occurs, a temporary burning sensation, minor redness, swelling, and/or blurred vision may result.

Skin Contact:
Severely irritating to the skin causing pain, redness and swelling. Other adverse effects not expected from brief skin contact.

Ingestion:
This material may be harmful or fatal if swallowed. Ingestion may result in vomiting; aspiration (breathing) of vomitus into lungs must be avoided as even small quantities may result in aspiration pneumonitis. Generally considered to have a low order of acute oral toxicity.
Other Health Effects:
Carcinogenic in animal tests. It is probable that the material causes cancer in laboratory animals.
Material may release hydrogen sulfide (H2S), a highly toxic and extremely flammable gas, when heated to 180 Degrees F or higher. H2S can cause irritation of the eyes and respiratory tract, headache, dizziness, nausea, vomitting, diarrhea, and pulmonary edema. The odor ("rotten egg") threshold is 0.02 ppm. Do not depend on sense of smell for warning; H2S rapidly deadens the sense of smell.

Refer to Section 11, Toxicological Information, for specific information on the following effects:
Genotoxicity
Signs and Symptoms:
Irritation as noted above. Aspiration pneumonitis may be evidenced by coughing, labored breathing and cyanosis (bluish skin); in severe cases death may occur.

For additional health information, refer to section 11.

SECTION 4 FIRST AID MEASURES

Inhalation:
Vaporization of H2S that has been trapped in clothing can be dangerous to rescuers. Maintain respiratory protection to avoid contamination from victim to rescuer. Mechanical ventilation should be used to resuscitate the victim. DO NOT attempt to rescue victim unless proper respiratory protection is worn. If the victim has difficulty breathing or tightness of the chest, is dizzy, vomiting or unresponsive, give 100% oxygen with rescue breathing or CPR as required and transport to the nearest medical facility.

Skin:
Remove contaminated clothing. Flush with large amounts of water for at least 15 minutes and follow by washing with soap if available. If redness, swelling, pain and/or blisters occur, transport to the nearest medical facility for additional treatment.

Eye:
Flush eyes with plenty of water while holding eyelids open. Rest eyes for 30 minutes. If redness, burning, blurred vision or swelling occur, transport to nearest medical facility for additional treatment.

Ingestion:
DO NOT take internally. In general no treatment is necessary unless large quantities are swallowed, however, get medical advice. Have victim rinse mouth out with water, then drink sips of water to remove taste from mouth. If vomiting occurs spontaneously, keep head below hips to prevent aspiration.

Note to Physician:
If more than 2.0ml/kg body weight has been ingested and vomiting has not occurred, emesis should be induced with supervision. Keep victim's head below hips to prevent aspiration. If symptoms such as loss of gag reflex, convulsions, or unconsciousness occur before emesis, gastric lavage using a cuffed endotracheal tube should be considered.

SECTION 5 FIRE FIGHTING MEASURES

Flash Point [Method]: >125 °F/>51.67 °C [Closed Cup]
Autoignition Temperature: 500 °F/260 °C
Flammability in Air: 0.5 - 4.4 %volume

Extinguishing Media:
Material will float and can be re-ignited on surface of water. Use water fog, 'alcohol foam', dry chemical or carbon dioxide (CO2) to extinguish flames. Do not use a direct stream of water.

Fire Fighting Instructions:
CAUTION! COMBUSTIBLE. Clear fire area of all non-emergency personnel. Do not enter confined fire space without full bunker gear (helmet with face shield, bunker coats, gloves and rubber boots), including a positive pressure, NIOSH approved, self-contained breathing apparatus. Cool surrounding equipment, fire-exposed containers and structures with water. Container areas exposed to direct flame contact should be cooled with large quantities of water (500 gallons water per minute flame impingement exposure) to prevent weakening of container structure.

SECTION 6 ACCIDENTAL RELEASE MEASURES

Protective Measures:
CAUTION! COMBUSTIBLE. Eliminate potential sources of ignition. Handling equipment must be bonded and grounded to prevent sparking.

Wear appropriate personal protective equipment when cleaning up spills. Refer to Section 8.

Spill Management:
Shut off source of leak if safe to do so. Dike and contain spill.

FOR LARGE SPILLS: Remove with vacuum truck or pump to storage/salvage vessels.

FOR SMALL SPILLS: Soak up residue with an absorbent such as clay, sand or other suitable material. Place in non-leaking container and seal tightly for proper disposal.

Reporting:
U.S. regulations require reporting releases of this material to the environment which exceed the reportable quantity to the National Response Center at (800)424-8802.
CWA: This product is an oil as defined under Section 311 of EPA's Clean Water Act (CWA). Spills into or leading to surface waters that cause a sheen must be reported to the National Response Center, 1-800-424-8802.

SECTION 7 HANDLING AND STORAGE

Precautionary Measures:
CAUTION! COMBUSTIBLE. Do not breathe material. Keep container closed. Use only with adequate ventilation. Avoid heat, open flames, including pilot lights, and strong oxidizing agents. Use explosion-proof ventilation to prevent vapor accumulation. Ground all handling equipment to prevent sparking. Avoid contact with eyes, skin and clothing. Wash thoroughly after handling.

Material may release hydrogen sulfide (H2S), a highly toxic and extremely flammable gas, when heated to 180 Degrees F or higher. H2S may collect in the headspace of the container.

Handling:
Surfaces that are sufficiently hot may ignite liquid material.

Storage:
Keep liquid and vapor away from heat, sparks and flame. Extinguish pilot lights, cigarettes and turn off other sources of ignition prior to use and until all vapors have dissipated. Use explosion-proof ventilation indoors and in laboratory settings.

Container Warnings:
Keep containers closed when not in use. Containers, even those that have been emptied, can contain explosive vapors. Do not cut, drill, grind, weld or perform similar operations on or near containers.

SECTION 8 EXPOSURE CONTROLS/PERSONAL PROTECTION

Benzene ACGIH TLV TWA: 0.5 ppmv STEL: 2.5 ppmv Notation: Skin
Benzene OSHA PEL TWA: 1 ppmv STEL: 5 ppmv
Diesel Fuel, as total hydrocarbons ACGIH TLV TWA: 100 mg/m3
Carbon dioxide ACGIH - TLV TWA: 5000 ppmm STEL: 30000 ppmm
Carbon dioxide OSHA - PEL STEL: 30000 ppmm
Carbon dioxide OSHA - PEL_IS TWA: 10000 ppmm
Carbon monoxide OSHA - PEL TWA: 35 ppmv Ceiling: 200 ppmv
Carbon monoxide Combustion

EXPOSURE CONTROLS
Adequate explosion-proof ventilation to control airborne concentrations.

PERSONAL PROTECTION
Personal protective equipment (PPE) selections vary based on potential exposure conditions such as handling practices, concentration and ventilation. Information on the selection of eye, skin and respiratory protection for use with this material is provided below.

Eye Protection:
Chemical Goggles - If liquid contact is likely., or Safety glasses with side shields

Skin Protection:
Use protective clothing which is chemically resistant to this material. Selection of protective clothing depends on potential exposure conditions and may include gloves, boots, suits and other items. The selection(s) should take into account such factors as job task, type of exposure and durability requirements.

Published literature, test data and/or glove and clothing manufacturers indicate the best protection is provided by:
Neoprene, or Nitrile Rubber

Respiratory Protection:
If engineering controls do not maintain airborne concentrations to a level which is adequate to protect worker health, an approved respirator must be worn. Respirator selection, use and maintenance should be in accordance with the requirements of the OSHA Respiratory Protection Standard, 29 CFR 1910.134.

Types of respirator(s) to be considered in the selection process include:
Supplied-Air Respirator. Air-Purifying Respirator for Organic Vapors.
Self-contained breathing apparatus for use in environments with unknown concentrations or emergency situations.

SECTION 9 PHYSICAL AND CHEMICAL PROPERTIES

Appearance & Odor: Bright and clear liquid (Tax Exempt Diesels - pale red liquid). Oil-type odor.
Substance Chemical Family: Petroleum Hydrocarbon, Fuel Oil
Appearance: Bright and clear liquid (Tax Exempt Diesels - pale red liquid).

Auto Ignition Temperature: 500 °F

Flammability in Air: 0.5 - 4.4 %volume

Flash Point: > 125 °F [Closed Cup]

Specific Gravity: 0.85 Typical

Stability: Stable

Vapor Pressure: 0.02 mmHg Typical [Calculated]

Viscosity: 1.9 - 4.1 cSt @ 40 °C

SECTION 10 REACTIVITY AND STABILITY

Stability:
Material is stable under normal conditions.

Conditions to Avoid:
Avoid heat and open flames.

Materials to Avoid:
Avoid contact with strong oxidizing agents.

Hazardous Decomposition Products:
Thermal decomposition products are highly dependent on combustion conditions. A complex mixture of airborne solids, liquids and gases will evolve when this material undergoes pyrolysis or combustion. Aldehydes, Carbon Monoxide, Carbon Dioxide, Ketones
and other unidentified organic compounds may be formed upon combustion.

SECTION 11 TOXICOLOGICAL INFORMATION

Acute Toxicity
Dermal LD50 > 5 ml/kg(Rabbit) OSHA: Non-Toxic Based on similar material(s)
Eye Irritation Non-Irritating [Rabbit] OSHA: Non-Irritating Based on similar material(s)
Oral LD50 9 ml/kg(Rat) OSHA: Non-Toxic Based on similar material(s)
Skin Irritation Draize Extremely irritating [Rabbit] OSHA: Irritating Based on similar material(s)
Carcinogenicity Classification
#2 Diesel
NTP: No IARC: No ACGIH: No OSHA: No
Benzene
NTP: Yes IARC: Carcinogen (1) ACGIH: A1 OSHA: Yes
Light Catalytic Cracked Distillate
NTP: No IARC: Possible Carcinogen (2B) ACGIH: No OSHA: No
Carcinogenicity
Related materials have caused the development of skin tumors in lifetime mouse skin painting studies. However, these tumors have a long latency period and may be associated with the repeated severe irritation caused by the test materials. Prolonged and repeated exposure to high concentrations (10s to 100s ppm) of benzene may cause serious injury to blood-forming organs and is associated with anemia (depletion of blood cells) and is linked to the later development of acute myelogenous leukemia (AML).

Genotoxicity
A closely related component (Hydrodesulfurized Middle Distillate) did not cause detectable mutations in two different in vivo (live animal) studies. Some evidence of genotoxicity was seen in separate in vitro (test tube) studies, usually in cases where the test material was metabolically activated.

SECTION 12 ECOLOGICAL INFORMATION

Environmental Impact Summary:
There is no ecological data available for this product.

SECTION 13 DISPOSAL CONSIDERATIONS

RCRA Information:

Under RCRA, it is the responsibility of the user of the material to determine, at the time of the disposal, whether the material meets RCRA criteria for hazardous waste. This is because material uses, transformations, mixtures, processes, etc. may affect the classification. Refer to the latest EPA, state and local regulations regarding proper disposal.

SECTION 14 TRANSPORT INFORMATION

US Department of Transportation Classification

Proper Shipping Name: Diesel Fuel
Identification Number: NA1993
Hazard Class/Division: Combustible Liquid
Packing Group: III
Hazardous Substance/Material RQ: Benzene / 1546.2005 lbs
Oil: This product is an oil under 49CFR (DOT) Part 130. If shipped by rail or highway in a tank with a capacity of 3500 gallons or more, it is subject to these requirements. Mixtures or solutions containing 10% or more of this product may also be subject to this rule.
Emergency Response Guide # 128

International Air Transport Association

Hazard Class/Division: 3 (Flammable Liquid)
Identification Number: UN1202
Packing Group: III
Proper Shipping Name: Diesel Fuel

International Maritime Organization Classification

Hazard Class/Division: 3 (Flammable Liquid)
Identification Number: UN1202
Packing Group: III
Proper Shipping Name: Diesel Fuel

SECTION 15 REGULATORY INFORMATION

FEDERAL REGULATORY STATUS

OSHA Classification:
Product is hazardous according to the OSHA Hazard Communication Standard, 29 CFR 1910.1200.
Comprehensive Environmental Release, Compensation & Liability Act (CERCLA):
Benzene RQ 10 lbs Reportable Spill => 10 lbs or 1 gal

Ozone Depleting Substances (40 CFR 82 Clean Air Act):
This material does not contain nor was it directly manufactured with any Class I or Class II ozone depleting substances.

Superfund Amendment & Reauthorization Act (SARA) Title III:

SARA Extremely Hazardous Substances (302/304):
Hydrogen sulfide RQ 100 lbs Reportable Spill => 702028 lbs or 99066 gal

SARA Hazard Categories (311/312):
Immediate Health:YES Delayed Health:YES Fire:YES Pressure:NO Reactivity:NO

SARA Toxic Release Inventory (TRI) (313):
Benzene

Toxic Substances Control Act (TSCA) Status:
This material is listed on the EPA/TSCA Inventory of Chemical Substances.

Other Chemical Inventories:
Australian AICS, Canadian DSL, European EINECS, Korean Inventory,

State Regulation
The following chemicals are specifically listed by individual states; other product specific health and safety data in other sections of the MSDS may also be applicable for state requirements. For details on your regulatory requirements you should contact the appropriate agency in your state.

California Safe Drinking Water and Toxic Enforcement Act (Proposition 65).

WARNING: This product contains a chemical(s) known to the State of California to cause cancer.

WARNING: This product contains a chemical(s) known to the State of California to cause birth defects or other reproductive harm.

New Jersey Right-To-Know Chemical List:

Benzene (71-43-2)	0.01 - 0.64	%weight	Carcinogen
Benzene (71-43-2)	0.01 - 0.64	%weight	Mutagen
Light Cat Cracked Distillate	0 - 39.99	%weight	Mutagen

Pennsylvania Right-To-Know Chemical List:

Benzene (71-43-2)	0.01 - 0.64	%weight	Spec Haz Sub/Env Hazardous

---

SECTION 16 OTHER INFORMATION

Revision#: 1
Revision Date: 04/22/2003
Revisions since last change (discussion): This Material Safety Data Sheet (MSDS) has been newly reviewed to fully comply with the guidance contained in the ANSI MSDS standard (ANSI Z400.1-1998). We encourage you to take the opportunity to read the MSDS and review the information contained therein.

SECTION 17 LABEL INFORMATION

READ AND UNDERSTAND MATERIAL SAFETY DATA SHEET BEFORE HANDLING OR DISPOSING OF PRODUCT. THIS LABEL COMPLIES WITH THE REQUIREMENTS OF THE OSHA HAZARD COMMUNICATION STANDARD (29 CFR 1910.1200) FOR USE IN THE WORKPLACE. THIS LABEL IS NOT INTENDED TO BE USED WITH PACKAGING INTENDED FOR SALE TO CONSUMERS AND MAY NOT CONFORM WITH THE REQUIREMENTS OF THE CONSUMER PRODUCT SAFETY ACT OR OTHER RELATED REGULATORY REQUIREMENTS.

PRODUCT CODE(S): 26967

BR HS Diesel 2 Dyed (.5%s)

WARNING!

COMBUSTIBLE LIQUID! MAY BE FATAL IF INHALED. CAUSES SEVERE SKIN IRRITATION. ASPIRATION HAZARD IF SWALLOWED - CAN ENTER LUNGS AND CAUSE DAMAGE. CONTAINS BENZENE WHICH IS A CANCER HAZARD - LINKED TO DEVELOPMENT OF ACUTE MYELOGENOUS LEUKEMIA.

Refer to Section 11, Toxicological Information, for specific information on the following effects:
Genotoxicity

Precautionary Measures:
Avoid heat and open flames. Hydrogen Sulfide and other hazardous vapors may evolve and collect in the headspace of storage tanks or other enclosed vessels. Hydrogen Sulfide is an extremely flammable, toxic gas. Respiratory protection should be worn when venting tanks. Avoid breathing of vapors, fumes, or mist. Do not take internally. Use only with adequate ventilation. Avoid contact with eyes, skin and clothing. Keep container closed when not in use. Wash thoroughly after handling.

FIRST AID

Inhalation: DO NOT attempt to rescue victim unless proper respiratory protection is worn. Vaporization of H2S that has been trapped in clothing can be dangerous to rescuers. Maintain respiratory protection to avoid contamination from victim to rescuer. Mechanical ventilation should be used to resuscitate the victim. If the victim has difficulty breathing or tightness of the chest, is dizzy, vomiting or unresponsive, give 100% oxygen with rescue breathing or CPR as required and transport to the nearest medical facility.
Skin Contact: Remove contaminated clothing. Flush with large amounts of water for at least 15 minutes and follow by washing with soap if available.

If redness, swelling, pain and/or blisters occur, transport to the nearest medical facility for additional treatment.
Eye Contact: Flush eyes with plenty of water while holding eyelids open. Rest eyes for 30 minutes. If redness, burning, blurred vision or swelling occur, transport to nearest medical facility for additional treatment.
Ingestion: DO NOT take internally. If vomiting occurs spontaneously, keep head below hips to prevent aspiration. Have victim rinse mouth out with water, then drink sips of water to remove taste from mouth. In general no treatment is necessary unless large quantities are swallowed, however, get medical advice.

FIRE

In case of fire, Use water fog, 'alcohol foam', dry chemical or carbon dioxide (CO2) to extinguish flames. Do not use a direct stream of water. Material will float and can be re-ignited on surface of water.

SPILL OR LEAK
Dike and contain spill.
FOR LARGE SPILLS: Remove with vacuum truck or pump to storage/salvage vessels.

FOR SMALL SPILLS: Soak up residue with an absorbent such as clay, sand or other suitable material. Place in non-leaking container and seal tightly for proper disposal.

CONTAINS: Full Range Straight Run Middle Distillate, 68814-87-9; Hydrotreated Middle Distillate, 64742-46-7; Light Catalytic Cracked Distillate, 64741-59-9; Benzene, 71-43-2; Sulfur, 7704-34-9

NFPA Rating (Health, Fire, Reactivity): 2, 2, 0

TRANSPORTATION
US Department of Transportation Classification

Proper Shipping Name: Diesel Fuel
Identification Number: NA1993
Hazard Class/Division: Combustible Liquid
Packing Group: III
Hazardous Substance/Material RQ: Benzene / 1546.2005 lbs
Oil: This product is an oil under 49CFR (DOT) Part 130. If shipped by rail or highway in a tank with a capacity of 3500 gallons or more, it is subject to these requirements. Mixtures or solutions containing 10% or more of this product may also be subject to this rule.
Emergency Response Guide # 128

California Safe Drinking Water and Toxic Enforcement Act (Proposition 65).

WARNING: This product contains a chemical(s) known to the State of California to cause cancer.

WARNING: This product contains a chemical(s) known to the State of California to cause birth defects or other reproductive harm.

Name and Address
Shell Oil Products US
P. O. Box 4453
Houston, TX 77210-4453

ADMINISTRATIVE INFORMATION
MANUFACTURER ADDRESS: Shell Oil Products US, P. O. Box 4453, Houston, TX. 77210-4453
Company Product Stewardship & Regulatory Compliance Contact: David Snyder
Phone Number: (281) 874-7728

THE INFORMATION CONTAINED IN THIS DATA SHEET IS BASED ON THE DATA AVAILABLE TO US AT THIS TIME, AND IS BELIEVED TO BE ACCURATE BASED UPON THAT : IT IS PROVIDED INDEPENDENTLY OF ANY SALE OF THE PRODUCT, FOR PURPOSE OF HAZARD COMMUNICATION. IT IS NOT INTENDED TO CONSTITUTE PRODUCT PERFORMANCE INFORMATION, AND NO EXPRESS OR IMPLIED WARRANTY OF ANY KIND IS MADE WITH RESPECT TO THE PRODUCT, UNDERLYING DATA OR THE INFORMATION CONTAINED HEREIN. YOU ARE URGED TO OBTAIN DATA SHEETS FOR ALL PRODUCTS YOU BUY, PROCESS, USE OR DISTRIBUTE, AND ARE ENCOURAGED TO ADVISE THOSE WHO MAY COME IN CONTACT WITH SUCH PRODUCTS OF THE INFORMATION CONTAINED HEREIN.

TO DETERMINE THE APPLICABILITY OR EFFECT OF ANY LAW OR REGULATION WITH RESPECT TO THE PRODUCT, YOU SHOULD CONSULT WITH YOUR LEGAL ADVISOR OR THE APPROPRIATE GOVERNMENT AGENCY. WE WILL NOT PROVIDE ADVICE ON SUCH MATTERS, OR BE RESPONSIBLE FOR ANY INJURY FROM THE USE OF THE PRODUCT DESCRIBED HEREIN. THE UNDERLYING DATA, AND THE INFORMATION PROVIDED HEREIN AS A RESULT OF THAT DATA, IS THE PROPERTY OF SHELL OIL PRODUCTS US AND IS NOT TO BE THE SUBJECT OF SALE OR EXCHANGE WITHOUT THE EXPRESS WRITTEN CONSENT OF SHELL OIL PRODUCTS US.

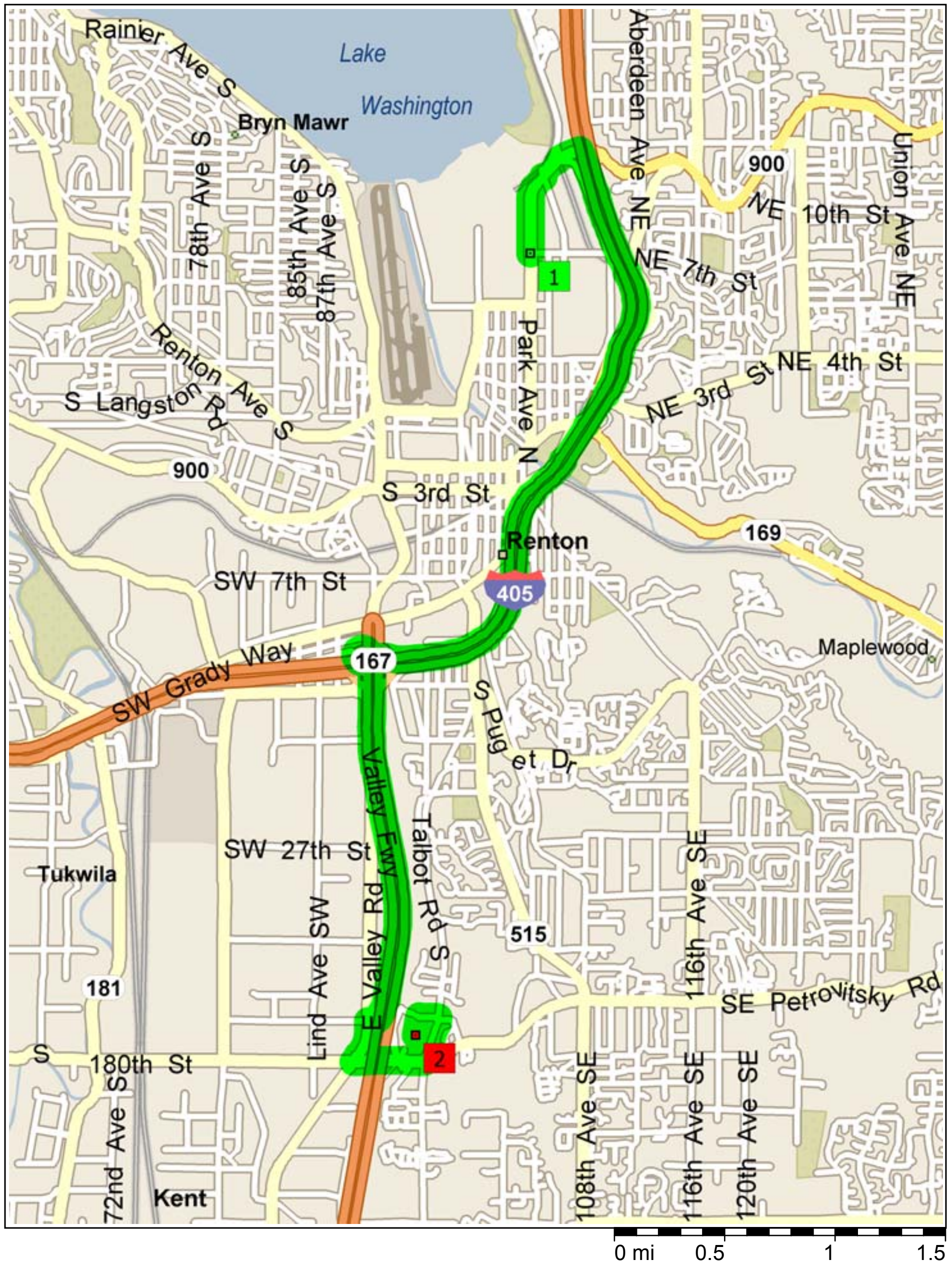
38407-11799-100R-04/22/2003

APPENDIX E

Map of Route to Hospital

Boeing Renton Facility to Valley Medical Center

6.6 miles; 11 minutes



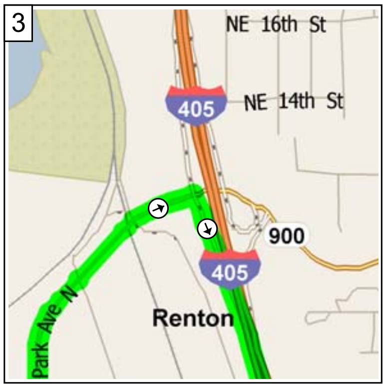
9:00 AM	0.0 mi	1 Depart Park Ave N & N 8th St, Renton, WA 98055 on Park Ave N (North) for 0.4 mi
9:00 AM	0.4 mi	Road name changes to NE Park Dr for 0.2 mi
9:01 AM	0.6 mi	Take Ramp (RIGHT) onto I-405 [SR-900] for 2.8 mi towards I-405 / Wa-900 / Tacoma
9:04 AM	3.4 mi	At exit 2A, take Ramp (RIGHT) onto SR-167 [Valley Fwy] for 2.1 mi towards Wa-167 / Kent / Auburn
9:07 AM	5.5 mi	Turn RIGHT onto Ramp for 0.1 mi towards E. Valley Rd. / S.W. 41st St. / S. 180th St.
9:07 AM	5.6 mi	Turn LEFT (South) onto E Valley Rd for 0.2 mi
9:07 AM	5.8 mi	Turn LEFT (East) onto S 180th St for 0.2 mi
9:08 AM	6.0 mi	Road name changes to SW 43rd St [S 43rd St] for 0.1 mi
9:09 AM	6.2 mi	Turn LEFT (North) onto Talbot Rd S for 0.2 mi
9:10 AM	6.4 mi	Turn LEFT (West) onto Local road(s) for 0.1 mi
9:11 AM	6.5 mi	Turn LEFT (South) onto Local road(s) for 164 yds
9:11 AM	6.6 mi	2 Arrive Valley Medical Center

Boeing Renton Facility to Valley Medical Center

6.6 miles; 11 minutes

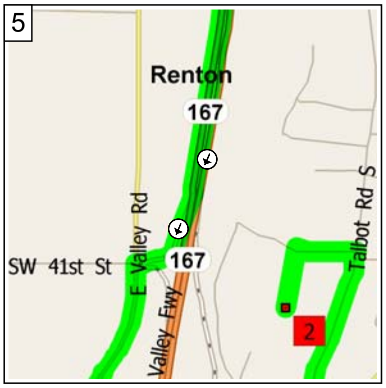
9:00 AM 0.0 mi
Depart Park Ave N & N 8th St, Renton, WA 98055 on Park Ave N (North) for 0.4 mi

9:00 AM 0.4 mi
Road name changes to NE Park Dr for 0.2 mi



9:01 AM 0.6 mi
Take Ramp (RIGHT) onto I-405 [SR-900] for 2.8 mi towards I-405 / Wa-900 / Tacoma

9:04 AM 3.4 mi
At exit 2A, take Ramp (RIGHT) onto SR-167 [Valley Fwy] for 2.1 mi towards Wa-167 / Kent / Auburn

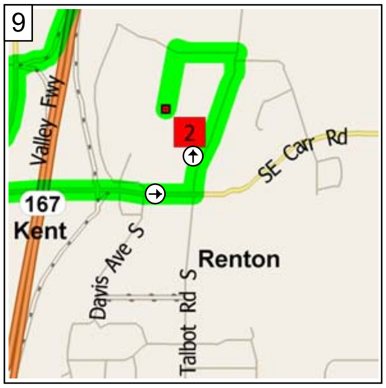


9:07 AM 5.5 mi
Turn RIGHT onto Ramp for 0.1 mi towards E. Valley Rd. / S.W. 41st St. / S. 180th St.

9:07 AM 5.6 mi
Turn LEFT (South) onto E Valley Rd for 0.2 mi

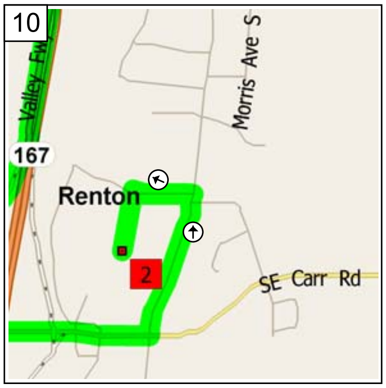
9:07 AM 5.8 mi
Turn LEFT (East) onto S 180th St for 0.2 mi

9:08 AM 6.0 mi
Road name changes to SW 43rd St [S 43rd St] for 0.1 mi



9:09 AM 6.2 mi
Turn LEFT (North) onto Talbot Rd S for 0.2 mi

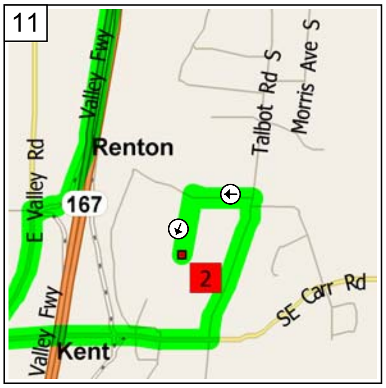
10



9:10 AM 6.4 mi

Turn LEFT (West) onto Local road(s) for 0.1 mi

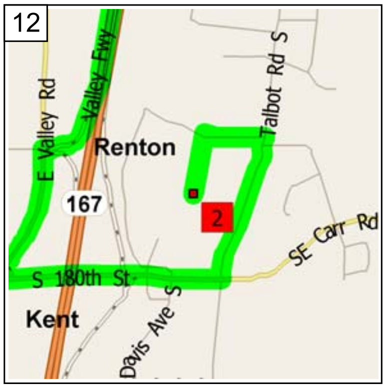
11



9:11 AM 6.5 mi

Turn LEFT (South) onto Local road(s) for 164 yds

12



9:11 AM 6.6 mi

Arrive Valley Medical Center

APPENDIX F

Specification Sheets for Bioremediation Substrates

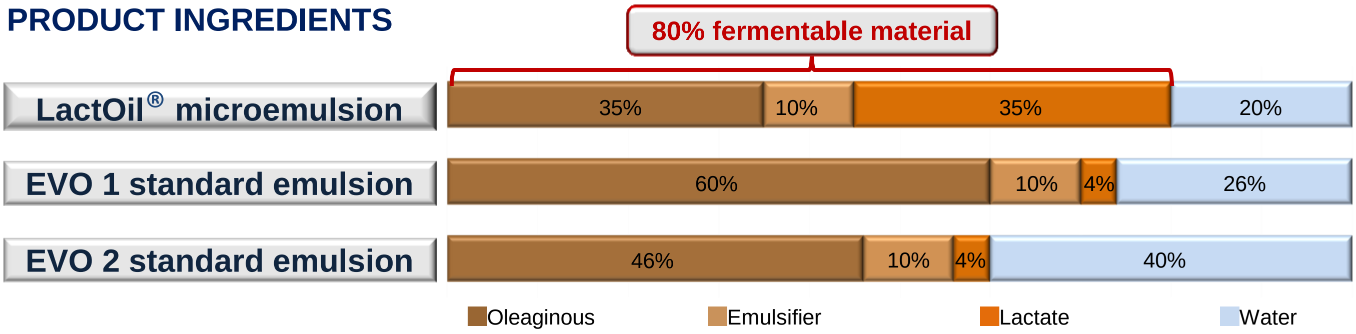
LACTOIL®

SOY MICROEMULSION

UNIQUE FORMULATION PROVIDES SAVINGS THROUGH IMPROVED SUBSTRATE LONGEVITY, EFFICIENCY, AND DEGRADATION RATES

LactOil® is a thermodynamically stable microemulsion formulation designed to offer the user greater product shelf life, ease of mixing and injection, and enhanced aquifer distribution at a cost lower than other commercially available emulsified vegetable oil products.

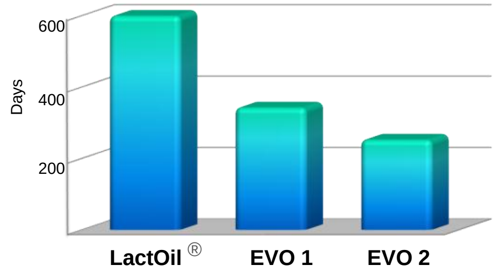
PRODUCT INGREDIENTS



On a per pound basis, LactOil® contains up to 27.5% more fermentable material than other commercially available emulsified vegetable oil products; providing cost savings on both product as well as shipping costs.

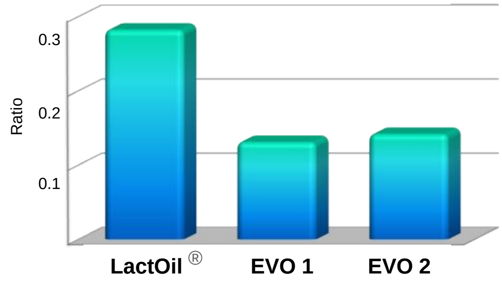
LACTOIL® ESTIMATED LONGEVITY

Microcosm studies have shown that LactOil® has an estimated electron donor longevity that is 2-3 times greater than other commercially available emulsified vegetable oil products.



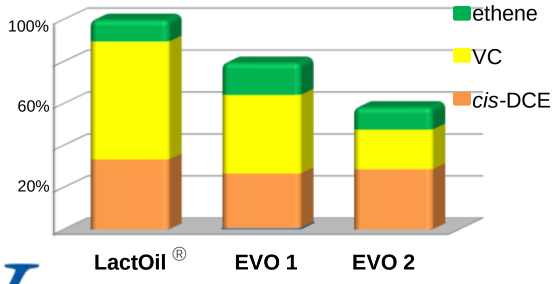
LACTOIL® DONOR EFFICIENCY

Microcosm studies have shown that compared to other commercially available emulsified vegetable oil products, LactOil® has a higher ratio of electrons stimulating dechlorination than consumed by methanogenesis and acetogenesis.



LACTOIL® DEGRADATION RATES

Microcosm studies have shown that LactOil® can degrade PCE to *cis*-DCE, vinyl chloride, and ethene quicker than other commercially available emulsified vegetable oil products.



JRW BIOREMEDIATION LLC

www.jrwbioremediation.com
(913)438-5544
info@jrwbiorem.com

JRW BIOREMEDIATION LLC

LACTOIL™

VEGETABLE OIL EMULSION

Description

LactOil™ is a self emulsifying vegetable oil emulsion for the remediation of chlorinated solvents, metals and perchlorates. LactOil™ is delivered as a concentrated, water-in-oil reverse emulsion with high solids and low viscosity. LactOil™ can also be amended with Accelerite™ bioremediation nutrient to increase metabolic kinetics and overall efficiency.

Typical Properties

	LactOil™
Appearance	Clear Brown Liquid
Viscosity, cP at 70°F	25
Specific Gravity (20°C)	1.05
Moisture, % wt/wt	20
Emulsion Stability	up to 1 year

Applications

LactOil™ is designed to combine the hydrogen donor properties of slow release carbon substrates with enhanced dispersion properties of emulsified vegetable oils.

LactOil™ self emulsifies in water over a wide range of concentrations with minimal mixing. Once emulsified at the target injection concentration, the emulsion can be injected at pressures only limited by the equipment ratings and formation characteristics.

Higher concentrations of LactOil™ are ideal for barrier application in slower moving aquifers or for the treatment of DNAPL. Lower concentrations are ideal for the remediation of dissolved phase contaminants over large areas.

Packaging

450 pound drums

Storage

Store unopened in at ambient conditions

10/07

Tel: 913.438.5544 • Fax: 913.438.5554 • 14321 West 96th Terrace, Lenexa, KS 66215

info@jrwbiorem.com • http://www.jrwbioremediation.com

MATERIAL SAFETY DATA SHEET

LACTOIL®
SOY MICROEMULSION

SECTION I PRODUCT IDENTIFICATION

PRODUCT NAME:	LactOil® Soy Microemulsion
PRODUCT USE:	In-situ Bioremediation
SUPPLIER:	JRW Bioremediation, LLC 14321 W. 96th Terrace Lenexa, KS 66215 913-438-5544
EMERGENCY TELEPHONE:	800-779-5545 x 116 (Mon-Fri 9am-5pm CST) 913-961-6644 (afterhours)
DATE REVISED:	06-27-2011

SECTION II COMPOSITION/INFORMATION ON INGREDIENTS

Name	CAS #	% by Weight
LactOil®	Proprietary blend	100%

SECTION III PHYSICAL/CHEMICAL CHARACTERISTICS

Boiling point:	Not applicable
Vapor pressure (Mg Hg):	Not determined
Vapor density (air = 1):	Not determined
Solubility in water:	Not determined
Appearance and odor:	Brown to yellow with bland odor
Specific gravity (H_2O = 1):	Not determined
Melting point:	Not determined
Evaporation rate:	Not determined
Density	1.05
pH:	7.5
Molecular Weight:	Not determined
Physical State:	Liquid

SECTION IV FIRE AND EXPLOSION HAZARD DATA

Closed cup Flash point:	>75C vis Pensky-Martens Closed Cup Test (ASTM std D93
Open cup Flash point:	Not determined
Auto Ignition:	Not determined
Fire Point:	Not determined
Flammable limits:	Not determined
LEL:	Not determined
UEL:	Not determined
Extinguishing media:	Dry chemical, foam, carbon dioxide, or water fog.
Special Fire Fighting procedures:	Wear full protective clothing and positive pressure breathing apparatus

SECTION V REACTIVITY DATA

Stability:	Unstable ☐ Stable ☒
Conditions to avoid:	Hydrolysis may occur in the presence of strong acids

	or bases.
Incompatibility (materials to avoid):	May react with strong oxidizing agents.
Hazardous decomposition or byproducts:	None known

SECTION VI HEALTH HAZARD DATA Based on concentration as sold

Route/s of Entry:

Inhalation:	Inhalation of vapors or mist may cause mild irritation of respiratory system. If symptoms are experienced, remove source of contamination or move to fresh air. If affected person is not breathing, apply artificial respiration. If breathing is difficult, give oxygen.
Skin contact:	In case of contact with skin, immediately wash with plenty of soap and water while removing contaminated clothing. Seek medical attention if skin irritation develops or persists.
Eye contact:	In case of contact with eyes, immediately flush eyes with water for at least 15 minutes, lifting eyelids to facilitate irrigation. Get medical attention if necessary.
Ingestion:	If swallowed, get medical attention.

Carcinogenicity:	Not determined.
Signs and symptoms of exposure:	Slight irritation to skin, eyes, respiratory system, headache, nausea, drowsiness. May cause abdominal discomfort, nausea, and diarrhea.
Medical conditions aggravated by exposure:	Soybean derived product. Avoid if sensitive to soy products.

SECTION VII PRECAUTIONS FOR SAFE HANDLING AND USE

Steps to be taken in case material is released or spilled:	Contain spill with absorbant materials such as clay or soil and shovel and place material in drum for disposal. Surfaces may become slippery after spillage. Dispose of according to all local, state, and federal regulations at an approved waste treatment facility.
Precautions to be taken in handling and storage:	Use personal protective equipment. Prevent spills, contamination, and leakage. Keep container tightly closed. Keep in properly labeled containers. Store in a cool, dry area. Avoid freezing or excessive heat.
Other precautions:	Prevent material from entering waterways.

SECTION VIII CONTROL MEASURES

Respiratory protection (specify type):	Respiratory protection may be required if material is used in poorly ventilated areas or if material is sprayed or heated. OSHA respiratory regulations found in 29 CFR 1910.134. Use an NIOSH approved respirator when necessary.
Ventilation:	General ventilation and local exhaust are recommended.
Protective gloves:	Chemical resistant gloves recommended.
Eye protection:	Chemical goggles recommended.
Other protective clothing or equipment:	Unnecessary if other control measures are used.
Hygiene practices:	Avoid contact with skin. When using, do not eat,

drink, or smoke. Remove and wash contaminated clothing before re-use.

SECTION IX	**DOT INFORMATION**
DOT hazard class:	Not Applicable, non-regulated
Labeling:	Not Applicable
Proper Shipping Name:	LactOil® Soy Microemulsion
NMFC#:	144920
Class	**65**

FMC Corporation
Chemical Products Group
Environmental Business
1735 Market Street
Philadelphia, PA 19103
Phone: 1-866-860-4760

Visit our E-Commerce Site at
http://www.fmcchemicals.com

PermeOx® Plus

CAS NO 1305-79-9

Introduction

PermeOx® Plus is an economical, viable and effective oxygen-generating compound for use in odor control, metals removal and bio-remediation. PermeOx® Plus is a passive, in situ approach to providing an oxygen source for bio-remediation. Successful bio-remediation depends on proper mix of nutrient, oxygen, and microbes. Often the limiting factor of aerobic degradation of contaminants is oxygen availability. PermeOx® Plus is designed for slow releases of oxygen over the pH range of 4 to 9 so that indigenous aerobic microbes may utilize the organic containments as a source of nutrient.

Formula

CaO_2 MW 72

Description

Off white granular solid

Specifications

Calcium Peroxide, wt%	75 min
Active Oxygen, wt%	16 min
Other Ingredients, wt%	25 max

Uses

Bioremediation
Petroleum hydrocarbon remediation
Creosote remediation
Partially halogenated hydrocarbon remediation

Typical Properties

Solubility	Slightly soluble in water Soluble in acid
pH of a 1% slurry at 25 degrees C., approximate	11.4-12.5
Loose Bulk Density, approximate lb/cu ft	27
Color	Off white
Odor	None
Reaction:	$CaO_2 + 2H_2O \rightarrow Ca(OH)_2 + ½ O_2 + H_2O$

Standard Containers

NOTICE

Fiber Drums, polyethylene lined	100 lbs (45.25 kg)

Shipping

PermeOx® Plus is shipped in the above standard containers. It is classified by DOT as "Oxidizer - 5.1" and containers carry the yellow oxidizer label.

Safety/Handling/Storage

PermeOx® Plus is one of the safest to handle of the peroxygen compounds. It represents no significant hazards with regards to skin contact, absorption, inhalation, or ingestion. Airborne dust is irritating to eyes, nose, throat, and lungs. PermeOx® Plus should be handled in well ventilated, dust controlled areas. When handling large quantities, the use of dust mask, goggles, and gloves is recommended.

PermeOx® Plus is an oxidizer, thus contact with combustible materials (paper, cotton, organics, wood, leather, reducing agents, and other oxidizers) should be avoided.

PermeOx® Plus is not flammable but will contribute oxygen to feed a fire. Contamination, heat, and humid conditions will enhance and accelerate decomposition. Fires involving calcium peroxide are best controlled by using large quantities of water. However, unlike most oxidizers, decomposition is endothermic.

PermeOx® Plus should be stored in a clean, dry place. Do not expose to heat sources or high humidity. Store away from combustible materials. Keep containers closed when not in use. Handle spills by dilution with water.

(Refer to the MSDS for more detailed information)

Customer Service

To place orders, request samples or obtain general information, please call the marketing office or visit our website at www.fmcchemicals.com

FMC Corporation
Active Oxidants Division, Environmental Business
1735 Market Street
Philadelphia, PA 19103
Tel 866-860-4760

For technical assistance, please call one of the offices below.

Applications and Chemistry of Peroxygens
FMC Research and Development Center
Chemical Products Group
Princeton, NJ 08543
(609) 951-3657

Systems for Storage and Handling
FMC Technical Services and Engineering
Tonawanda, NY 14240
(716) 876-8306

NOTICE

Material Safety Data Sheet

PermeOx® Plus

MSDS #: 4365-C
Revision Date: 2010-09-29
Version 1

This MSDS has been prepared to meet U.S. OSHA Hazard Communication Standard 29 CFR 1910.1200
And Canadian Workplace Hazardous Materials Information System (WHMIS) requirements.

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1. PRODUCT AND COMPANY IDENTIFICATION

Product name	**PermeOx® Plus**
Synonyms	PermeOx-Solid Peroxygen, Calcium Superoxide, Calcium Peroxide
Recommended use:	Environmental applications

Manufacturer

FMC CORPORATION
FMC Peroxygens
1735 Market Street
Philadelphia, PA 19103
Phone: +1 215/ 299-6000 (General Information)
E-Mail: msdsinfo@fmc.com

Emergency telephone number

For leak, fire, spill or accident emergencies, call:
1 800 / 424 9300 (CHEMTREC - U.S.A.)
1 703 / 527 3887 (CHEMTREC - Collect - All Other Countries)
1 303 / 595 9048 (Medical - U.S. - Call Collect)

2. HAZARDS IDENTIFICATION

Emergency Overview

Oxidizer
Contact with combustible material may cause fire
Severely irritating (eyes)

Potential health effects

Principle Routes of Exposure	Eye contact Inhalation
Eyes	Severely irritating (eyes).
Skin	Non-irritating during normal use.
Inhalation	Irritating to respiratory system.
Ingestion	Not an expected route of exposure. Low oral toxicity.
Chronic Toxicity	No known effect.

3. COMPOSITION/INFORMATION ON INGREDIENTS

Ingredients

Chemical Name	CAS-No	Weight %
Calcium Peroxide	1305-79-9	>75
Calcium Hydroxide	1305-62-0	<25

4. FIRST AID MEASURES

Eye contact	Rinse immediately with plenty of water, also under the eyelids, for at least 15 minutes. If irritation persists, call a physician.
Skin contact	Wash skin with soap and water. Get medical attention if irritation develops and persists.
Inhalation	Move to fresh air. If symptoms persist, call a physician.
Ingestion	Rinse mouth with water and afterwards drink plenty of water or milk. Do NOT induce vomiting. Never give anything by mouth to an unconscious person. Get medical attention.

5. FIRE-FIGHTING MEASURES

Flammable properties	Not combustible.
Flash Point	Not flammable
Suitable extinguishing media	Use plenty of water - FLOOD IT! If water is not available, use CO_2, dry chemical or dirt.
Unsuitable Extinguishing Media	Dry chemical. Foam.

Contains a chemical that is an oxidizer

Hazardous combustion products	On decomposition product releases oxygen which may intensify fire.

Explosion Data

Sensitivity to Mechanical Impact	Oxidizable materials can be ignited by grinding and may become explosive
Sensitivity to Static Discharge	Not available
Specific hazards arising from the chemical	This is a strong oxidizer and will react vigorously or explosively with many materials including fuels. Cool drums with water spray.
Protective equipment and precautions for firefighters	As in any fire, wear self-contained breathing apparatus pressure-demand, MSHA/NIOSH (approved or equivalent) and full protective gear. Move containers from fire area if you can do it without risk.

NFPA	**Health Hazard** 2	**Flammability** 0	**Stability** 1	**Special Hazards** OX

6. ACCIDENTAL RELEASE MEASURES

Personal precautions	Avoid dust formation. For personal protection see section 8.
Methods for containment	Confine spill and place into container. Do not return product to the original storage container/tank due to risk of decomposition. Dilute with large quantities of water. Keep in suitable and closed containers for disposal.
Methods for cleaning up	Do not flush powdered material to sewer. Runoff to sewer may create fire or explosion hazard. Dispose of waste as indicated in Section 13.

7. HANDLING AND STORAGE

Handling	In case of insufficient ventilation, wear suitable respiratory equipment if release of airborne dust is expected. If compounded with organics or combustible materials be sure to exclude moisture. Avoid contact by using personal protective equipment. Refer to Section 8.
Storage	Keep tightly closed in a dry and cool place. Reacts with moisture. Keep away from heat and sources of ignition i.e., steam pipes, radiant heaters, hot air vents or welding sparks. .

8. Exposure controls/personal protection

Exposure guidelines Ingredients with workplace control parameters.

Chemical Name	British Columbia	Quebec	Ontario TWAEV	Alberta
Calcium Hydroxide 1305-62-0	TWA: 5 mg/m³	TWA: 5 mg/m³	TWA: 5 mg/m³	TWA: 5 mg/m³

Occupational exposure controls

Engineering measures	Provide appropriate exhaust ventilation at places where dust is formed. Ensure that eyewash stations and safety showers are close to the workstation location.
Respiratory protection	Whenever dust in the worker's breathing zone cannot be controlled with ventilation or other engineering means, workers should wear respirators or dust masks approved by NIOSH/MSHA, EU CEN or comparable organization to protect against airborne dust.
Eye/face protection	For dust, splash, mist or spray exposure, wear chemical protective goggles or a face-shield
Skin and body protection	Long sleeved clothing. Rubber or plastic boots.
Hand protection	Rubber/latex/neoprene or other suitable chemical resistant gloves. Wash the outside of gloves with soap and water prior to reuse. Inspect regularly for leaks.

Hygiene measures	Handle in accordance with good industrial hygiene and safety practice. Clean water, preferably an eyewash station and a safety shower, should be available for washing in case of eye or skin contamination.

9. PHYSICAL AND CHEMICAL PROPERTIES

Information on basic physical and chemical properties

Appearance	dry, free flowing granules
Color	off-white
Physical state	dry powder
Odor	odorless
Odor Threshold	Not applicable
pH	(1% solution) 10.5 - 11.8 (1% solution)
Melting Point/Range	Decomposes on heating. @ ~275 °C
Freezing point	No information available.
Boiling Point/Range	Not applicable
Flash Point	Not flammable
Evaporation rate	No data available
Flammable properties	Not combustible
Oxidizing properties	Oxidizer
Vapor pressure	No information available.
Vapor density	No information available.
Specific Gravity	2.92
Relative density	~ 2.92
Bulk density	27 lb/cu ft
Water solubility	Slightly soluble
Percent volatile	No information available.
Partition coefficient:	Not applicable
Viscosity	Not applicable

Decomposition Temperature	275 °C

10. STABILITY AND REACTIVITY

Stability	Stable under recommended storage conditions. Decomposition can occur on exposure to heat or moisture.
Conditions to avoid	To avoid thermal decomposition, do not overheat, (275)
Materials to avoid	Heavy metals. Combustible materials
Hazardous decomposition products	Oxygen which supports combustion, Calcium oxides.
Hazardous polymerization	Hazardous polymerization does not occur.
Hazardous reactions	Oxidizable material can be ignited by grinding and may become explosive.

11. TOXICOLOGICAL INFORMATION

Acute effects

Eye irritation	Severely irritating, corrosive (rabbit)
Skin irritation	Non-irritating (rabbit) May cause skin irritation in susceptible persons
LD50 Oral	> 5 g/kg (Rat)
LD50 Dermal	> 10 g/kg (Rat)
LC50 Inhalation:	> 17 mg/L 1 hr (Rat)
Sensitization	No information available.
Acute toxicity of over-exposure	Dust is irritating eyes, nose, throat, and lungs.

Chronic Toxicity

Chronic Toxicity	No known effect.
Carcinogenicity	There are no known carcinogenic chemicals in this product

12. ECOLOGICAL INFORMATION

Ecotoxicity

The environmental impact of this product has not been fully investigated

Persistence and degradability	Biodegradability does not pertain to inorganic substances.
Bioaccumulation	Does not bioaccumulate.
Mobility	No information available.
Other adverse effects	None known

13. DISPOSAL CONSIDERATIONS

Waste disposal methods	This material, as supplied, is a hazardous waste according to federal regulations (40 CFR 261). Dispose of in accordance with local regulations.
Contaminated packaging	Empty remaining contents. Empty containers should be taken to an approved waste handling site for recycling or disposal.
US EPA Waste Number	D001

14. TRANSPORT INFORMATION

DOT

UN/ID No	1457
Proper shipping name	CALCIUM PEROXIDE MIXTURE
Hazard Class	5.1
Packing group	II
49 STCC Number	49187717

TDG

UN/ID No	1457
Proper shipping name	CALCIUM PEROXIDE MIXTURE
Hazard Class	5.1
Packing group	II

ICAO/IATA	Oxidizers are prohibited from aircraft.

IMDG/IMO

UN/ID No	1457
Proper shipping name	CALCIUM PEROXIDE MIXTURE
Hazard Class	5.1
Packing group	II

Other information	This material is shipped in 25 lb. plastic pails, and 30 lb. and 100 lb. fiber drums.

15. REGULATORY INFORMATION

International Inventories

TSCA Inventory (United States of America)	Complies
DSL (Canada)	Complies
NDSL (Canada)	Complies
EINECS/ELINCS (Europe)	Complies
ENCS (Japan)	Complies
IECSC (China)	Complies
KECL (Korea)	Complies
PICCS (Philippines)	Complies
AICS (Australia)	Complies
NZIoC (New Zealand)	Complies

U.S. Federal Regulations

SARA 313

Section 313 of Title III of the Superfund Amendments and Reauthorization Act of 1986 (SARA). This product does not contain any chemicals which are subject to the reporting requirements of the Act and Title 40 of the Code of Federal Regulations, Part 372.

SARA 311/312 Hazard Categories

Acute Health Hazard	yes

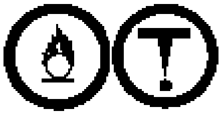
Chronic Health Hazard	no
Fire Hazard	yes
Sudden Release of Pressure Hazard	no
Reactive Hazard	no

CERCLA
This material, as supplied, does not contain any substances regulated as hazardous substances under the Comprehensive Environmental Response Compensation and Liability Act (CERCLA) (40 CFR 302) or the Superfund Amendments and Reauthorization Act (SARA) (40 CFR 355). There may be specific reporting requirements at the local, regional, or state level pertaining to releases of this material.

International Regulations

Mexico - Grade	No information available.

Canada
This product has been classified in accordance with the hazard criteria of the Controlled Products Regulations (CPR) and the MSDS contains all the information required by the CPR.
WHMIS Hazard Class
C Oxidizing materials
D2B Toxic materials



16. OTHER INFORMATION

HMIS	**Health Hazard** 2	**Flammability** 0	**Stability** 1	**Special precautions** J

NFPA/HMIS Ratings Legend
Severe = 4; Serious = 3; Moderate = 2; Slight = 1; Minimal = 0

Protection=J (Safety goggles, gloves, apron, combination dust and vapor respirator)

Revision Date:	2010-09-29
Reason for revision:	Format Change.

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Prepared By

FMC Corporation
Permeox and FMC Logo - Trademarks of FMC Corporation

End of Material Safety Data Sheet

ORC ADVANCED®
OXYGEN RELEASE COMPOUND

Highest amount of active oxygen in a controlled-release, oxygen producing compound

PRODUCT OVERVIEW

ORC Advanced® is the state-of-the-art technology for stimulating aerobic bioremediation. It offers unparalleled, maximum oxygen release for periods up to 12 months on a single injection and is specifically designed to minimize oxygen waste while maximizing contaminated site remediation.

ORC Advanced is a formulation of calcium oxyhydroxide which, upon hydration, releases oxygen and forms simple calcium hydroxide and water.

$$CaO(OH)_2 + H_2O \longrightarrow \tfrac{1}{2}O_2 + Ca(OH)_2 + H_2O$$

PRODUCT BENEFITS

PRODUCT BENEFITS

HIGHEST AVAILABLE OXYGEN CONTENT

More active oxygen (17%) plus Regenesis' patented controlled-release technology (CRT™) saves time and money by increasing degradation rates and improving remediation performance by providing more oxygen on a single injection. It is particularly effective at higher demand sites where oxygen may be limited and scavenged by competing carbon sources.

PATENTED CONTROLLED-RELEASE TECHNOLOGY (CRT™)

Based on the same proven technology employed in the industry standard Oxygen Release Compound (ORC®), CRT allows for an efficient, long-term release of oxygen providing the optimal conditions for sustained aerobic biodegradation. This can save time and money by reducing the potential need for multiple applications. Also, oxygen release "lock-up" is avoided – an unfortunate problem experienced with commodity chemicals.

IN SITU APPLICATION

Remediation with ORC Advanced is typically more cost-effective than *ex situ* treatments. With the use of ORC Advanced there is minimal site disturbance with no above-ground piping or mechanical equipment, no operations and maintenance costs and no hazardous materials handling or disposal.

CRT

DEFINING THE SCIENCE BEHIND CONTROLLED-RELEASE TECHNOLOGY (CRT™)

Early on, Regenesis researchers noted that in order to optimally stimulate the natural attenuation of aerobically degradable contaminants, biologically usable oxygen was best supplied in low but constant concentrations. Big bursts of oxygen are wasteful and simply "bubble off", often generating undesirable foaming and producing unwanted preferential flow paths in the subsurface. Regenesis sought to solve this problem by controlling the rate of oxygen release from solid oxygen sources.

The answer was provided by the development of CRT. The CRT process involves intercalating (embedding) phosphates into the crystal structure of solid peroxygen molecules. This patented feature, now available in the ORC Advanced® formulation, slows the reaction that yields oxygen within the crystal, minimizing "bubble off" which can waste the majority of oxygen available in common solid peroxygen chemicals.

CRT provides "balance" – it slows down the rate of oxygen release while at the same time preventing "lock-up". Commodity solid peroxygen chemicals, when in contact with water, will produce an initial rapid and uncontrolled-release of oxygen. Then, as hydroxides form, a significant portion of the oxygen deeper in the crystal is made unavailable or becomes"locked-up." This undesirable effect is inefficient and costly. CRT prevents lock up and controls the rate of oxygen release, representing the state-of-the-art technology in passive oxygen delivery.

FIGURE 1:
FILLING A PUMP WITH
ORC ADVANCED SLURRY

The original controlled-release oxygen compound, since 1994

ORC®
OXYGEN RELEASE COMPOUND

PRODUCT OVERVIEW

The original Oxygen Release Compound (ORC®) is a fine, powdery material comprised of a patented formulation of phosphate-intercalated magnesium peroxide. The intercalation or embedding of phosphates within the magnesium peroxide is Regenesis' patented, controlled-release mechanism.

Upon hydration, ORC is designed to produce a controlled-release of oxygen (10% by weight) into the subsurface in accordance with the following reaction:

$$MgO_2 + H_2O \longrightarrow \tfrac{1}{2}\, O_2 + Mg(OH)_2$$

This process can proceed for periods of up to one year depending on site conditions. In the presence of this long-lasting oxygen source, aerobic microbes flourish - accelerating the naturally slow rates of aerobic biodegradation.

BENEFITS

PRODUCT BENEFITS

By enhancing bioremediation using ORC, in situ treatment of contaminants can result in an efficient, simple and cost-effective alternative to traditional technologies. With low capital costs, no operations and maintenance, minimal site disturbance and proven effectiveness, ORC can restore water quality and property values at a reasonable cost.

PRODUCT APPLICATION

MATERIAL APPLICATION

Most contaminated sites are treated using ORC slurry which is a prescribed and easily injectable water and ORC mixture (Figure 2). The direct - injection of ORC slurry maximizes ORC and oxygen distribution in the subsurface increasing the range of enhanced biodegradation. ORC is dosed in pounds per vertical foot of material treated. The amount of ORC recommended depends greatly on various factors such as contaminant concentrations, oxygen sinks, groundwater flow rates and subsurface geology. It is recommended that a Regenesis Technical Services Representative be contacted for detailed design information.

ORC treatment approaches or designs may consist of one, or combinations of the following: Source Area Grids, Plume Area Grids or Barriers, Excavations and Biopiles.

SUBSURFACE EMPLACEMENT

- Direct – Push Injection
- Hollow Stem Augers
- Existing Wells
- Recirculating Wells
- Replaceable Filter Socks (existing wells)
- Excavations
- Trenches

CONTAMINANTS

TREATABLE CONTAMINANTS

ORC can treat a wide range of contaminants and most any aerobically degradable compound including: gasoline and fuel additives (BTEX and MTBE), diesel, kerosene, jet fuel, gas condensates, fuel oils, lubricants, bunker oil, PAHs, certain metals (arsenic), certain pesticides/herbicides and certain industrial solvents (alcohols and ketones).

FIGURE 2: ORC SLURRY

Oxygen Release Compound – Advanced (ORC *Advanced*™)
MATERIAL SAFETY DATA SHEET (MSDS)

Last Revised: June 24, 2010

Section 1 - Material Identification

Supplier:

REGENESIS

1011 Calle Sombra
San Clemente, CA 92673

Phone:	**949.366.8000**
Fax:	**949.366.8090**
E-mail:	**info@regenesis.com**
Chemical Description:	A mixture of Calcium OxyHydroxide [$CaO(OH)_2$] and Calcium Hydroxide [$Ca(OH)_2$].
Chemical Family:	Inorganic Chemical
Trade Name:	Advanced Formula Oxygen Release Compound (ORC *Advanced*™)
Chemical Synonyms	Calcium Hydroxide Oxide; Calcium Oxide Peroxide
Product Use:	Used to remediate contaminated soil and groundwater (environmental applications)

Section 2 – Composition

CAS No.	**Chemical**
682334-66-3	**Calcium Hydroxide Oxide [$CaO(OH)_2$]**
1305-62-0	**Calcium Hydroxide [$Ca(OH)_2$]**
7758-11-4	**Dipotassium Phosphate (HK_2O_4P)**
7778-77-0	**Monopotassium Phosphate (H_2KO_4P)**

Section 3 – Physical Data

Form:	Powder
Color:	White to Pale Yellow
Odor:	Odorless
Melting Point:	527 °F (275 °C) – Decomposes
Boiling Point:	Not Applicable (NA)
Flammability/Flash Point:	NA
Auto- Flammability:	NA
Vapor Pressure:	NA
Self-Ignition Temperature:	NA
Thermal Decomposition:	527 °F (275 °C) – Decomposes
Bulk Density:	0.5 – 0.65 g/ml (Loose Method)
Solubility:	1.65 g/L @ 68° F (20° C) for calcium hydroxide.
Viscosity:	NA
pH:	11-13 (saturated solution)
Explosion Limits % by Volume:	Non-explosive
Hazardous Decomposition Products:	Oxygen, Hydrogen Peroxide, Steam, and Heat
Hazardous Reactions:	None

Section 4 – Reactivity Data

Stability:	Stable under certain conditions (see below).
Conditions to Avoid:	Heat and moisture.
Incompatibility:	Acids, bases, salts of heavy metals, reducing agents, and flammable substances.
Hazardous Polymerization:	Does not occur.

Section 5 – Regulations

TSCA Inventory List:	Listed

CERCLA Hazardous Substance (40 CFR Part 302)

Listed Substance:	No
Unlisted Substance:	Yes
Reportable Quantity (RQ):	100 pounds
Characteristic(s):	Ignitibility
RCRA Waste Number:	D001

SARA, Title III, Sections 302/303 (40 CFR Part 355 – Emergency Planning and Notification)

Extremely Hazardous Substance:	No

SARA, Title III, Sections 311/312 (40 CFR Part 370 – Hazardous Chemical Reporting: Community Right-To-Know

Hazard Category:	Immediate Health Hazard Fire Hazard
Threshold Planning Quantity:	10,000 pounds

Section 5 – Regulations (cont)

SARA, Title III, Section 313 (40 CFR Part 372 – Toxic Chemical Release Reporting: Community Right-To-Know

Extremely Hazardous Substance:	No	
WHMIS Classification:	C	Oxidizing Material Poisonous and Infectious Material
	D	Material Causing Other Toxic Effects – Eye and Skin Irritant
Canadian Domestic Substance List:	Not Listed	

Section 6 – Protective Measures, Storage and Handling

Technical Protective Measures

Storage:	Keep in tightly closed container. Store in dry area, protected from heat sources and direct sunlight.
Handling:	Clean and dry processing pipes and equipment before operation. Never return unused product to the storage container. Keep away from incompatible products. Containers and equipment used to handle this product should be used exclusively for this material. Avoid contact with water or humidity.

Section 6 – Protective Measures, Storage and Handling (cont)

Personal Protective Equipment (PPE)

Engineering Controls:	Calcium Hydroxide ACGIH® TLV® (2000) 5 mg/m^3 TWA OSHA PEL Total dust–15 mg/m^3 TWA Respirable fraction– 5 mg/m^3 TWA NIOSH REL (1994) 5 mg/m^3
Respiratory Protection:	For many conditions, no respiratory protection may be needed; however, in dusty or unknown atmospheres use a NIOSH approved dust respirator.
Hand Protection:	Impervious protective gloves made of nitrile, natural rubbber or neoprene.
Eye Protection:	Use chemical safety goggles (dust proof).
Skin Protection:	For brief contact, few precautions other than clean clothing are needed. Full body clothing impervious to this material should be used during prolonged exposure.
Other:	Safety shower and eyewash stations should be present. Consultation with an industrial hygienist or safety manager for the selection of PPE suitable for working conditions is suggested.
Industrial Hygiene:	Avoid contact with skin and eyes.
Protection Against Fire & Explosion:	NA

Section 7 – Hazards Identification

Emergency Overview:	Oxidizer – Contact with combustibles may cause a fire. This material decomposes and releases oxygen in a fire. The additional oxygen may intensify the fire.
Potential Health Effects:	Irritating to the mucous membrane and eyes. If the product splashes in ones face and eyes, treat the eyes first. Do not dry soiled clothing close to an open flame or heat source. Any

	clothing that has been contaminated with this product should be submerged in water prior to drying.
Inhalation:	High concentrations may cause slight nose and throat irritation with a cough. There is risk of sore throat and nose bleeds if one is exposed to this material for an extended period of time.
Eye Contact:	Severe eye irritation with watering and redness. There is also the risk of serious and/or permanent eye lesions.
Skin Contact:	Irritation may occur if one is exposed to this material for extended periods.
Ingestion:	Irritation of the mouth and throat with nausea and vomiting.

Section 8 – Measures in Case of Accidents and Fire

After Spillage/Leakage/Gas Leakage:	Collect in suitable containers. Wash remainder with copious quantities of water.
Extinguishing Media:	See next.
Suitable:	Large quantities of water or water spray. In case of fire in close proximity, all means of extinguishing are acceptable.
Further Information:	Self contained breathing apparatus or approved gas mask should be worn due to small particle size. Use extinguishing media appropriate for surrounding fire. Apply cooling water to sides of transport or storage vessels that are exposed to flames until the fire is extinguished. Do not approach hot vessels that contain this product.
First Aid:	After contact with skin, wash immediately with plenty of water and soap. In case of contact with eyes, rinse immediately with plenty of water and seek medical attention. Consult an opthalmologist in all cases.

Section 8 – Measures in Case of Accidents and Fire

Eye Contact:	Flush eyes with running water for 15 minutes, while keeping the eyelids wide open. Consult with an ophthalmologist in all cases.
Inhalation:	Remove subject from dusty environment. Consult with a physician in case of respiratory symptoms.

Ingestion:	If the victim is conscious, rinse mouth and admnister fresh water. DO NOT induce vomiting. Consult a physician in all cases.
Skin Contact:	Wash affected skin with running water. Remove and clean clothing. Consult with a physician in case of persistent pain or redness.
Special Precautions:	Evacuate all non-essential personnel. Intervention should only be done by capable personnel that are trained and aware of the hazards associated with this product. When it is safe, unaffected product should be moved to safe area.
Specific Hazards:	Oxidizing substance. Oxygen released on exothermic decomposition may support combustion. Confined spaces and/or containers may be subject to increased pressure. If product comes into contact with flammables, fire or explosion may occur.

Section 9 – Accidental Release Measures

Precautions:	Observe the protection methods cited in Section 3. Avoid materials and products that are incompatible with product. Immediately notify the appropriate authorities in case of reportable discharge (> 100 lbs).
Cleanup Methods:	Collect the product with a suitable means of avoiding dust formation. All receiving equipment should be clean, vented, dry, labeled and made of material that this product is compatible with. Because of the contamination risk, the collected material should be kept in a safe isolated place. Use large quantities of water to clean the impacted area. See Section 12 for disposal methods.

Section 10 – Information on Toxicology

Toxicity Data

Acute Toxicity:	Oral Route, LD_{50}, rat, > 2,000 mg/kg (powder 50%) Dermal Route, LD_{50}, rat, > 2,000 mg/kg (powder 50%) Inhalation, LD_{50}, rat, > 5,000 mg/m^3 (powder 35%)
Irritation:	Rabbit (eyes), severe irritant

Sensitization:	No data
Chronic Toxicity:	In vitro, no mutagenic effect (Powder 50%)
Target Organ Effects:	Eyes and respiratory passages.

Section 11 – Information on Ecology

Ecology Data

Acute Exotoxicity:	10 mg $Ca(OH)_2$/L: pH = 9.0 100 mg $Ca(OH)_2$/L: pH = 10.6 Fishes, Cyprinus carpio, LC_{50}, 48 hrs, 160 mg/L Crustaceans, Daphnia sp., EC_{50}, 24 hours, 25.6 mg/L (Powder 16%)
Mobility:	Low Solubility and Mobility
Abiotic Degradation:	Water – Slow Hydrolysis. Degradation Products: Calcium Hydroxide Water/soil – complexation/precipitation. Carbonates/sulfates present at environmental concentrations. Degradation products: carbonates/sulfates sparingly soluble
Biotic Degradation:	NA (inorganic compound)
Potential for Bioaccumulation:	NA (ionizable inorganic compound)

Section 11 – Information on Ecology (cont)

Comments:	Observed effects are related to alkaline properties of the product. Hazard for the environment is limited due to the product properties of: • No bioaccumulation • Weak solubility and precipitation as carbonate or sulfate in an aquatic environment. Diluted product is rapidly neutralized at environmental pH.
Further Information:	NA

Section 12 – Disposal Considerations

Waste Disposal Method:	Consult current federal, state and local regulations regarding the proper disposal of this material and its emptied containers.

Section 13 – Shipping/Transport Information

D.O.T Shipping Name:	Oxidizing Solid, N.O.S [A mixture of Calcium OxyHydroxide [$CaO(OH)_2$] and Calcium Hydroxide [$Ca(OH)_2$].
UN Number:	1479
Hazard Class:	5.1
Label(s):	5.1 (Oxidizer)
Packaging Group:	II
STCC Number:	4918717

Section 14 – Other Information

HMIS® Rating	Health – 2 Flammability – 0	Reactivity – 1 PPE - Required

HMIS® is a registered trademark of the National Painting and Coating Association.

NFPA® Rating	Health – 2 Flammability – 0	Reactivity – 1 OX

NFPA® is a registered trademark of the National Fire Protection Association.

Reason for Issue: Update toxicological and ecological data

Section 15 – Further Information

The information contained in this document is the best available to the supplier at the time of writing, but is provided without warranty of any kind. Some possible hazards have been determined by analogy to similar classes of material. The items in this document are subject to change and clarification as more information become available.

APPENDIX G

CALIBRE Standard Operation Procedures for Bioremediation

ENHANCED REDUCTIVE DECHLORINATION (ERD) SUBSTRATE INJECTION SOPS AND CONTINGENCY PLAN
CALIBRE STANDARD OPERATING PROCEDURES ADDENDUM

1.0 POLICY

It is the policy of CALIBRE that any individual engaging in ERD injections will abide by the procedures outlined in this document. These procedures include project specific addendums to the CALIBRE Contingency Plan and Emergency Procedures Standard Operating Procedures and are designed to meet or exceed applicable Occupational Safety and Health Administration (OSHA) standards for safe work practices.

2.0 PURPOSE

The following is an amendment to the Contingency Plan and Emergency Procedures (CALIBRE 2004) specifically relating to ERD operation and potential spills of ERD injection materials (specifically water with sugar, carbohydrates or chase water used to flush the wells after substrate injection). The amendment provides specific detailed steps to be followed in the case of a large or small spill, within or outside of the containment area. For each scenario, the following response actions will be taken. Prior to any work being conducted the following procedures will be followed by all on-site personnel.

1. All personnel must read and discuss this contingency plan prior to any day of work/activity in which fluids are to be processed/handled or injected.
2. Storm drains near the work area will be identified.
3. Storm drain covers will be located. These will be placed on the storm drains before work proceeds except in inclement weather (significant precipitation where the covers would cause extensive pooling of water) when they will be kept close at hand.
4. Assemble all required spill control supplies and verify that all are functional.
5. Verify that power source is activated; find circuit breakers (for reset if required) or backup power.

3.0 SPILL CONTROL SUPPLIES

Shop vac
Extension cord(s)
Power supply
Multiple 5 gallon buckets
Broom
Storm drain covers
Flat-head shovel
Absorbent media (kitty litter)
Absorbent pads
Open top drum(s)
Wrench to open drums

4.0 PLANNING FOR POTENTIAL SPILL SCENARIOS

4.1 Small Spill within Containment Area

1. Stop the flow of the spill by shutting the valve or up-righting the hose or bucket from which the solution/fluid is coming.
2. Use the shop vac to clean up any remaining solution/fluid.
3. Repair or tighten any portion of the system that caused the small spill.

4.2 Large Spill within Containment Area

1. Stop the flow of the solution by unplugging the pump and closing valve at outlet of the Baker tank.
2. Place a bucket or other container under the spill to capture it
3. Vacuum spilled liquid and return to Baker tank, or other secure vessel.

4.3 Small Out of Containment Area Spill

1. Slow or stop the flow of the solution/fluid using the valve adjacent to the flow meter.
2. Sweep the solution/fluid back into the well head.
3. Vacuum any remaining solution/fluid.
4. Return solution/fluid to the system.

4.4 Large Out of Containment Area Spill

1. Stop the flow of the solution by unplugging the pump and closing the valve at outlet of the Baker tank.
2. Cover all storm drains with appropriate storm drain covers if not already done.
3. Vacuum spilled liquid and return to Baker tank or other secure vessel.
4. Call assigned Boeing project personnel to notify them of spill.

4.5 Spill that Discharges to Storm Drain

1. Stop the flow of the solution by unplugging the pump and closing valve at outlet of the Baker tank.
2. Cover all storm drains with appropriate storm drain covers if not already done.
3. Contact Boeing Fire and Security to notify them of the incident.
4. Vacuum spilled liquid and return to Baker tank or other secure vessel.
5. Call assigned Boeing project personnel to notify them of spill.

5.0 OPERATING PROCEDURES FOR ERD INJECTIONS

5.1 Delivery/Mixing of Sucrose Solution for Substrate Injection

The delivery and mixing of the sucrose solution is dependent on desired/available substrate used. Where appropriate, personal protective equipment such as splash protection (face shield, or safety glasses/goggles), and gloves should be worn before handling and mixing of substrate solution. Have broom, absorbent pads, and shop vac ready at mixing site in case of spill of substrate solution or water.

Recycled beverage mix:

1. Set up containment below delivery tanker, transfer lines/pump, and holding tank.
2. Connect transfer lines/pump from delivery tanker to holding tank.
3. Open valves on delivery tanker and holding tank.
4. Begin transfer of substrate to holding tank.
5. Record brix level.
6. Connect holding tank to pump for injecting.

Concentrated stock sucrose mix:

1. Set up containment below stock 250 gallon totes, transfer lines/pump, and holding tank.
2. Connect transfer lines/pump from stock 250 gallon totes to holding tank.
3. Open valves on stock 250 gallon totes and holding tank.
4. Begin transfer of stock sucrose mix to holding tank.
5. Depending on consistency and/or weather conditions the stock mix may need to be cut with water to increase fluidity.
6. Once the necessary volume of stock sucrose mix has been transferred to the final holding tank, begin adding water (fire hydrant) until desired concentration is reached. Whenever possible, add water through tank valve at base rather than the top tank opening to promote full mixing. Use a brix meter to check substrate mix concentration.
7. Record final brix level.
8. If necessary, adjust pH level.
9. Connect holding tank to pump for injecting.

5.2 Startup Steps

1. Check that all cam-locks and hoses are fully connected.
2. Check that all well head connections are setup and tight.
3. Check that all hose-clamps are tight.
4. Verify that the correct filters are placed in housings (typical 10 micron or 50 micron).
5. Verify that all flow meters are zeroed.
6. Close all valves located to the left of flow meters, reopen a small fraction (~ 1/16 to 1/8 of a turn from the seated-valve condition).
7. Open valve at outlet of Baker tank.
8. Turn on pump.
9. Check and adjust flow rates to each well, initially set flows to no more than ~ 3 gpm/well (unless operational data from the specific wells indicate more or less is appropriate).
10. Check each well.
11. Check all lines for drips/leaks, tighten/repair as required.
12. Increase (or decrease) flow to each well as injection capacity is determined.

5.3 Flow Meters

The flow meters consist of 2 parts: Burkert type S030 inline fitting (the paddlewheel unit) and a Burkert type 8035 flow totalizer/transmitter; operation manuals are attached. The flow transmitter attaches to the inline fitting with a ¼ twist and is secured with the small set-screw on the inline fitting. Check that the inline fitting has both O-rings (one on each end). Take care not to lose or pinch the O-rings, if O-rings are missing the unit cannot be used. Check that the internal paddle wheel is clean and flows freely when you blow on it (small pieces of leaves/grit/paper will make it stick). Use toothbrush to clean (gently) if required.

Zero the totalizer/flow meter at the start of an injection using the following steps:

1. Press the center button (down arrow) once, wait till it blinks and press it again, the meter should display 0.0 GA/M
2. Hold the two right buttons (down arrow and Enter key) for approximately 5 seconds, this brings the flow meter into a setup menu with the following options; Language (English), unit (gpm), K—factor (284.82), filter (2), total , Res (toggle to YES by hitting the down arrow in order to reset to zero)
3. Press the Enter key twice
4. Meter should then read 0,0 GA/M and then shortly switch to 0 GA totalized flow.

The K factor of 284.82 is for a ¾ inch pipe and units of GPM, any other pipe size or flow units require a different K-Factor (see attached operations manual, check all units carefully when changing the K-factor).

In standard operation, the flow meter reads the totalized flow. When adjusting the flow valves it is necessary to toggle the flow meters to the flow rate setting (gallons per minute);

1. Press the center button (down arrow) once, wait till it blinks and press it again and
2. the meter will display the flow rate in GA/M,
3. If the center button is held down the GA/M display will remain.
4. After the center button is released the display will revert back to the totalized flow in approximately 10 seconds.

5.4 Filter changes

The frequency of filter changes will depend on the consistency of the solution and it will vary. Loss of flow on the flow meters, changes in pump or flow meter sound, and pressures of greater than approximately 80 psi on the filter housing are signs that the filters may require changing. The following steps describe the process of changing filters.

1. Identify flow through filter operation (parallel or serial flow).
2. Select filters to be placed in housings and verify size imprinted on outside of filter bag (typical 10 micron or 50 micron).
3. Turn off pump.
4. Close valve at outlet of Baker tank.
5. Slowly release pressure in filter housing by partially unscrewing the lid, allow all pressure to dissipate before removing lid.
6. Remove filter bag and cage to hold filter placing them into 5 gallon bucket.
7. Pour solution into open filter housing.
8. Remove filter and place in garbage bag.

9. Inspect the filters to determine which is plugging (based on slime layer on filter face), if both are plugging continue with same serial flow operation with 50 micron and 10 micron filters, if only the 2nd filter is plugging, switch to parallel flow with valving and use two 10 micron filter bags.
10. Replace with new filter and push the filter bag to bottom of cage.
11. Place cage and filter into the housing and push the top plastic ring to form a seal.
12. Open valve at outlet of Baker tank.
13. Allow the filters to refill and tighten the cap back on top of housing when the water level nears (within 3-4 inches) top of the housing.
14. If significant spills are present from the filter change, cleanup with shop vac.
15. Restart pump.
16. Check and adjust flow rates to each well.
17. Check each well.

5.5 Process and Finishing Steps

At the end of the event, record all the following data:

1. gallons/well for substrate
2. gallons/well for chase water

6.0 OTHER EQUIPMENT

The following equipment will be required, in adequate supply, for ERD injection:

1. pH probe
2. Brix meter
3. Pong filter bags, typically 10 and 50 micron
4. Trash pump for transfer
5. Injection pump and manifold/valves/flow-meters

APPENDIX H

Soil Vapor Flow Analysis

APPENDIX H
SOIL VAPOR FLOW ANALYSIS

Boeing Renton Facility
Renton, Washington

Prepared for:

The Boeing Company
Seattle, Washington

Prepared by:

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(206) 342-1760

October 2013

Project No. 0088880090

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APPENDIX H
SOIL VAPOR FLOW ANALYSIS
Boeing Renton Facility
Renton, Washington

1.0 INTRODUCTION

This document describes a soil vapor flow analysis performed to support the design of a horizontal soil vapor extraction (SVE) system for the Building 4-78/79 Solid Waste Management Unit/Area of Concern (SWMU/AOC) Group (4-78/79 Area) at the Boeing Renton Facility. The objective of the SVE system is to remove petroleum hydrocarbons and chlorinated solvents from vadose zone soil within a target zone. The vadose zone beneath 4-78/79 Area is varies seasonally, with a minimum thickness of 2.5 feet and a maximum of about 5 feet; vadose zone soils are poorly-graded sand with some gravels. The objective of the soil vapor analysis is to predict the performance of the SVE system under the design parameters for operations with the minimum vadose zone.

The groundwater elevation beneath the 4-78/79 Area varies seasonally. Based on quarterly groundwater monitoring data collected from January 2010 through December 2012, the depth to groundwater beneath the pavement surface varied from about 2.6 feet to about 5.4 feet, with an average of 4.3 feet. Based on the expected pavement and bedding thickness (total of 1 foot), the thickness of the vadose zone varies from about 1.6 feet to 4.4 feet. The minimal separation of the groundwater table to the soil surface beneath the pavement bedding increases the potential for drawing groundwater into the soil vapor extraction wells, especially during spring/early summer, when the water table is highest.

The horizontal SVE system design consists of a network of horizontal SVE wells installed in trenches that will extend approximately 1.5 feet below the pavement surface .Cracks and joints in the surface pavement covering the area targeted by the SVE system will be sealed to minimize entry of ambient air through the pavement. The conceptual design soil vapor extraction rate presented in the Cleanup Action Plan ([CAP], AMEC, 2012) for each SVE well is 25 standard cubic feet per minute (scfm). Figure 1 shows the design of the SVE trench. From bottom to top, the SVE well trench consists of the following layers: a 5-6-inch sand layer where the horizontal SVE well screen is placed, a high density polyethylene (HDPE) liner, a 6-inch layer of gravel fill material, and a 6-inch asphalt or concrete layer (asphalt or concrete will be selected to match the existing grade). The SVE well screen will be a machine-slotted pipe that is either 2 inches in diameter and 5 feet in length or 1 inch in diameter and 10 feet in length. During the seasonal high groundwater table, the depth to water beneath a horizontal SVE well could be as low as 1.5 to 1.75 feet.

Due to the thin vadose zone during high groundwater conditions, there is a substantial probability that the SVE wells may be affected by groundwater upwelling as a result of vacuum created by the SVE blower. Therefore, the objective of this analysis is to predict how long it will take for groundwater upwelling to affect SVE performance at the design extraction rate and estimated radius of influence (ROI). A vacuum of maximum wellhead vacuum of 10 inches water column was used to assess groundwater upwelling, as this vacuum would raise the groundwater table in the vicinity of the well to within about 6-inches of the well screen, increasing the likelihood of drawing groundwater into the well. The SVE system will be designed and operated to apply a vacuum of 10 inches water column or less at each well screen during periods of high groundwater table. Greater vacuums may be applied during periods the groundwater table is low.

2.0 METHOD

This analysis was performed using a closed-form solution for pressure distribution around a horizontal well in the vadose zone under covered ground surface, as presented in Zhan & Park (2002). The conceptual model employed by Zhan & Park includes a single homogeneous layer of soil between a covered (or closed) ground surface and the top of water table, as shown in Figure 2. The covered ground surface is impermeable to air flow. The model formulation considers flow of vapor under isothermal conditions and assumes Darcy's law is valid.

MATLAB® codes published by Zhan & Park were used for this analysis. Although the codes were modified to produce plots of vacuum versus time and vacuum contours around SVE wells at specific times, the codes for the analytical solution were unchanged.

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3.0 ASSUMPTIONS AND PARAMETERS

Simplifying assumptions were made in order to apply the Zhan & Park analytical solution. The asphalt/concrete layer is assumed to be impermeable to air flow. Because cracks in the surface cover will be sealed, this is considered a reasonable assumption. The horizontal SVE well is assumed to be vertically in the middle of the vadose zone. The vadose zone is assumed to be homogeneous, i.e., the fill material beneath the pavement and the sand in the SVE trench are assumed to have the same permeability and porosity as native soil, and the asphalt layer is ignored. The volumetric gas flow rates are all under standard conditions.

Table 1 presents the soil and vapor physical properties. The assumed permeability value of 20 darcies corresponds to the permeability for a sandy soil, which typically ranges from 10 to 100 darcies (Johnson et al., 1990). Soil porosity is assumed to be 20 percent. The vapor parameters are for air at standard temperature.

A design extraction rate of 25 scfm was chosen as a reasonable starting point to evaluate the ROI, potential effects of different screen lengths, and the potential for upwelling. This initial flow rate was based on the conceptual design flow rate of 320 scfm that was used in the Feasibility Study and CAP.

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4.0 RESULTS

Two sets of calculations were performed: one for a 5-foot-long SVE well and one for a 10-foot-long SVE well. The only parameter that was changed for the two calculations is the length of well. Although the well diameter is different for the 5-foot-long and 10-foot-long wells, well diameter does not used in the Zhan & Park analytical solution and is not expected to affect flow in the vadose zone. An extraction rate of 25 scfm per well was used initially to calculate the change in vacuum over time at a location within the soil zone that is close to the horizontal midpoint of the SVE well (results plotted in Figures 3 and 4) and horizontal vacuum distribution around the SVE well at specific times (results plotted in Figures 5 and 6). The vacuum at a location near the screen midpoint (a point approximately 0.5 foot from the SVE well center) was plotted in Figures 3 and 4 (and in subsequent plots) because the analytical solution is expected to be applicable only within the soil column, and will not be accurate in or adjacent to the SVE well screen. Darcy's law is not valid adjacent to the SVE well due to high flow velocity.

Figures 3 and 4 show that at an extraction rate of 25 scfm, the vacuum near the SVE well will exceed the threshold of 10 inches water column almost immediately for both screen lengths. Figures 5 and 6 show that the vacuum induced by the SVE wells diminishes radially outward from the SVE well and that the induced vacuum for the 10-foot-long well diminishes slightly more with distance than the 5-foot-long well.

Based on these results, the extraction rates were adjusted to determine the appropriate soil gas flow rate that would not exceed the vacuum threshold for groundwater upwelling and that would achieve an acceptable radius of influence. The vacuum versus time plots and horizontal vacuum contours for these extraction rates are shown in Figures 7 through 13. As summarized by the data in Table 2, individual well extraction rates of 8 and 9 scfm are projected to create a vacuum exceeding 10 inches of water column near the well in less than one day of operation in both 5-foot and 10-foot wells. A flow rate of 6 scfm is predicted to require 230 days of continuous operation to reach the vacuum threshold of 10 inches water column. Based on these modeling results, individual well extraction rates lower than 8 to 9 scfm will be required for continuous operation of the SVE system during periods of high water table without causing excessive groundwater upwelling.

The radius of influence that can be achieved for individual wells was assessed by using the model to predict the distance at which a vacuum of 1 inch water column is predicted for a 5-foot well. Simulations were not run for a 10-foot well, as the previous simulation results indicate that the longer well behaves similarly. Figure 14 shows that withdrawal of 1.5 scfm is predicted to create a vacuum of 1 inch water column at a distance more than 20 feet from the well within less than 18 hours of operation. This simulation shows that the design SVE radius of influence can be achieved at an individual well flow rate of about 1.5 scfm. Figure 15 shows simulation results for a 5-foot well screen at a flow rate of 6 scfm; the plot of pressure versus time shows that the maximum well vacuum of 10-inches water column would not be exceeded for almost 3500 hours (144 days) of continuous operation, indicating that this flow rate is not expected to recover excessive quantities of groundwater during shallow water table conditions. Figures 16 and 17 present simulation results for low water table conditions, where the vadose zone thickness will exceed 4 feet. Figure 16 shows that a flow rate of 10-scfm in a 5-foot well with a vadose zone thickness of 4 feet would achieve a radius of influence extending more than 90 feet from the well within 1.24 hours. Figure 17 shows that a flow or 10 scfm would not exceed a vacuum of about 10-inches water column within 150 days of operation when the vadose zone thickness is 4 feet; therefore, dry season operation at high flow rates is not expected to draw groundwater into the wells.

5.0 CONCLUSIONS

The following conclusions are made from this analysis:

- At the CAP extraction rate of 25 scfm, groundwater upwelling that potentially occludes the well screen will likely be induced within minutes of SVE startup, indicating that this flow rate cannot be achieved.
- Flow rates between 1.5 and 10 scfm per well would produce ROIs from 20 to 90 feet within reasonable time frames for vadose zone thicknesses ranging from 1.5 to 4 feet.
- Due to flow constraints created by the seasonally high water table, alternate modes of operation, such as providing subsurface air inlets to allow sweep air to flow through the vadose zone and to the SVE wells, may be appropriate to achieve cleanup objectives without causing excessive groundwater upwelling at the extraction wells.

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6.0 REFERENCES

AMEC Environment & Infrastructure, Inc. (AMEC), 2012, Draft Cleanup Action Plan, Boeing Renton Facility, Renton, Washington, September.

Geomatrix Consultants, Inc. (Geomatrix), 2008, Draft Final Feasibility Study Report, Boeing Renton Facility, Renton, Washington, June.

Johnson, P.C., M.W. Kemblowski, and J.D. Colthart, 1990, Quantitative Analysis for the Cleanup of Hydrocarbon-Contaminated Soils by In-Situ Soil Venting, *Ground Water*, 28:3:413-429.

Zhan, H. and E. Park, 2002, Vapor Flow to Horizontal Wells in Unsaturated Zones, *Soil Sci. Soc. Am. J.* 66:710-721.

TABLES

TABLE 1

SOIL AND VAPOR PARAMETERS

Boeing Renton Facility
Renton, Washington

Parameter	Unit	Value
Soil Permeability[1]	darcies	20
Soil Porosity	--	0.2
Thickness of vadose zone	feet	2.50
Air density[2]	g/cm^3	1.25E-09
Air kinetic viscosity[2]	cm^2/s	1.42E-01

Notes:

1. Permeability corresponds to sandy soil (Johnson et al., 1990).
2. Standard values for air, taken from Zhan and Park (2002)

Abbreviations:

cm^2 = square centimeters
cm^3 = cubic centimeters
g = grams
s = second

TABLE 2

SUMMARY OF RESULTS

Boeing Renton Facility
Renton, Washington

Upwelling Results

Flow Rate (scfm)	5-foot Horizontal Well		10-foot Horizontal Well	
	Time	Vacuum[1] inches water column	Time	Vacuum[1] inches water column
25	< 1 min	>10	< 2 min	>10
8	22 hours	>10	NM	NM
9	NM	NM	22 hours	>10
6	230 days	>10	NM	NM

Radius of Influence Results[2]

Flow Rate (scfm)	Distance from center of screen	Time	Vacuum [1] inches water column
1.5	~ 20 feet	~ 20 hours	< 2
6	~ 90 feet	~ 1 hour	< 6

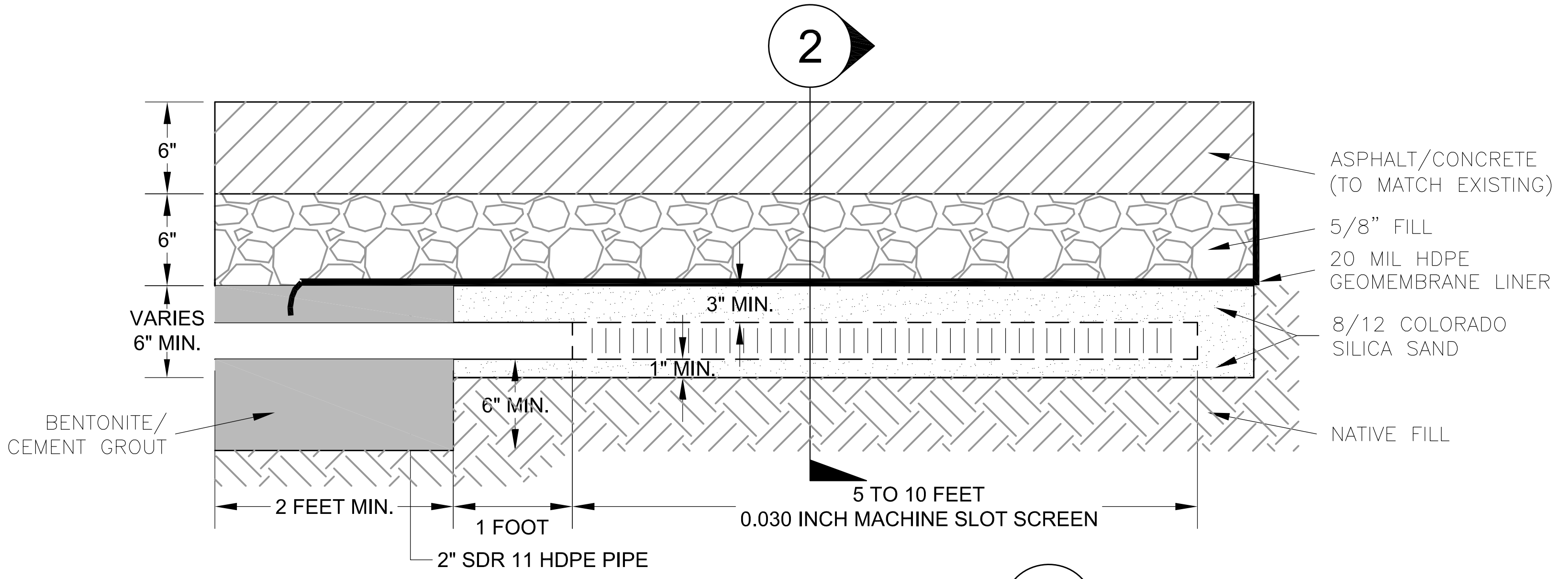
Notes:

1. Evaluated at a short distance away from the center of the well, x = 0.5 ft, y = 0.5 ft.
2. Amount of time it takes for vacuum to exceed 1 inch water column distance listed for a 5-foot horizontal well

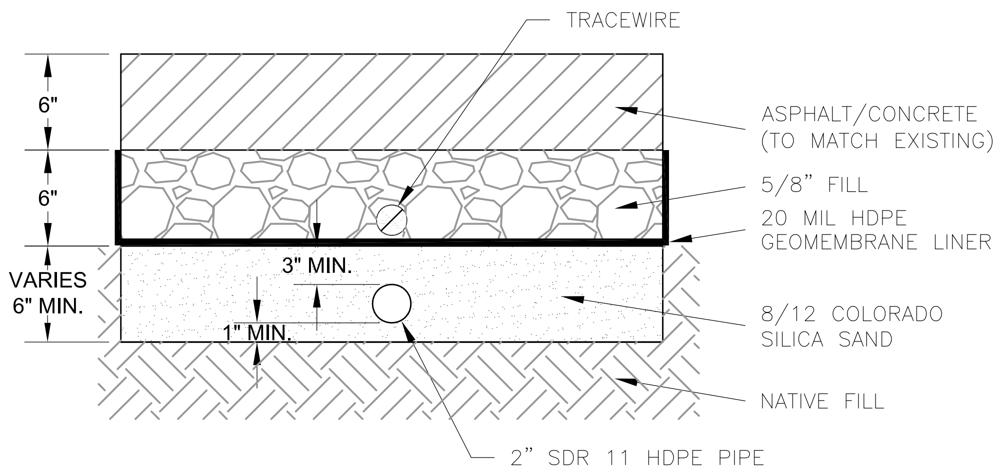
Abbreviations:

NM= not modelled
scfm = standard cubic feet per minute

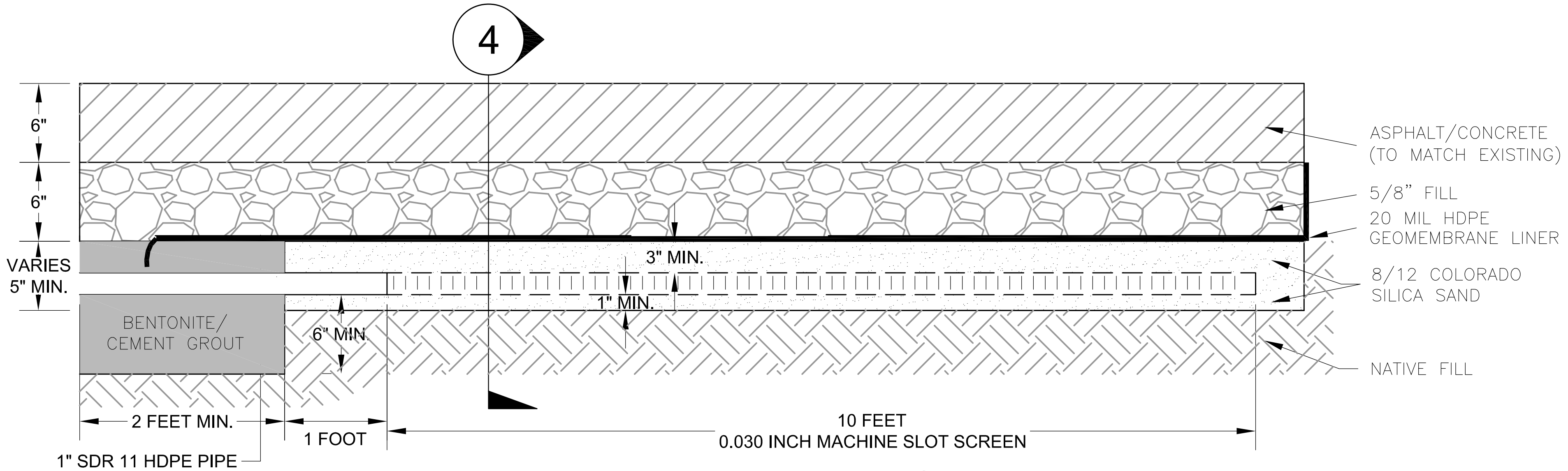
FIGURES



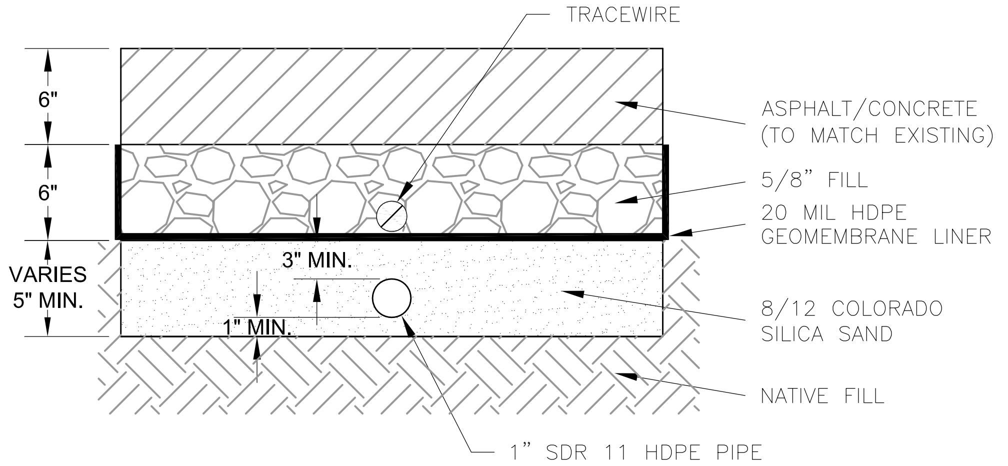
HORIZONTAL WELL DETAIL SIDE VIEW 1
SCALE: NTS



HORIZONTAL WELL DETAIL 3
SCALE: NTS



HORIZONTAL WELL DETAIL SIDE VIEW 2
SCALE: NTS



HORIZONTAL WELL DETAIL 4
SCALE: NTS

RE-PAVING NOTES

SUBGRADE

1. PAVEMENT SUBGRADE SHALL CONSIST OF MINIMUM 6 INCHES OF ¾ INCH MINUS CRUSHED ROCK MEETING THE REQUIREMENTS OF WSDOT 9-03.9(3) CRUSHED SURFACING TOP COURSE. SUBGRADE SHALL BE COMPACTED TO AT LEAST 95% OF THE MAXIMUM DRY DENSITY (ASTM D1557).

PAVEMENT

1. THE PAVEMENT THICKNESS SHALL MATCH THE EXISTING PAVEMENT THICKNESS, BUT NO LESS THAN 6 INCHES THICK.
2. ALL PAVEMENTS MATERIAL AND PLACEMENT SHALL BE IN ACCORDANCE WITH THE REQUIREMENTS OF WSDOT STANDARD SPECIFICATIONS 2012 (M 41-10).
3. ASPHALT PAVEMENT SHALL CONSIST OF 4 INCHES OF CLASS E BASE COURSE AND 2 INCHES OF CLASS B WEARING COURSE. TACK COAT SHALL BE APPLIED BETWEEN LAYERS AND ALONG THE JOINTS WITH THE EXISTING PAVEMENT.
4. CONCRETE PAVEMENT SHALL HAVE A 28-DAY STRENGTH OF AT LEAST 3,500 PSI AND HAVE 7% AIR ENTRAINMENT. COLLECT SAMPLE CYLINDERS AND BREAK EVERY 7 DAYS. PROVIDE THE TEST RESULTS TO THE ENGINEER.
5. INSTALL DOWELS EVERY 4 FEET ALONG ALL THE JOINTS WITH THE NEW AND EXISTING CONCRETE PAVEMENT.
6. CONCRETE SHALL BE PLACED IN 20-FOOT PANELS, SUCH THAT THERE IS A COLD JOINT EVERY 20 FEET. INSTALL EXPANSION MATERIAL BETWEEN JOINTS.

GENERAL NOTES

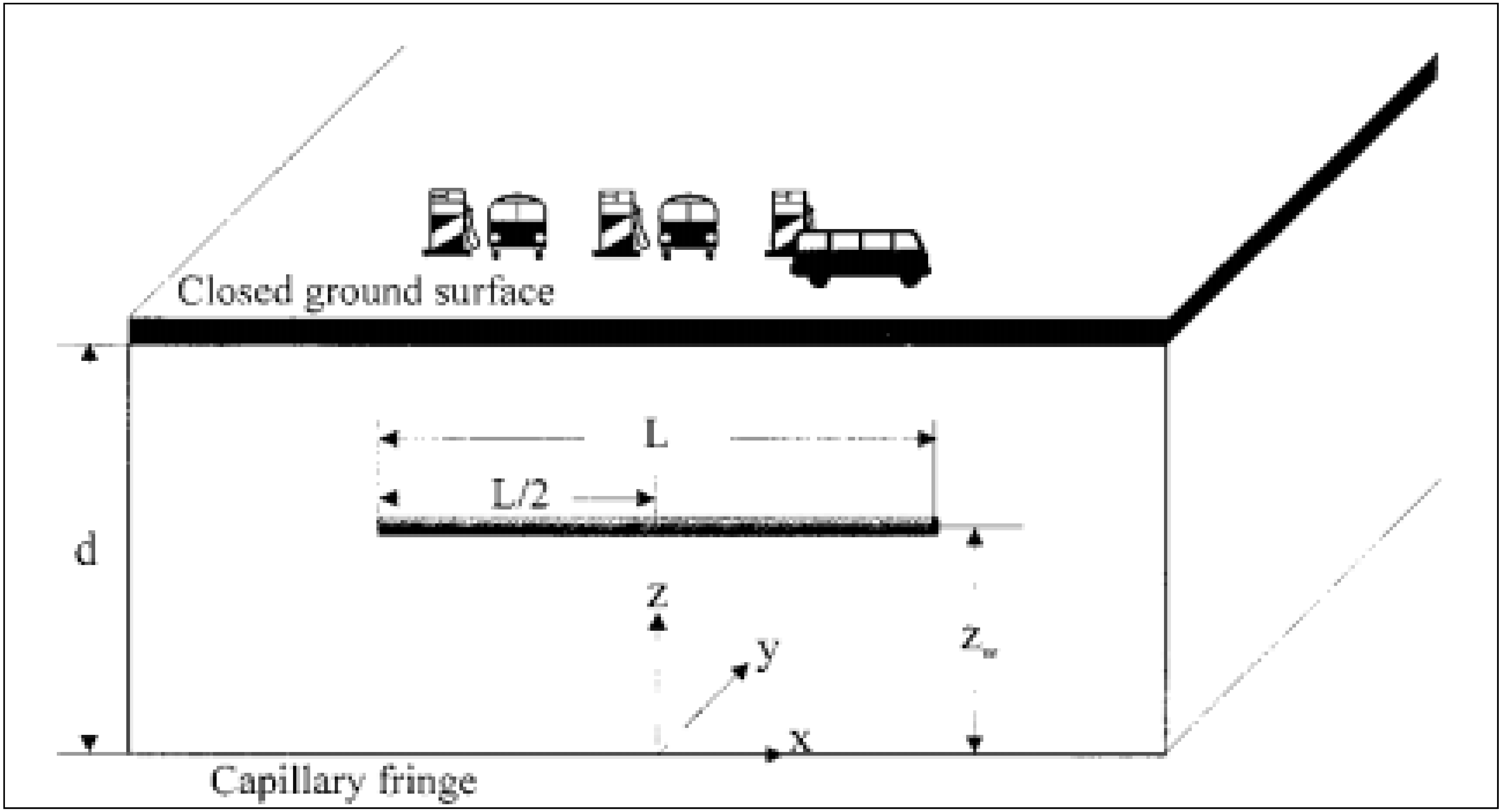
1. ALL CRACKS/JOINTS TO BE SEALED IN SVE TARGET AREAS.
2. HDPE SCREENS HAVE WELDED CAPS AT END.
3. HDPE LINER TO BE LAID AS ONE CONTINUOUS PIECE IF POSSIBLE. LINER WILL COVER ENTIRE WIDTH OF TRENCH IF SVE WELL IS LAID WITH OTHER PIPES.
4. HDPE LINER TO BE LAID OVER BENTONITE/CEMENT GROUT WHILE STILL WET TO ENSURE A GOOD SEAL.
5. CEMENT/BENTONITE GROUT SHALL BE 5% BY WEIGHT AND WILL BE INSTALLED ACROSS ENTIRE WIDTH OF TRENCH (INCLUDING OTHER PIPES IF PRESENT).

BOEING

BUILDING 4-78/79 SWMU/AOC GROUP
HORIZONTAL SVE WELL DETAILS
Boeing Renton Facility
Renton, Washington

By: APS
Date: 10/25/13
Project No. 8888
amec
Figure 1

Plot Date: 10/25/13 - 1:31pm, Plotted by: adam.stenberg
Drawing Path: S:\8888_2006\069_EDR\, Drawing Name: Building 4-78 and 79_WorkPlanDesign_092313_20scale.dwg

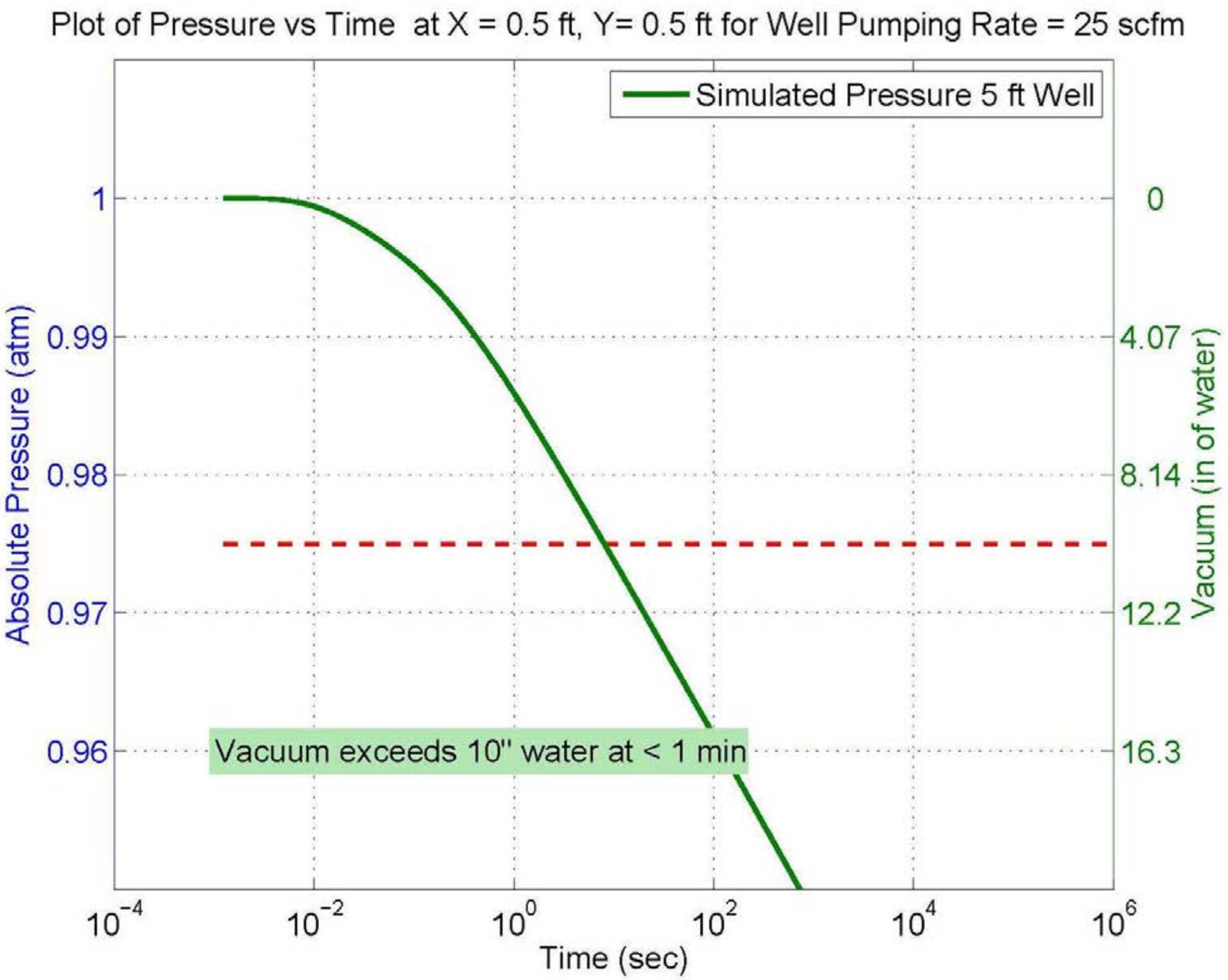


Source: Zhan and Park (2002)

CONCEPTUAL MODEL OF HORIZONTAL SVE
WELL IN VADOSE ZONE WITH COVERED
GROUND SURFACE
Boeing Renton Facility
Renton, Washington

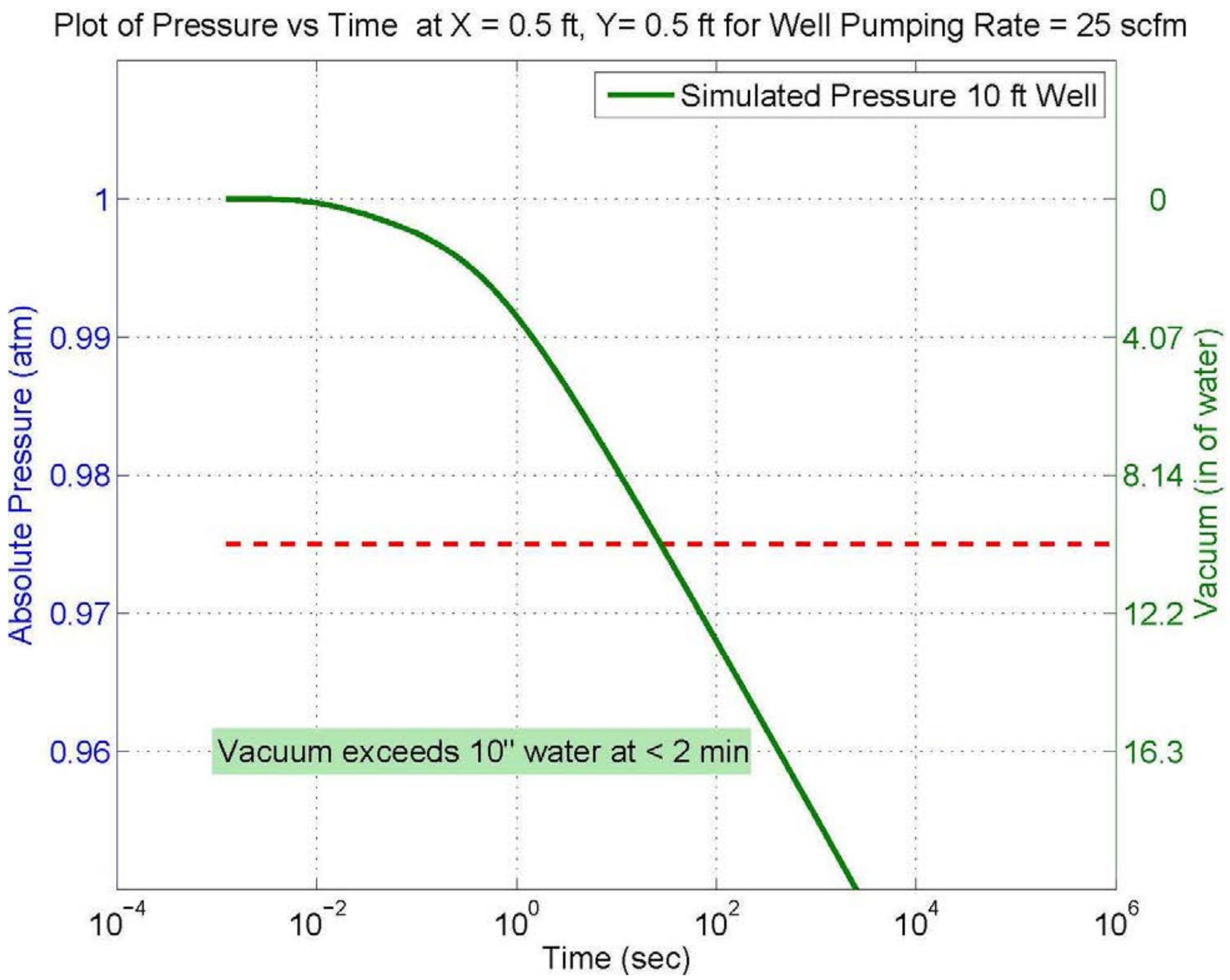
By: KKM	Date: 09/18/13	Project No. 8888
amec		Figure 2

Non GDS



CHANGE IN WELLHEAD VACUUM OVER TIME
FOR 5-FOOT WELL AT 25 SCFM
Boeing Renton Facility
Renton, Washington

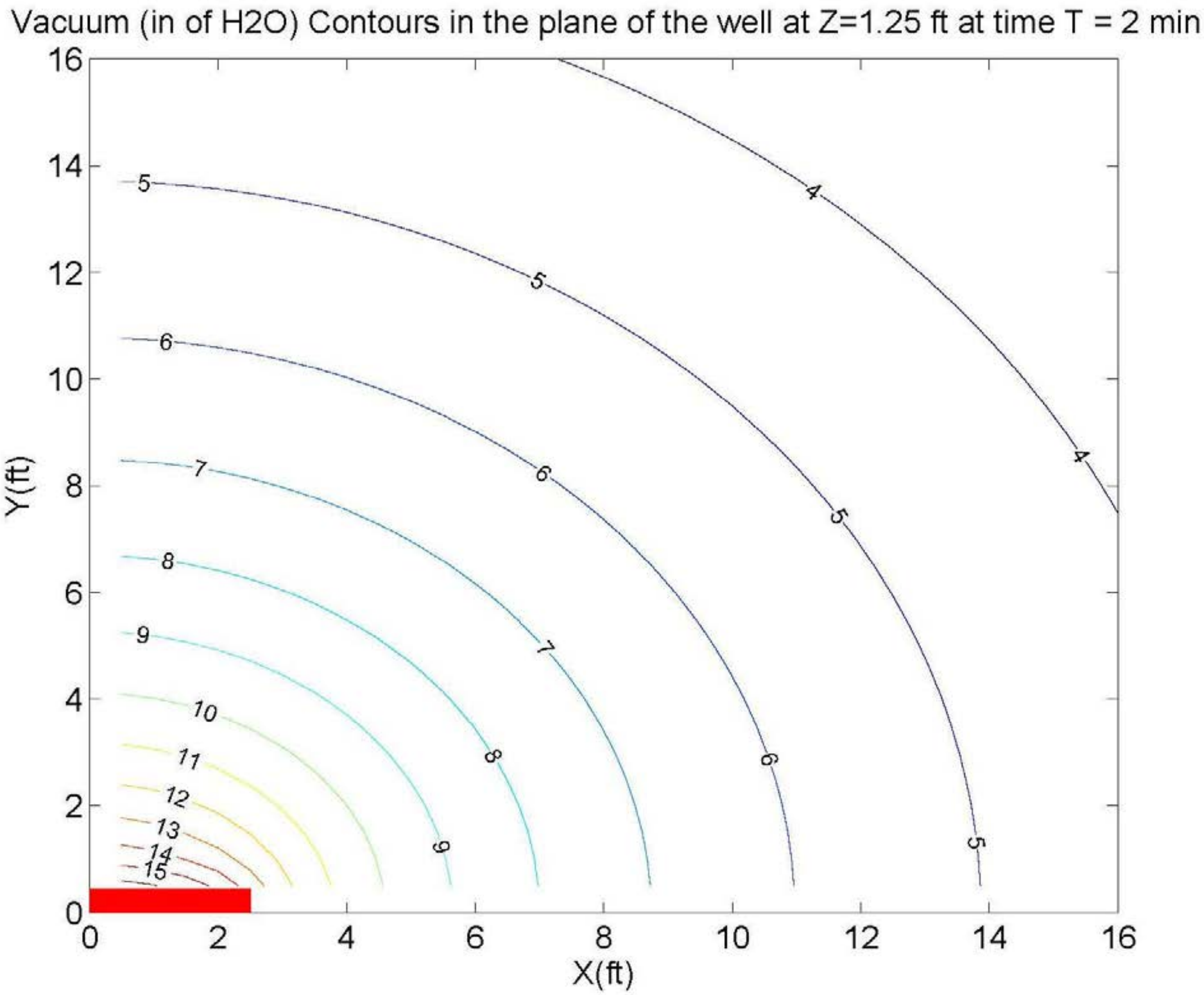
By: KKM	Date: 09/18/13	Project No. 8888
amec		Figure 3



CHANGE IN WELLHEAD VACUUM OVER TIME
FOR 10-FOOT WELL AT 25 SCFM
Boeing Renton Facility
Renton, Washington

By: KKM	Date: 09/18/13	Project No. 8888
amec		Figure 4

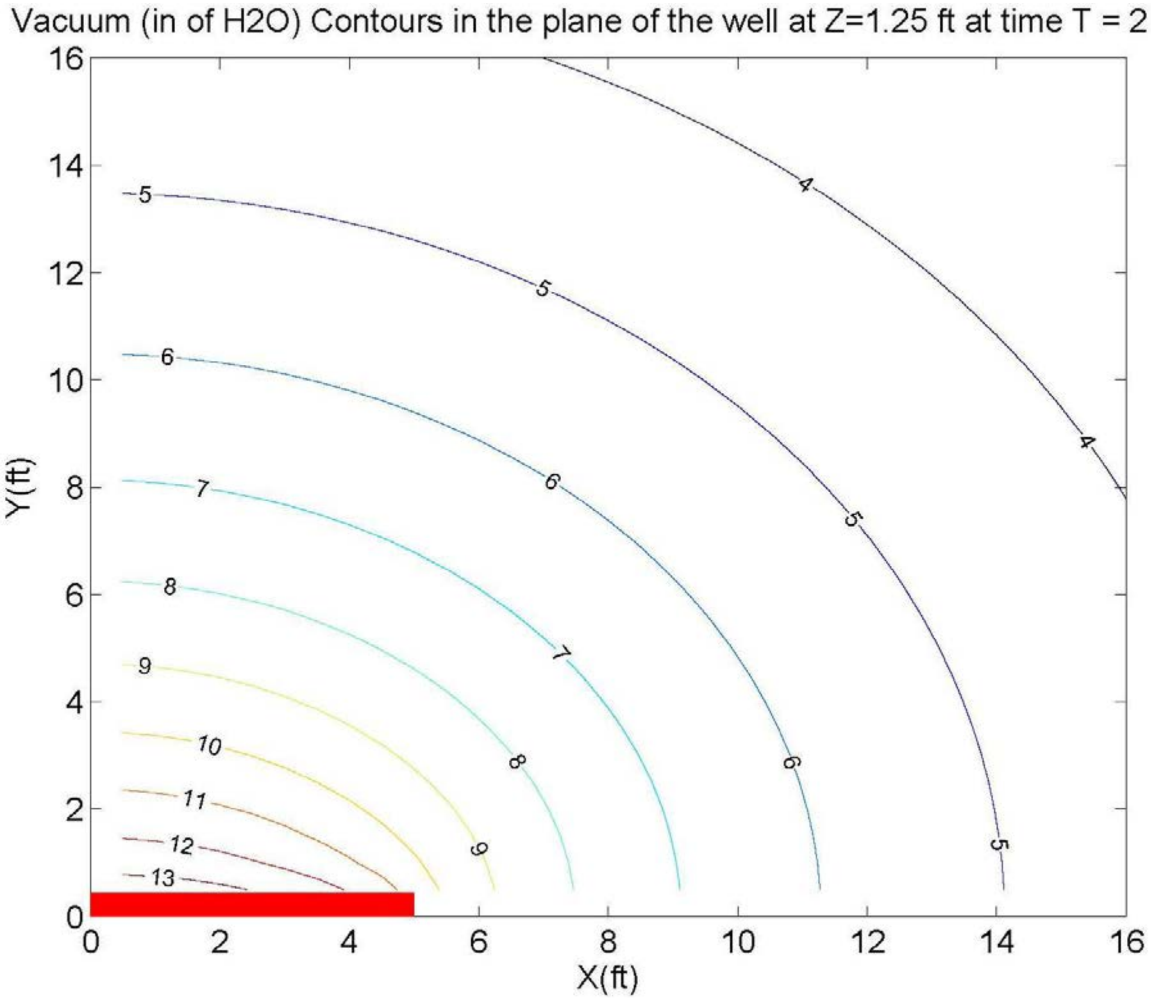
Non GDS



HORIZONTAL VACUUM DISTRIBUTION FOR
5-FOOT WELL
AT 25 SCFM AFTER 2 MIN. OF OPERATION
Boeing Renton Facility
Renton, Washington

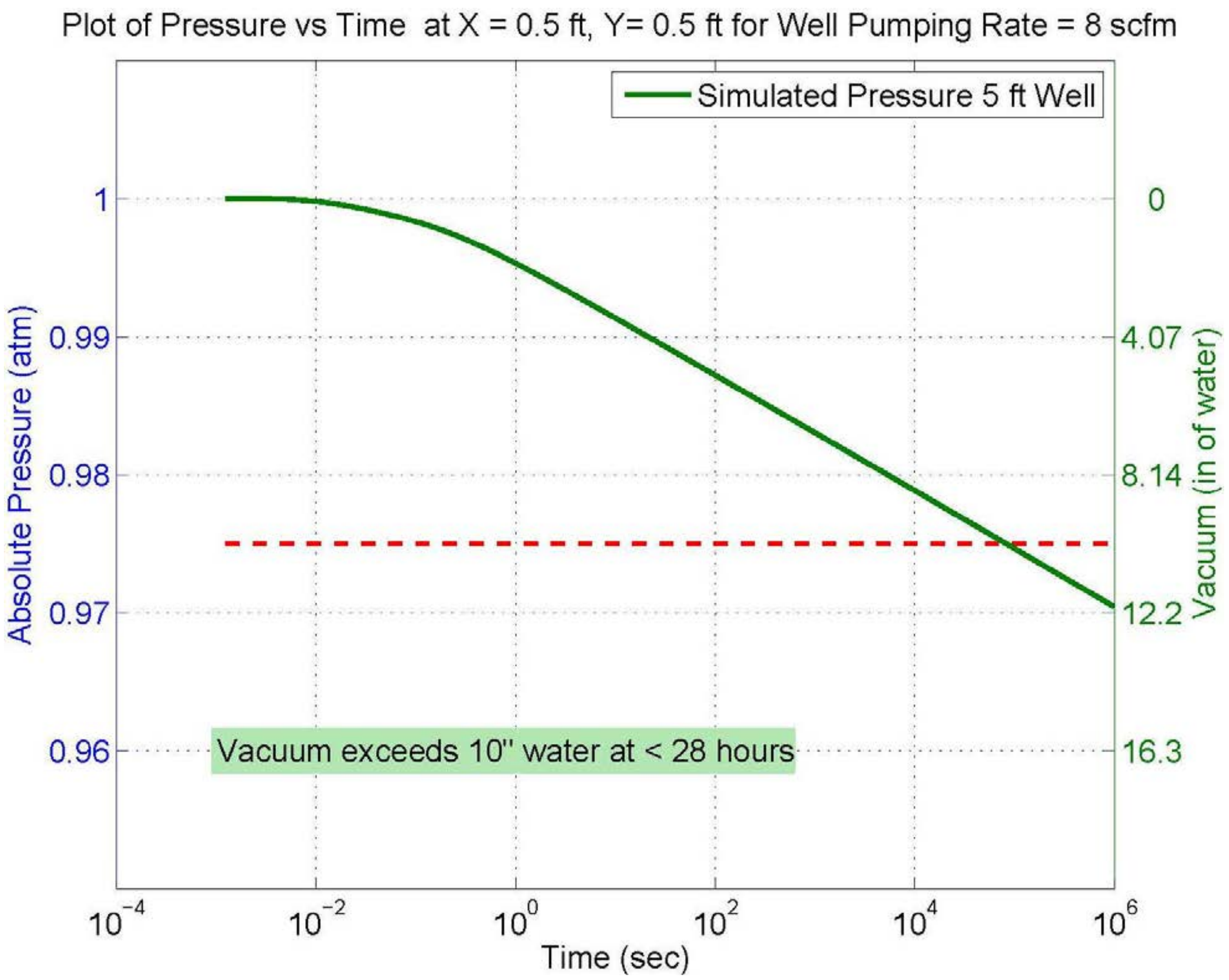
By: KKM	Date: 09/18/13	Project No. 8888
amec		Figure 5

Non GDS



HORIZONTAL VACUUM DISTRIBUTION FOR
10-FOOT WELL
AT 25 SCFM AFTER 2 MIN. OF OPERATION
Boeing Renton Facility
Renton, Washington

By: KKM	Date: 09/18/13	Project No. 8888
amec		Figure 6

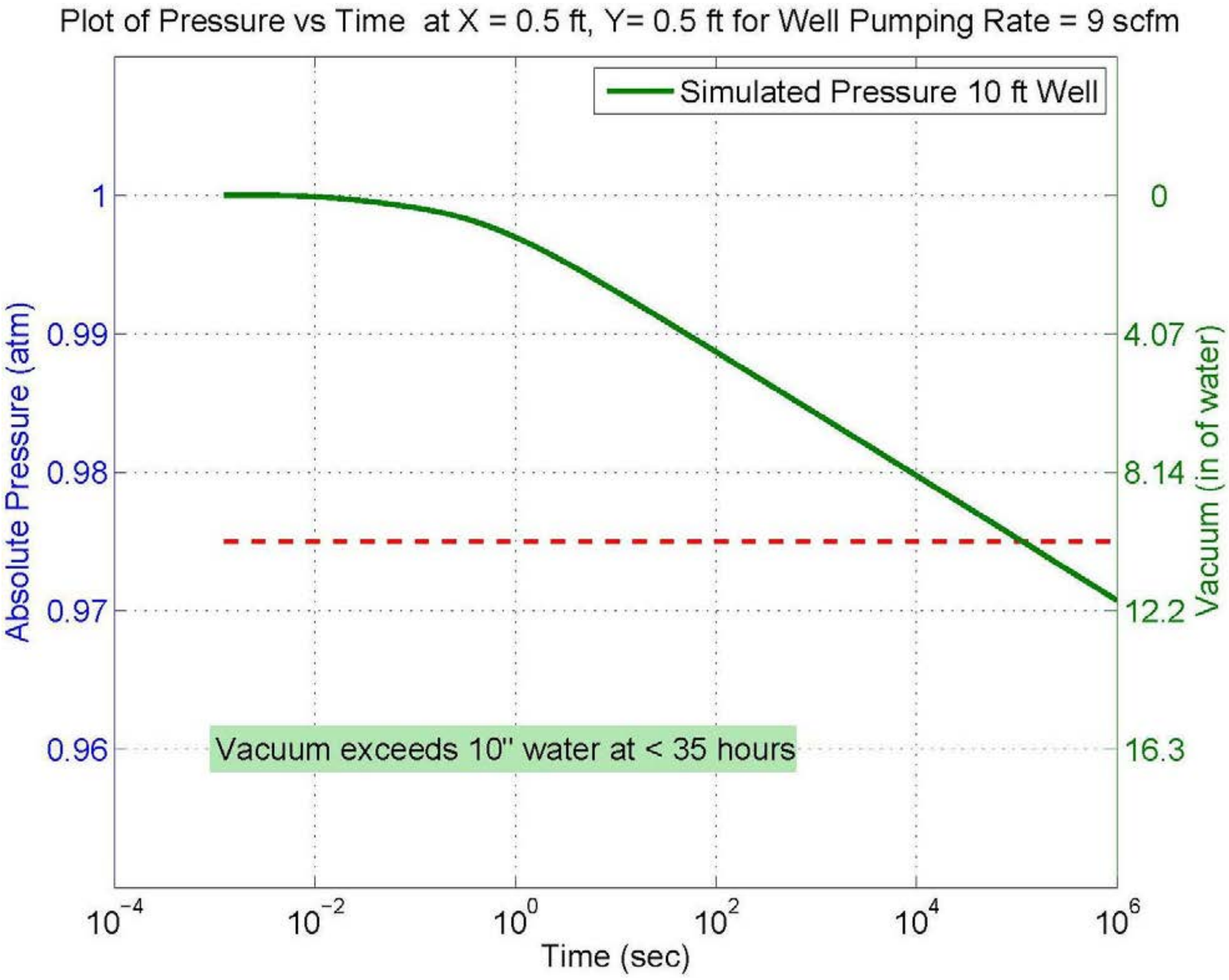


CHANGE IN WELLHEAD VACUUM OVER TIME
FOR 5-FOOT WELL AT 8 SCFM
Boeing Renton Facility
Renton, Washington

By: KKM
Date: 09/18/13
Project No. 8888

amec

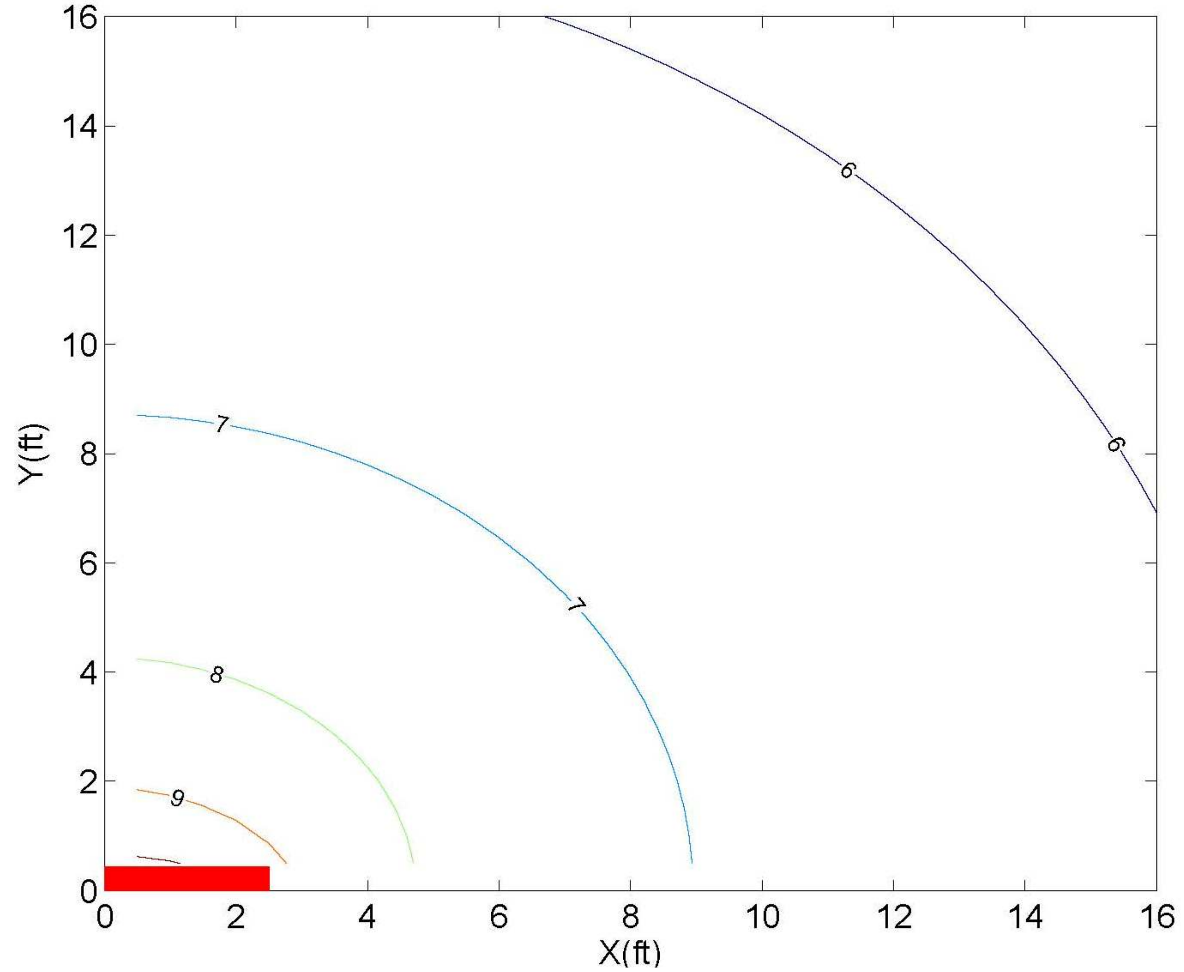
Figure **7**



CHANGE IN WELLHEAD VACUUM OVER TIME
FOR 10-FOOT WELL AT 9 SCFM
Boeing Renton Facility
Renton, Washington

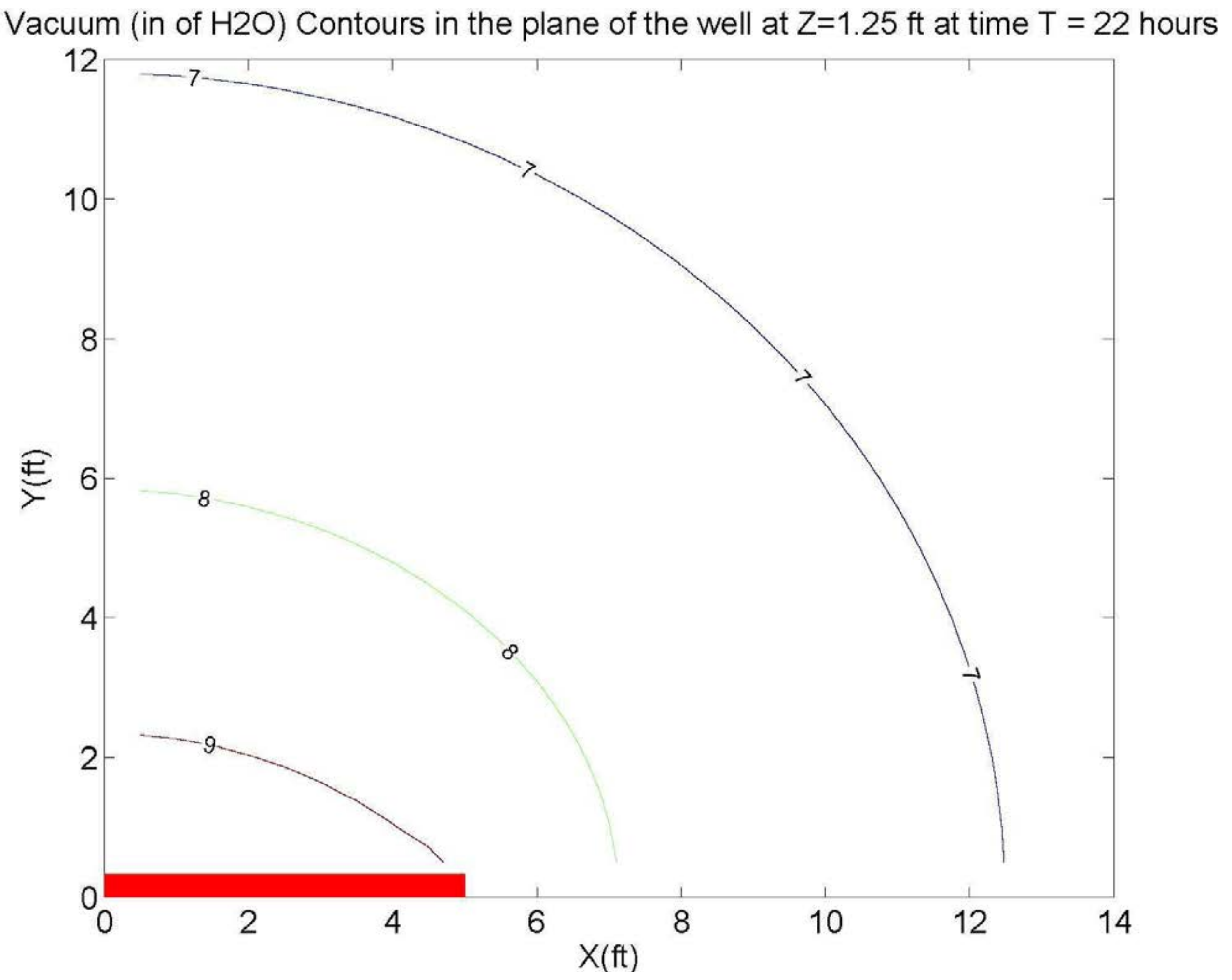
By: KKM	Date: 09/18/13	Project No. 8888
amec		Figure 8

Vacuum (in of H2O) Contours in the plane of the well at Z=1.25 ft at time T = 22 hours



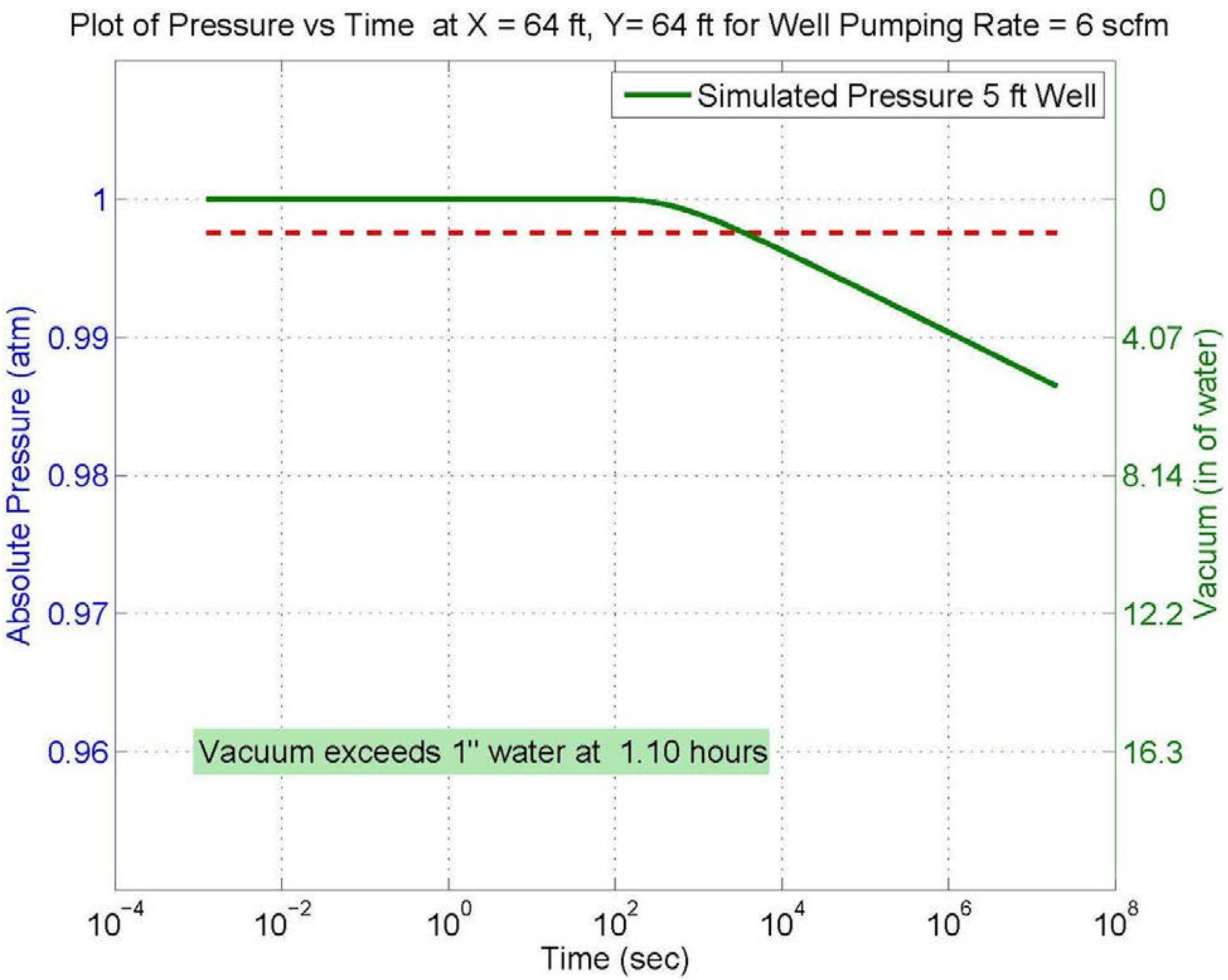
HORIZONTAL VACUUM DISTRIBUTION FOR 10-FOOT WELL AT 8 SCFM AFTER 22 HR. OF OPERATION
Boeing Renton Facility
Renton, Washington

By: KKM	Date: 09/18/13	Project No. 8888
amec		Figure 9



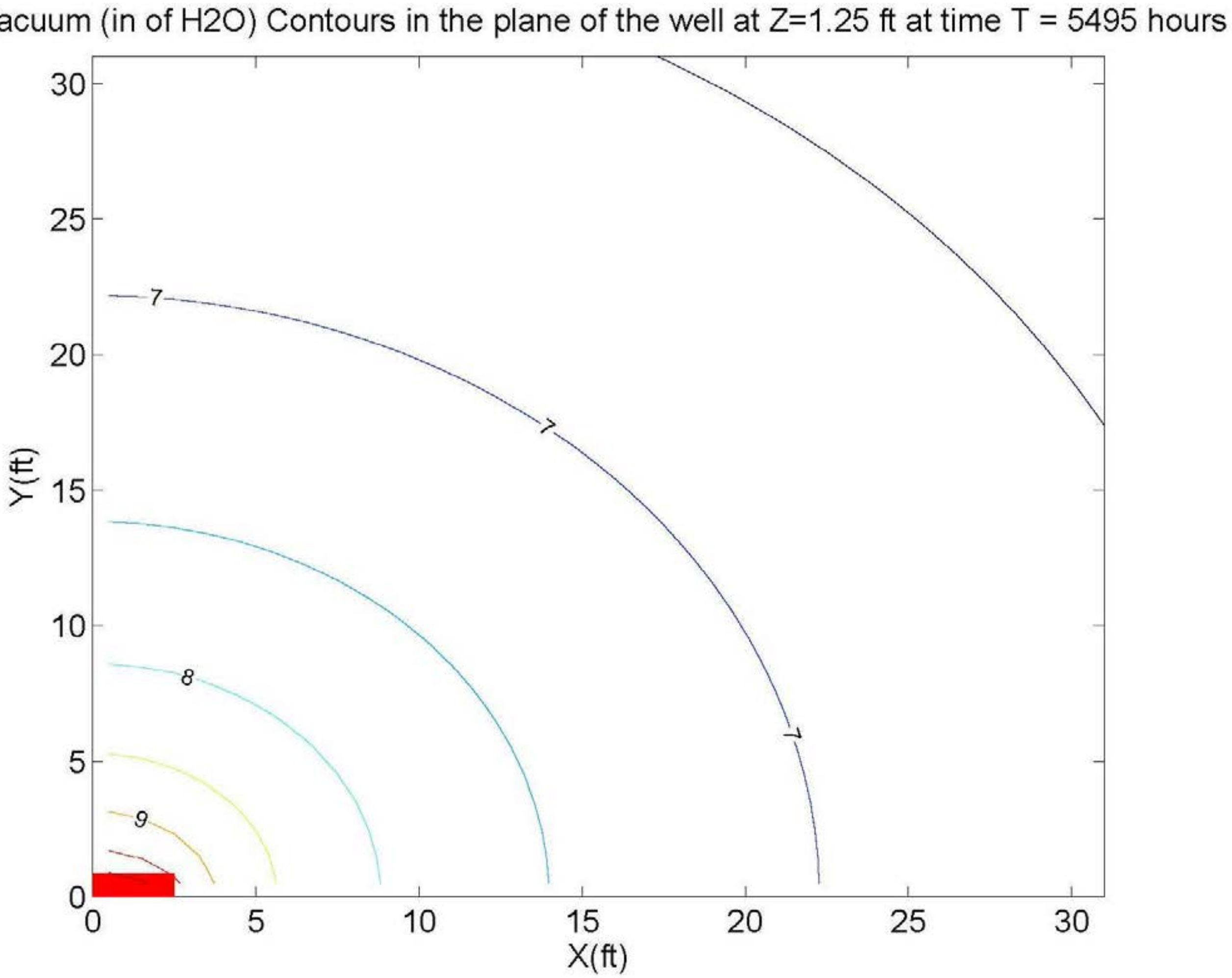
HORIZONTAL VACUUM DISTRIBUTION FOR 10-FOOT WELL AT 9 SCFM AFTER 22 HR. OF OPERATION
Boeing Renton Facility
Renton, Washington

By: KKM	Date: 09/18/13	Project No. 8888
amec		Figure **10**



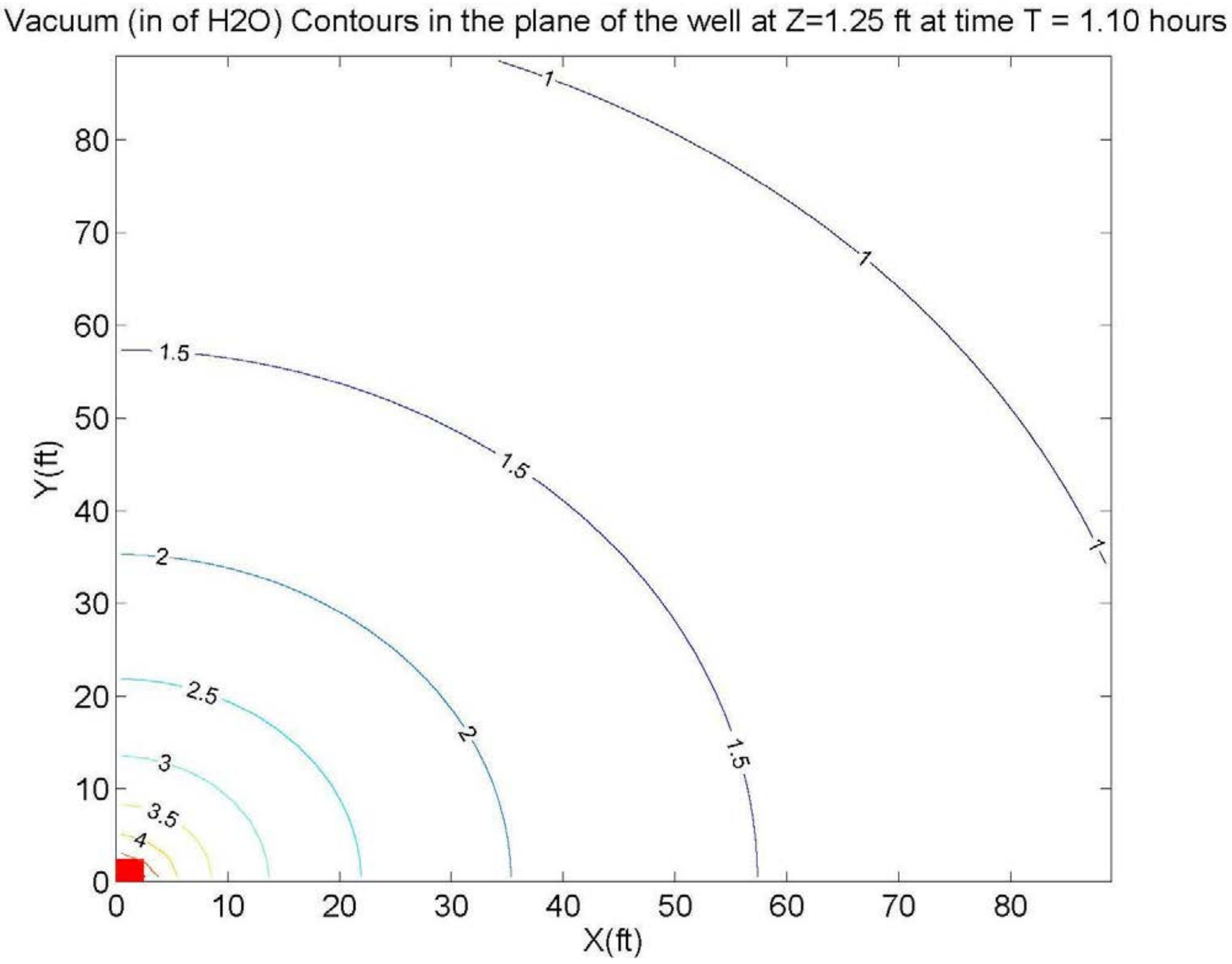
CHANGE IN VACUUM OVER TIME AT 90 FOOT
RADIUS FOR 5-FOOT WELL AT 6 SCFM
Boeing Renton Facility
Renton, Washington

By: KKM	Date: 09/18/13	Project No. 8888
amec		Figure 11



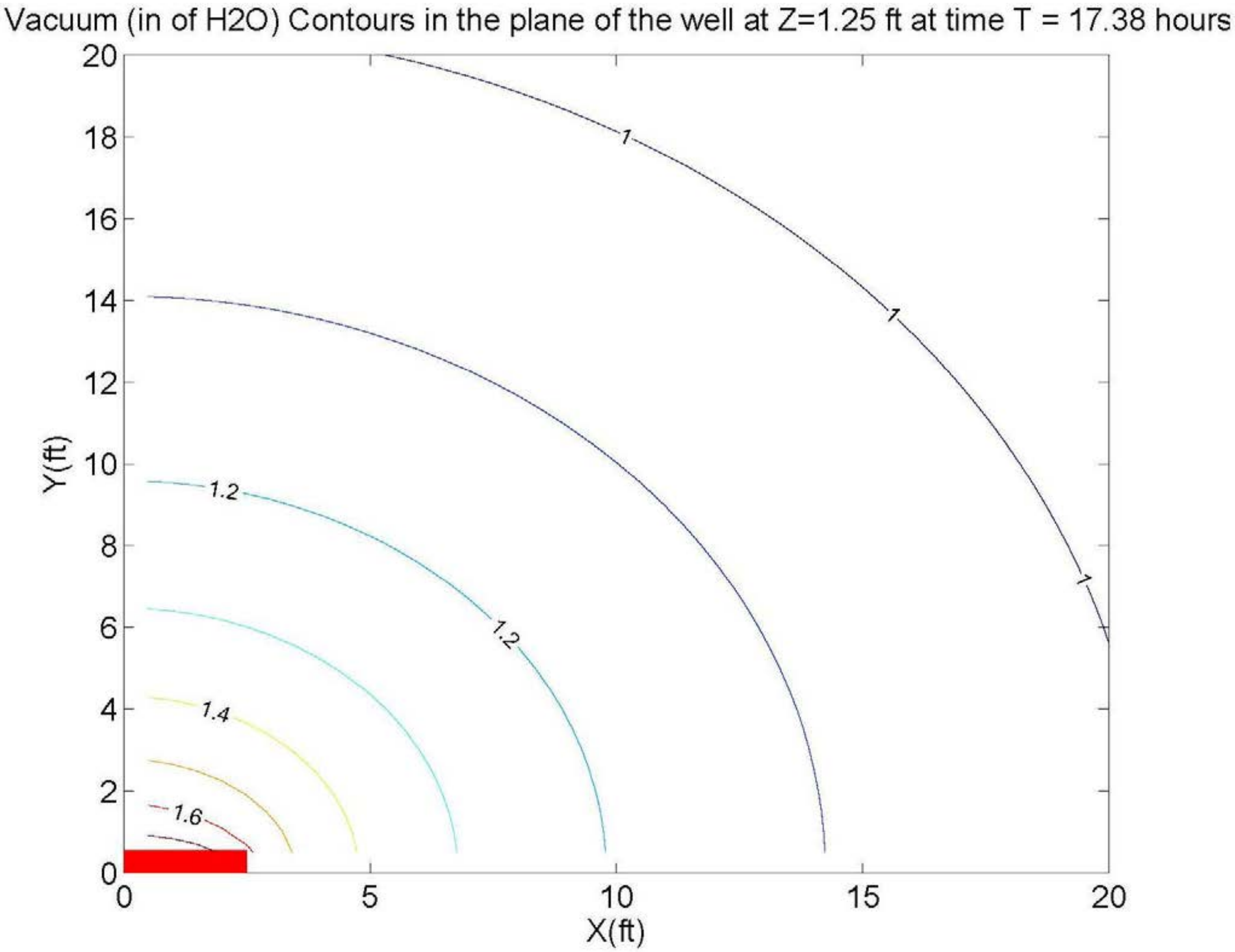
HORIZONTAL VACUUM DISTRIBUTION FOR
5-FOOT WELL AT 6 SCFM AFTER 5,495 HR. OF
OPERATION
Boeing Renton Facility
Renton, Washington

By: KKM	Date: 09/18/13	Project No. 8888
amec		Figure 12



HORIZONTAL VACUUM DISTRIBUTION FOR
5-FOOT WELL AT 6 SCFM AFTER 1.1 HR. OF
OPERATION
Boeing Renton Facility
Renton, Washington

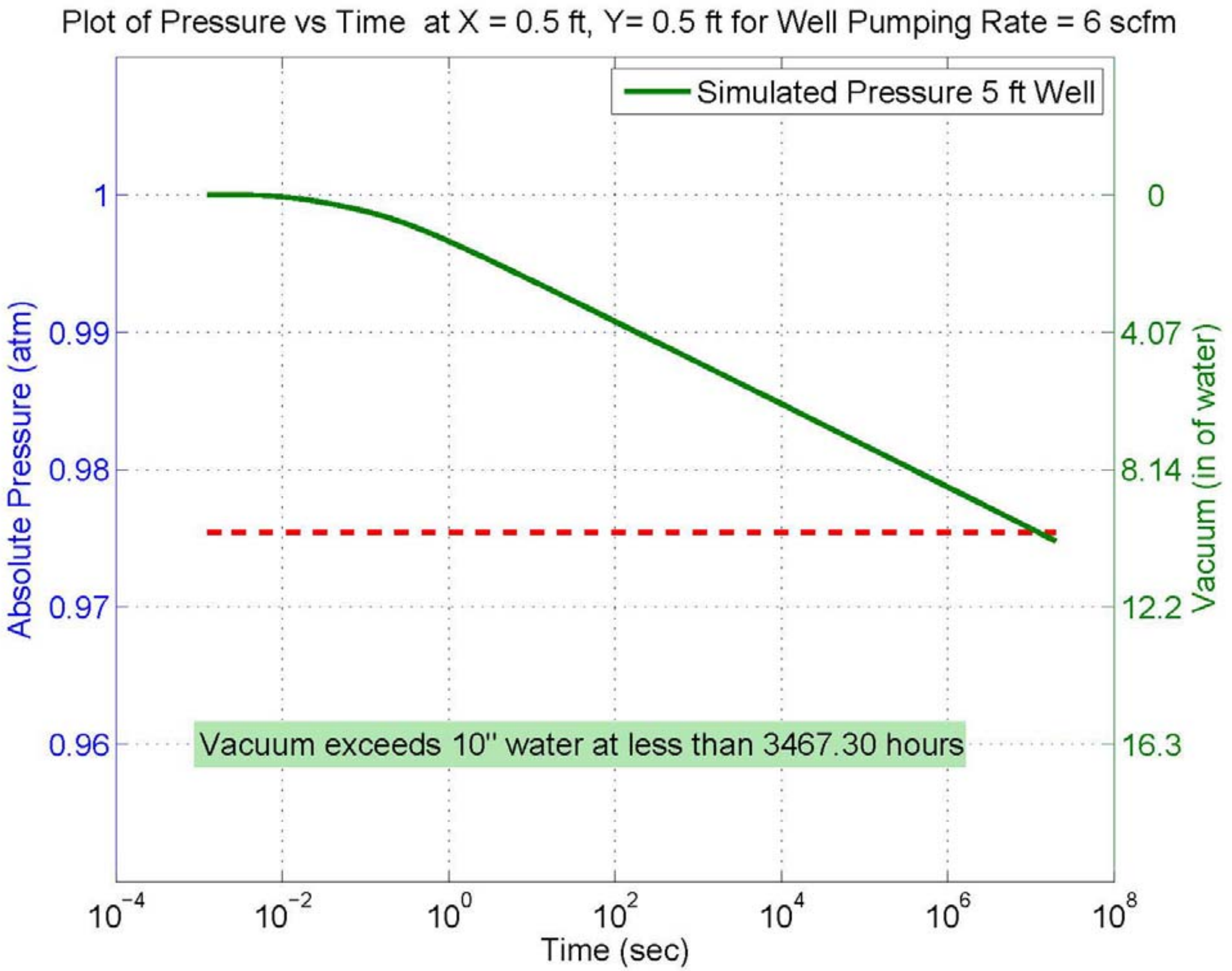
By: KKM	Date: 09/18/13	Project No. 8888
amec		Figure 13



HORIZONTAL VACUUM DISTRIBUTION FOR
5-FOOT WELL AT 1.5 SCFM
Boeing Renton Facility
Renton, Washington

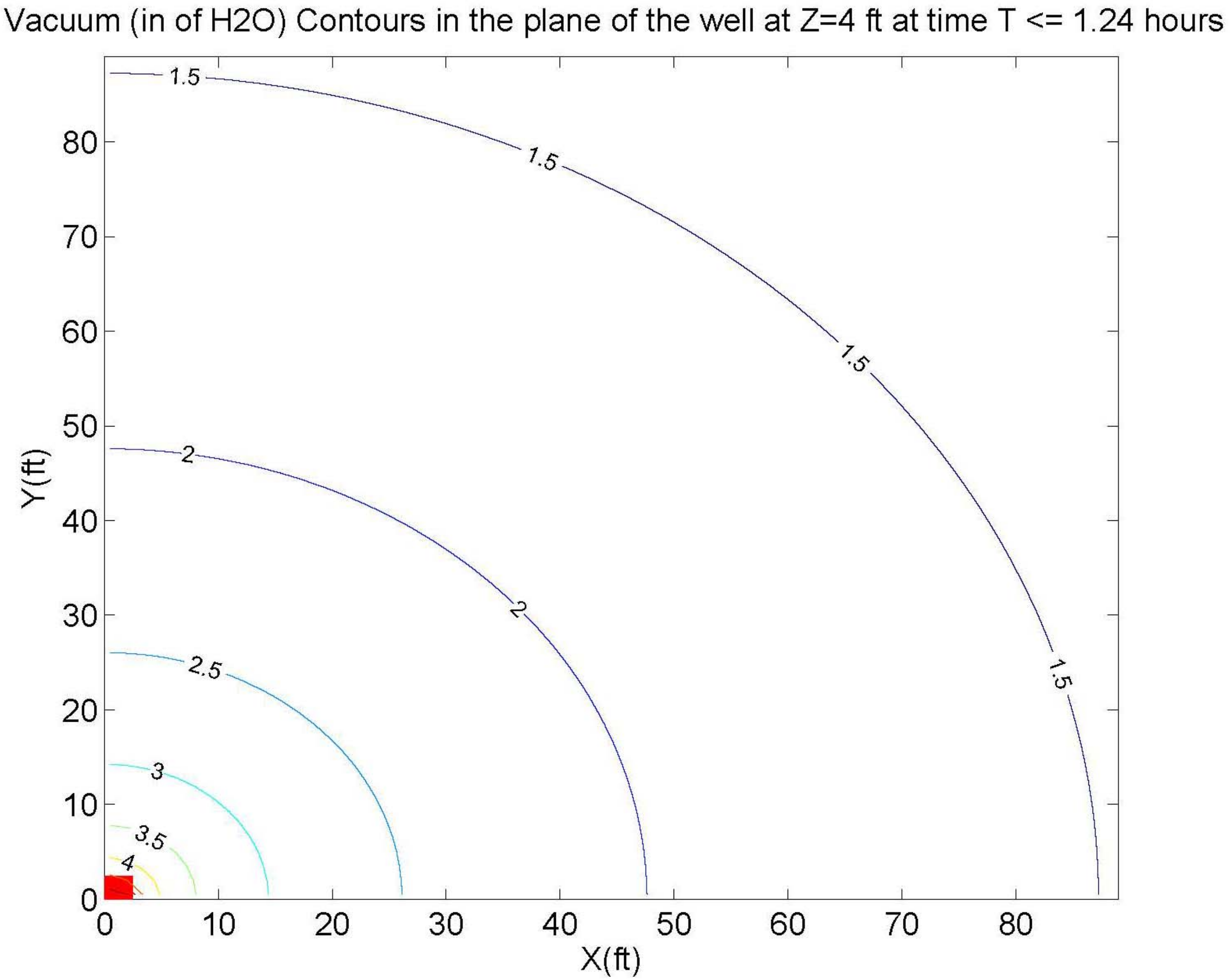
By: KKM	Date: 09/18/13	Project No. 8888
amec		Figure **14**

Non GDS



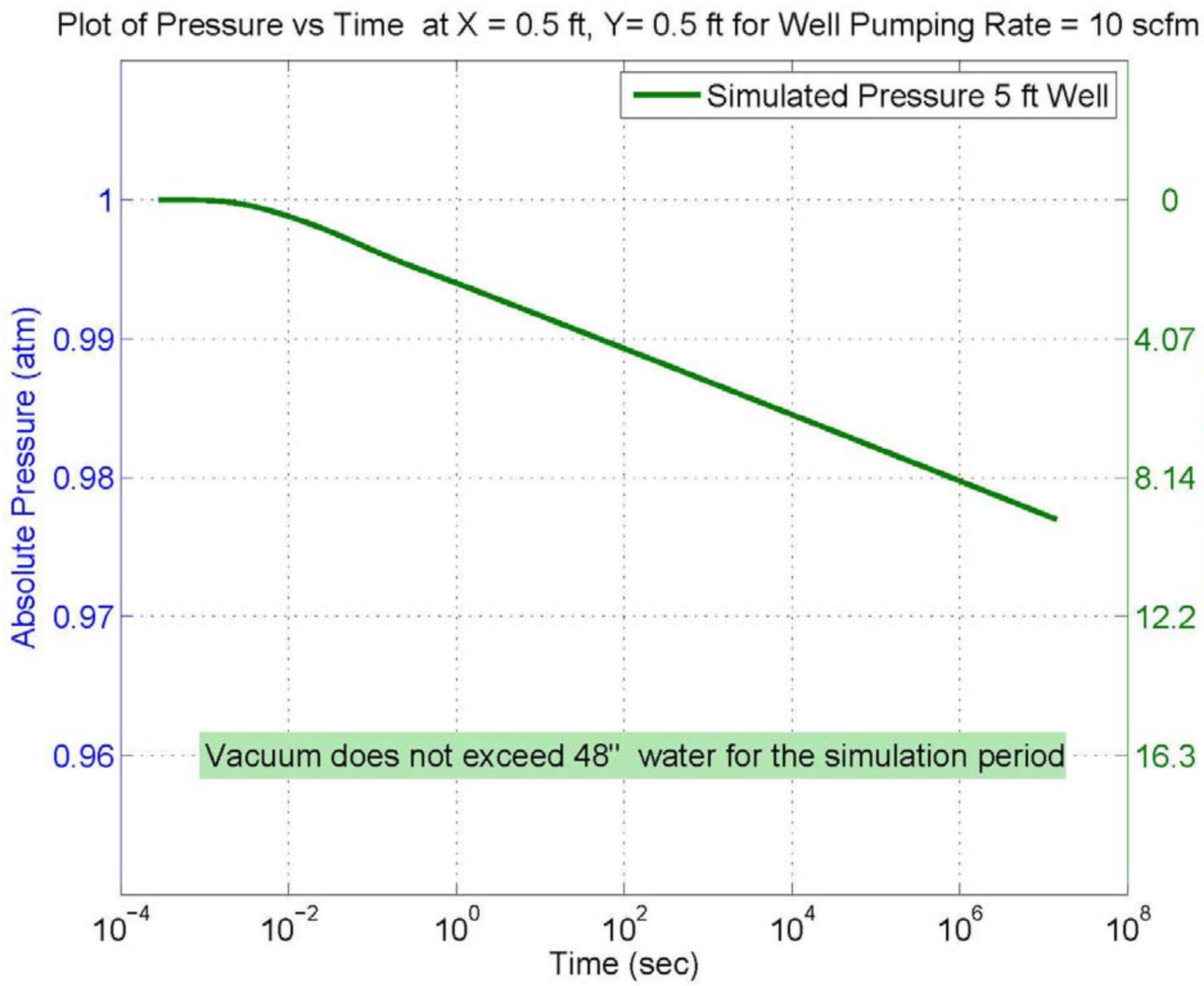
CHANGE IN WELLHEAD VACUUM OVER TIME
FOR 5-FOOT WELL AT 6 SCFM
Boeing Renton Facility
Renton, Washington

By: LMM	Date: 10/25/13	Project No. 8888
amec		Figure **15**



HORIZONTAL VACUUM DISTRIBUTION FOR
5-FOOT WELL AT 10 SCFM AFTER 1.24 HR. OF
OPERATION
Boeing Renton Facility
Renton, Washington

By: LMM	Date: 10/25/2013	Project No. 8888
amec		Figure **16**



CHANGE IN WELLHEAD VACUUM OVER TIME
FOR 5-FOOT WELL AT 10 SCFM
Boeing Renton Facility
Renton, Washington

By: LMM	Date: 00/00/00	Project No. 8888
amec		Figure 17

APPENDIX I

PSCAA Operating Permit

pscleanair.org
Puget Sound Clean Air Agency

AIR OPERATING PERMIT

Puget Sound Clean Air Agency
1904 Third Avenue – Suite 105
Seattle, Washington 98101

Issued in accordance with the provisions of Puget Sound Clean Air Agency (previously known as Puget Sound Air Pollution Control Agency (PSAPCA)) Regulation I, Article 7 and Chapter 173-401 WAC.

Pursuant to Puget Sound Clean Air Agency Regulation I, Article 7 and Chapter 173-401 WAC, Boeing Commercial Airplane Group Renton is authorized to operate subject to the terms and conditions in this permit.

PERMIT NO.: 13125

DATE OF ISSUANCE: February 2, 2004

Administrative Amendments: Aug. 26, 2004, May 12, 2005, Aug. 17, 2005, Feb. 17, 2006, March 17, 2010, March 30, 2011

Significant Modification: May 2, 2007

ISSUED TO: Boeing Commercial Airplane Group - Renton

PERMIT EXPIRATION DATE: February 2, 2009

SIC Code, Primary:	3721
NAICS Code	336411
Nature of Business:	Aircraft Manufacturing
Mailing Address:	PO Box 3707, MC 67-74, Seattle, WA 98124
Facility Address:	737 Logan Ave. N., Renton WA 98055
Responsible Official:	Beverly Wyse, Vice President – General Manager, 737 Airplane Production
Telephone No.:	(425) 965-9000
Site Contact:	Michael Verhaar, Environmental Manager
Telephone No.:	(425) 965-1567
FAX No.:	(425) 965-0055

Puget Sound Clean Air Agency Approval:

Agata McIntyre P.E.
Agata Z. McIntyre
Senior Engineer

Ste M. Va
Steven M. Van Slyke, PE
Compliance Manager

TABLE OF CONTENTS

I. EMISSION LIMITS AND PERFORMANCE STANDARDS

The following tables list the citation for the "applicable requirement" in the second column. The third column (Date) contains the adoption or effective date of the requirement. In some cases, the effective dates of the Federally Enforceable Requirement and the State Only Requirement are different because only rules approved by EPA through Sections 110, 111, and 112 of the federal Clean Air Act are federally enforceable and either the state has not submitted the regulation to the EPA or the EPA has not approved it.

The first column is used as an identifier for the requirement, and the fourth (Requirement Paraphrase) column paraphrases the requirement. The first and fourth columns are for information only and are not enforceable conditions of this permit. The actual enforceable requirement is embodied in the requirement cited in the second and third columns.

The fifth column (Monitoring, Maintenance & Recordkeeping Method) identifies the methods described in Section II of the permit. Following these methods is an enforceable requirement of this permit. The sixth (Emission Standard Period) column identifies the averaging time for the reference test method. The last column (Reference Test Method) identifies the reference method associated with an applicable emission limit that is to be used when a source test is required. In some cases where the applicable requirement does not cite a test method, one has been added.

In the event of conflict or omission between the information contained in the fourth and sixth columns and the actual statute or regulation cited in the second column, the requirements and language of the actual statute or regulation cited shall govern. For more information regarding any of the requirements cited in the second and third columns, refer to the actual requirements cited.

A. *FACILITY-WIDE APPLICABLE REQUIREMENTS*

The requirements in this section apply facility-wide to all the emission units regulated by this permit except that monitoring methods specified elsewhere in the permit for specific applicable requirements for specific emission units or activities supersede the general monitoring requirements listed in Section I.A.

Table 1 Facility-Wide Applicable Requirements

Reqmt. No.	Enforceable Requirement	Adoption or Effective Date	Requirement Paraphrase (Information Only)	Monitoring, Maintenance & Recordkeeping Method (See Section II)	Emission Standard Period	Reference Test Method
I.A.1	Puget Sound Clean Air Agency Reg I: 9.03 *This requirement will be superseded upon adoption of the 3/11/99 version of Reg I: 9.03 into the SIP* *Puget Sound Clean Air Agency Reg. I: 9.03 (State Only). This requirement will become federally enforceable upon adoption into the SIP and will replace the 9/08/94 version of Reg I: 9.03* WAC 173-400-040(1) *This requirement will be superseded upon adoption of the 9/15/01version of* WAC 173-400-040(1) *into the SIP* WAC 173-400-040(1) *(State Only). This requirement will become federally enforceable upon adoption into the SIP and will replace the 8/20/1993 version of* WAC 173-400-040(1)	09/08/1994 03/11/1999 08/20/1993 9/15/01	Shall not emit air contaminants in excess of 20% opacity for more than 3 minutes per hour	II.A.1(a) Opacity Monitoring II.A.1(b) Complaint Response II.A.1(c) Facility Inspections	More than 3 min in any 1 hr	Ecology Method 9A (See Section VIII)
I.A.2	Puget Sound Clean Air Agency Reg I: 9.09(a) *This requirement will be superseded upon adoption of the 4/9/98 version of Reg I: 9.09 into the SIP*	2/10/1994	Shall not emit particulate matter in excess of 0.05 gr/dscf from equipment used in a manufacturing process and general process units, uncorrected for	II.A.1(a) Opacity Monitoring II.A.1(b)	At least 1-hr per run	Puget Sound Clean Air Agency

Reqmt. No.	Enforceable Requirement	Adoption or Effective Date	Requirement Paraphrase (Information Only)	Monitoring, Maintenance & Recordkeeping Method (See Section II)	Emission Standard Period	Reference Test Method
	Puget Sound Clean Air Agency Reg I: 9.09 *(State Only) This requirement will become federally enforceable upon adoption of the 4/9/1998 version of Reg I: 9.09 into the SIP* WAC 173-400-060 This requirement shall be superseded by the 9/15/01 version of WAC 173-400-060 upon its adoption into the SIP WAC 173-400-060) (State Only). This requirement will become federally enforceable upon adoption into the SIP and will replace the 8/20/93 version of WAC 173-400-060	04/09/1998 8/20/1993 9/15/2001	excess air	Complaint Response II.A.1(c) Facility Inspections		Method 5 (See Section VIII)
I.A.3	Puget Sound Clean Air Agency Reg I: 9.09(a) *This requirement will be superseded upon adoption of the 4/9/98 version of Reg I: 9.09 into the SIP* Puget Sound Clean Air Agency Reg I: 9.09 *(State Only) This requirement will become federally enforceable upon adoption of the 4/9/1998 version of Reg I: 9.09 into the SIP*	02/10/1994 04/09/1998	Shall not emit particulate matter in excess of 0.05 gr/dscf corrected to 7% O_2 from fuel burning equipment and combustion sources (applies to the equipment that produces hot air, hot water, steam, or other heated fluids by external combustion of fuel. Examples include indirect-fired drying ovens and space heaters and water heaters)	II.A.1(a) Opacity Monitoring II.A.1(b) Complaint Response II.A.1(c) Facility Inspections	At least 1-hr per run	Puget Sound Clean Air Agency Method 5 (See Section VIII)

Reqmt. No.	Enforceable Requirement	Adoption or Effective Date	Requirement Paraphrase (Information Only)	Monitoring, Maintenance & Recordkeeping Method (See Section II)	Emission Standard Period	Reference Test Method
I.A.4	WAC 173-400-050 *This requirement will be superseded upon adoption of the 9/15/01 version of WAC 173-400-050 into the SIP* *WAC 173-400-050 (State Only) This requirement will be federally enforceable upon adoption into the SIP and will replace the 3/22/91 version of WAC 173-400-050*	3/22/91 9/15/01	Shall not emit particulate matter in excess of 0.10 gr/dscf corrected to 7% O_2 from fuel burning equipment and combustion sources. (Applies to the equipment that produces hot air, hot water, steam, or other heated fluids by external combustion of fuel, such as boilers and water heaters.	II.A.1(a) Opacity Monitoring II.A.1(b) Complaint Response II.A.1(c) Facility Inspections	At least 1-hr per run	Puget Sound Clean Air Agency Method 5 (See Section VIII)
I.A.5	Puget Sound Clean Air Agency Reg I: 9.07 WAC 173-400-040(6) first paragraph only. *This requirement shall be superseded by the 9/15/01version of WAC 173-400-040(6) upon its adoption into the SIP* *WAC 173-400-040(6) (State Only). This requirement will become federally enforceable upon adoption into the SIP and will replace the 8/20/93 version of WAC 173-400-040(6)*	04/14/1994 08/20/1993 9/15/01	Shall not emit SO_2 in excess of 1,000 ppmv (dry) corrected to 7% O_2 for fuel burning equipment	II.A.2(e) Purchase Specification	At least 1-hr per run	EPA Method 6C (See 40 CFR Part 60, Appendix A, July 1, 2001)

Reqmt. No.	**Enforceable Requirement**	**Adoption or Effective Date**	**Requirement Paraphrase** (Information Only)	**Monitoring, Maintenance & Recordkeeping Method** (See Section II)	**Emission Standard Period**	**Reference Test Method**
I.A.6	Puget Sound Clean Air Agency Reg I: 9.11 *This requirement will be superseded upon adoption of the 3/11/99 version of Reg I: 9.11 into the SIP*	06/9/1983	Shall not emit air contaminants in sufficient quantities and of such characteristics and duration as is, or is likely to be, injurious to human health, plant or animal life, or property, or which unreasonably interferes with enjoyment of life and property	II.A.1(b) Complaint Response; II.A.1(c) Facility Inspections	N/A	N/A
	WAC 173-400-040(5) *This requirement will be superseded upon adoption of the 9/15/01 version of* WAC 173-400-040(5) *into the SIP*	08/20/1993				
	Puget Sound Clean Air Agency Reg I: 9.11 *(State Only) This requirement will become federally enforceable upon adoption into the SIP and will replace the 6/9/1983 version of Reg I: 911(a).*	03/11/1999				
	WAC 173-400-040(5) *(State Only). This requirement will become federally enforceable upon adoption into the SIP and will replace the 8/20/93 version of WAC 173-400-040(5)*	9/15/01				

Reqmt. No.	Enforceable Requirement	Adoption or Effective Date	Requirement Paraphrase (Information Only)	Monitoring, Maintenance & Recordkeeping Method (See Section II)	Emission Standard Period	Reference Test Method
I.A.7	Puget Sound Clean Air Agency Reg I: 9.15 *This requirement will be superseded upon adoption of the 3/11/1999 version of Reg I: 9.15 into the SIP*	08/10/1989	(a) Shall not emit visible dust unless BACT is employed to control the emissions (b) Unlawful to operate a vehicle on paved public roads unless: (1) The vehicle is constructed or loaded to prevent load from escaping or spilling; (2) The vehicle is covered to prevent load from escaping or spilling if loaded with gravel or dirt; and (3) Mud, dirt, and other debris is cleaned from the chassis and tires of the vehicle (c) Unlawful to allow emission of fugitive dust from any refuse or fuel burning, manufacturing, or emissions control equipment (d) Unlawful to allow emission of fugitive dust in such quantities and of such characteristics and duration as is, or is likely to be, injurious to human health, plant or animal life, or which unreasonably interferes with enjoyment of life and property	II.A.1(b) Complaint Response; II.A.1(c) Facility Inspections II.A.1(f) Fugitive Dust, Track-Out, and Odor Bearing Contaminants	N/A	N/A

Reqmt. No.	Enforceable Requirement	Adoption or Effective Date	Requirement Paraphrase (Information Only)	Monitoring, Maintenance & Recordkeeping Method (See Section II)	Emission Standard Period	Reference Test Method
I.A.8	Puget Sound Clean Air Agency Reg I: 9.15 *(State only)* *This requirement shall become federally enforceable upon adoption into the SIP and will replace the 8/10/1989 version of Reg I:9.15*	03/11/1999	It shall be unlawful for any person to cause or allow visible emissions of fugitive dust unless reasonable precautions are employed to minimize the emissions. Reasonable precautions include, but are not limited to, the following: (1) The use of control equipment, enclosures, and wet (or chemical) suppression techniques, as practical, and curtailment during high winds; (2) Surfacing roadways and parking areas with asphalt, concrete, or gravel; (3) Treating temporary, low-traffic areas (e.g., construction sites) with water or chemical stabilizers, reducing vehicle speeds, constructing pavement or rip rap exit aprons, and cleaning vehicle undercarriages before they exit to prevent the track-out of mud or dirt onto paved public roadways; or (4) Covering or wetting truck loads or allowing adequate freeboard to prevent the escape of dust-bearing materials	II.A.1(b) Complaint Response; II.A.1(c) Facility Inspections II.A.1(f) Fugitive Dust, Track-Out, and Odor Bearing Contaminants	N/A	N/A

Reqmt. No.	Enforceable Requirement	Adoption or Effective Date	Requirement Paraphrase (Information Only)	Monitoring, Maintenance & Recordkeeping Method (See Section II)	Emission Standard Period	Reference Test Method
I.A.9	WAC 173-400-040(3) & (8) *These requirements will be superseded upon adoption of the 9/15/01 versions of* WAC 173-400-040(3) & (8) *into the SIP* WAC 173-400-040(3) & (8) *(State Only). These requirements will become federally enforceable upon adoption into the SIP and will replace the 8/20/93 versions of WAC 173-400-040(3) & (8)*	08/20/1993 9/15/01	Shall not emit visible dust unless reasonable precautions are employed to minimize the emissions	II.A.1(b) Complaint Response; II.A.1(c) Facility Inspections II.A.1(f) Fugitive Dust, Track-Out, and Odor Bearing Contaminants	N/A	N/A
I.A.10	Puget Sound Clean Air Agency Reg I: 9.20(b)	06/09/1988	Must maintain equipment not subject to Puget Sound Clean Air Agency Regulation I, Section 9.20(a) in good working order	II MONITORING, MAINTENANCE AND RECORDKEEPING PROCEDURES	N/A	N/A
I.A.11	Puget Sound Clean Air Agency Reg I: 7.09(b) *This requirement will be superseded upon adoption of the 9/10/1998 version of Reg I: 7.09(b) into the SIP* Puget Sound Clean Air Agency Reg I: 7.09(b) *(State Only) This requirement shall become federally enforceable upon adoption into the SIP and will replace the 9/12/96 version of Reg I:7.09(b)*	09/12/1996 09/10/1998	Must develop and implement an O&M Plan to assure continuous compliance with Puget Sound Clean Air Agency Regulations I, II and III	II MONITORING, MAINTENANCE AND RECORDKEEPING PROCEDURES	N/A	N/A

Reqmt. No.	Enforceable Requirement	Adoption or Effective Date	Requirement Paraphrase (Information Only)	Monitoring, Maintenance & Recordkeeping Method (See Section II)	Emission Standard Period	Reference Test Method
I.A.12	WAC 173-400-040(4) *(State Only)*	9/15/01	Must use recognized good practice and procedures to reduce odors which may unreasonably interfere with any other property owners' use and enjoyment of their property	II.A.1(b) Complaint Response; II.A.1(c) Facility Inspections	N/A	N/A
I.A.13	WAC 173-400-040(2) *(State Only)*	9/15/01	Shall not deposit particulate matter beyond property boundary in sufficient quantity to interfere unreasonably with the use and enjoyment of the property	II.A.1(b) Complaint Response; II.A.1(c) Facility Inspections	N/A	N/A
I.A.14	Puget Sound Clean Air Agency Reg I: 9.10(a) *(State Only)*	06/09/1988	Shall not emit HCl in excess of 100 ppm (dry) corrected to 7% O_2 for combustion sources	No monitoring required	At least three 1-hr runs	EPA Method 26A (See 40 CFR Part 60, Appendix A; July 1, 2000)
I.A.15	RCW 70.94.040 *(State Only)*	1996	Shall not cause air pollution in violation of 70.94 RCW or any ordinance, resolution, rule or regulation adopted thereunder	No monitoring required	N/A	N/A

N/A = Not Applicable

B. EMISSION UNIT SPECIFIC APPLICABLE REQUIREMENTS

The requirements in Section I.B. only apply to the specific emission units cited; however, the requirements in Section I.A. also apply to the specific emission units or activities described in Section I.B. If a requirement in Section I.A. is repeated in this section, then the monitoring, maintenance, and recordkeeping method specified in this section supersedes the monitoring, maintenance, and recordkeeping method specified in Section I.A.

The first part of each subsection in Section I.B. lists a description of the emission activity and identifying information about each specific emission point or unit. The identifying information includes the building number, the column and door number (grid system for locating points within the buildings), a Boeing inventory control identification number (MSS/ID No.), the Notice of Construction Order of Approval number for equipment that has gone through the new source review process, the installation date and a short description of the emission unit. This information, which is in italics, is not an enforceable part of the permit. Because of the size of Boeing and its complexity, the information is provided as an aid in understanding the permit and locating the specific emission point or activity.

The following tables list the citation for the "applicable requirement" in the second column.

The third column (Requirement Paraphrase) paraphrases the requirements and is not an enforceable condition of this permit. The actual enforceable requirement is embodied in the requirement cited in the second column.

The fourth column (Monitoring, Maintenance and Recordkeeping Method) identifies the activities that Boeing shall use to monitor compliance with the applicable requirements identified in the second column. These methods are described in Section II of this permit. Following the method is a requirement of this permit. In some cases where the applicable requirement does not cite a test method, one has been added.

Boeing is subject to all the requirements in all the tables listed below. The paraphrasing contained in the third column below is intended to generally state the relevant requirements for the purposes of the table, but is not intended in any way to alter or change the meaning of any requirement referenced in the second column.

In the event of conflict or omission between the information contained in the third column and the actual statute or regulation cited in the second column, the requirements and language of the actual statute or regulation cited shall govern. For more information regarding any of the requirements cited in the second column, refer to the actual requirements cited.

1. Vapor Degreasing Operations

DESCRIPTION: *This section includes all activities and equipment associated with vapor degreasing operations, including degreasing, distillation, and storage.*

Bldg.	*Col./Dr.*	*MSS/ID No.*	*Order of Approval No.*	*Install Date*	*Source Description*
10-71	*Lab 79*	*TNK017*	*5973*	*1990*	*Batch machine, <13 square feet air solvent interface, without lip exhaust.*

Data in italics are for information only and are not enforceable conditions of this permit.

COMPLIANCE REQUIREMENTS:

Reqmt. No.	Enforceable Requirement	Requirement Paraphrase (For Information Only)	Monitoring, Maintenance & Recordkeeping Method (See Section II)
(a) Requirement Nos. EU 1.1 through EU 1.13 are the NESHAP General Provisions (40 CFR 63 Subpart A). Applicability of 40 CFR 63 Subpart A is defined in Table 1 to Subpart T of Part 63. Table 1 supersedes this permit, if an apparent conflict exists.			
EU 1.1	40 CFR 63.1(c)(1), 63.4 (4/5/02)	Must comply with 40 CFR 63 Subpart A and T.	No Monitoring Required (NMR)
EU 1.2	40 CFR 63.5 (4/5/02)	Must comply with preconstruction review requirements if reconstructing source.	NMR
EU 1.3	40 CFR 63.6(b)(2) (4/5/02)	New and reconstructed affected sources that have an initial startup after the effective date of 40 CFR 63 Subpart T must comply with the requirements of Subpart T upon startup.	NMR
EU 1.4	40 CFR 63.6(e)(1) (4/5/02)	At all times, including startup, shutdown, and malfunction, must operate and maintain affected sources consistent with good air pollution control practice. Correct malfunctions as soon as practicable after their occurrence.	II.A.2(d)(vii) Vapor Degreasers Maintenance II.A.2(l) Vapor Degreaser Closed Cover II.A.2(m) Vapor Degreaser Hoist Speed II.A.2(n) Vapor Degreaser Air Blanket Center Temperature

Reqmt. No.	Enforceable Requirement	Requirement Paraphrase (For Information Only)	Monitoring, Maintenance & Recordkeeping Method (See Section II)
EU 1.5	40 CFR 63.6(f) (4/5/02)	The nonopacity emission standards set forth in Subpart A shall apply at all times except during periods of startup, shutdown, and malfunction as set forth in 40 CFR Part 63 Subparts A & T.	II.A.2(d)(vii) Vapor Degreasers Maintenance II.A.2(l) Vapor Degreaser Closed Cover II.A.2(m) Vapor Degreaser Hoist Speed II.A.2(n) Vapor Degreaser Air Blanket Center Temperature
EU 1.6	40 CFR 63.8 (a)(1), (a)(2), & (b)(1) (4/5/02)	Conduct of monitoring. Monitoring shall be conducted as set forth in Subparts A & T.	II.A.2(d)(vii) Vapor Degreasers Maintenance II.A.2(l) Vapor Degreaser Closed Cover II.A.2(m) Vapor Degreaser Hoist Speed II.A.2(n) Vapor Degreaser Air Blanket Center Temperature
EU 1.7	40 CFR 63.8(f) (4/5/02)	Boeing must receive permission from the Puget Sound Clean Air Agency before using an alternative monitoring procedure.	NMR
EU 1.8	40 CFR 63.9(b)(3), (b)(5) (4/5/02)	Boeing shall notify the Puget Sound Clean Air Agency according to 40 CFR 63.9(b)(3)-(5) if it constructs or reconstructs a new affected source. Subpart T, 63.468(a)-(b) has some more information requirements specific to the vapor degreasers.	NMR
EU 1.9	40 CFR 63.9(i) (4/5/02)	Adjustment to time periods or postmark deadlines for submittal and review of required communications may be requested from and approved by the Puget Sound Clean Air Agency.	NMR
EU 1.10	40 CFR 63.9(j) (4/5/02)	Notification Requirements. Any change in the information already provided under 40 CFR 63.9 shall be sent to the Puget Sound Clean Air Agency within 15 days after the change.	NMR
EU 1.11	40 CFR 63.10(a)(3)-(7) (4/5/02)	Boeing must send the reports according to 40 CFR 63.10(a)(3)-(7) and can request alternate reporting dates.	NMR

Reqmt. No.	Enforceable Requirement	Requirement Paraphrase (For Information Only)	Monitoring, Maintenance & Recordkeeping Method (See Section II)
EU 1.12	40 CFR 63.10(f) (4/5/02)	Boeing must comply with the recordkeeping and reporting requirements in 40 CFR 63.10 unless a waiver is granted by the Puget Sound Clean Air Agency.	NMR
EU 1.13	40 CFR 63.10(d)(1) (4/5/02)	Boeing shall submit reports in accordance with 40 CFR 63 Subpart T.	NMR
(b) Requirement Nos. 1.14 through EU 1.48 are the Halogenated Solvent Cleaning NESHAP requirements.			
EU 1.14	40 CFR 63.463(a)(1)(i) (9/8/00)	Cleaning machine shall be designed and operated with: 1)An idling and downtime mode cover, as described in § 63.463(d)(1)(i), that may be readily opened or closed, that completely covers the cleaning machine openings when in place, and is free of cracks, holes, and other defects.	II.A.2(l) Vapor Degreaser Closed Cover
EU 1.15	40 CFR 63.463(a)(2) (9/8/00)	Each cleaning machine shall have a freeboard ratio of 0.75 or greater.	II.A.2(c) Documentation on File
EU 1.16	40 CFR 63.463(a)(3) (9/8/00)	Each cleaning machine shall have an automated parts handling system capable of moving parts or parts baskets at a speed of 3.4 meters per minute (11 feet per minute) or less from the initial loading of parts through removal of cleaned parts.	II.A.2(m) Vapor Degreaser Hoist Speed
EU 1.17	40 CFR 63.463(a)(4) (9/8/00)	Each vapor cleaning machine shall be equipped with a device that shuts off the sump heat if the sump liquid solvent level drops to the sump heater coils.	II.A.2(d)(vii) Vapor Degreasers Maintenance
EU 1.18	40 CFR 63.463(a)(5) (9/8/00)	Each vapor cleaning machine shall be equipped with a vapor level control device that shuts off sump heat if the vapor level in the vapor cleaning machine rises above the height of the primary condenser.	II.A.2(d)(vii) Vapor Degreasers Maintenance
EU 1.19	40 CFR 63.463(a)(6) (9/8/00)	Each vapor cleaning machine shall have a primary condenser.	II.A.2(c) Documentation on File
EU 1.20	40 CFR 63.463(b)(1)(i) (9/8/00)	Employ one of the control combinations listed in Table 1 of 40 CFR 63.463(b)(1).	II.A.2(c) Documentation on File II.A.2(n) Vapor Degreaser Air Blanket Center Temperature

Reqmt. No.	Enforceable Requirement	Requirement Paraphrase (For Information Only)	Monitoring, Maintenance & Recordkeeping Method (See Section II)
EU 1.21	40 CFR 63.463(d)(1)(i) (9/8/00)	Cover(s) to each solvent cleaning machine shall be in place during the idling mode, and during the downtime mode unless either the solvent has been removed from the machine or maintenance or monitoring is being performed that requires the cover(s) to not be in place.	II.A.2(l) Vapor Degreaser Closed Cover
EU 1.22	40 CFR 63.463(d)(2) (9/8/00)	The parts baskets or the parts being cleaned shall not occupy more than 50% of the solvent/air interface area unless the parts baskets or parts are introduced at a speed of 0.9 meters per minute (3 feet per minute) or less.	II.A.2(c) Documentation on File
EU 1.23	40 CFR 63.463(d)(3) (9/8/00)	Any spraying operations shall be done within the vapor zone or within a section of the solvent cleaning machine that is not directly exposed to the ambient air (i.e., a baffled or enclosed area of the solvent cleaning machine)	II.A.1(d) Work Practice Inspection
EU 1.24	40 CFR 63.463(d)(4) (9/8/00)	Parts shall be oriented so that the solvent drains from them freely. Parts having cavities or blind holes shall be tipped or rotated before being removed from the cleaning machine.	II.A.1(d) Work Practice Inspection
EU 1.25	40 CFR 63.463(d)(5) (9/8/00)	Parts baskets or parts shall not be removed from any solvent cleaning machine until dripping has stopped.	II.A.1(d) Work Practice Inspection
EU 1.26	40 CFR 63.463(d)(6) (9/8/00)	During startup of each cleaning machine, the primary condenser shall be turned on before the sump heater.	II.A.1(d) Work Practice Inspection
EU 1.27	40 CFR 63.463(d)(7) (9/8/00)	During shutdown of each cleaning machine, the sump heater shall be turned off and the solvent vapor layer allowed to collapse before the primary condenser is turned off.	II.A.1(d) Work Practice Inspection
EU 1.28	40 CFR 63.463(d)(8) (9/8/00)	When solvent is added or drained from any cleaning machine, the solvent shall be transferred using threaded or other leak proof couplings and the end of the pipe in the solvent sump shall be located beneath the liquid solvent surface.	II.A.2(c) Documentation on File

Reqmt. No.	Enforceable Requirement	Requirement Paraphrase (For Information Only)	Monitoring, Maintenance & Recordkeeping Method (See Section II)
EU 1.29	40 CFR 63.463(d)(9) (9/8/00)	Each solvent cleaning machine and associated controls shall be maintained as recommended by the manufacturers of the equipment or using alternative maintenance procedures approved by the Administrator.	II.A.2(d)(vii) Vapor Degreasers Maintenance
EU 1.30	40 CFR 63.463(d)(10) (9/8/00)	Each operator of a solvent cleaning machine shall complete and pass the applicable sections of the test of solvent cleaning operating procedures in Appendix B of 40 CFR Part 63 Subpart T if requested during an inspection by the Puget Sound Clean Air Agency.	NMR
EU 1.31	40 CFR 63.463(d)(11) (9/8/00)	Waste solvent, still bottoms, and sump bottoms shall be collected and stored in closed containers. The closed containers may contain a device that would allow pressure relief, but would not allow liquid solvent to drain from container.	II.A.1(d) Work Practice Inspection
EU 1.32	40 CFR 63.463(d)(12) (9/8/00)	Sponges, fabric, wood, and paper products shall not be cleaned.	II.A.1(d) Work Practice Inspection
EU 1.33	40 CFR 63.463(e)(1) (9/8/00)	Must conduct monitoring of each control device used to comply with 40 CFR 63.463 as provided in 40 CFR 63.466.	II.A.2(d)(vii) Vapor Degreasers Maintenance II.A.2(l) Vapor Degreaser Closed Cover II.A.2(m) Vapor Degreaser Hoist Speed II.A.2(n) Vapor Degreaser Air Blanket Center Temperature
EU 1.34	40 CFR 63.463(e)(2)(i) (9/8/00)	For freeboard refrigeration device, must ensure that the chilled air blanket temperature measured at the center of the air blanket is no greater than 30% of the solvent's boiling point.	II.A.2(n) Vapor Degreaser Air Blanket Center Temperature
EU 1.35	40 CFR 63.463(e)(3) (9/8/00)	If any of the requirements of 40 CFR 63.463(e)(2) are not met, Boeing must determine whether an exceedance of the Freeboard Refrigeration Device or Hoist Speed has occurred using the criteria of 40 CFR 63.463(e)(3)(i) and (ii).	NMR
EU 1.36	40 CFR 63.463(e)(4) (9/8/00)	Boeing shall report all exceedances and all corrections and adjustments made to avoid an exceedance as specified in 63.468(h)	II.A.2(c) Documentation on File

Reqmt. No.	Enforceable Requirement	Requirement Paraphrase (For Information Only)	Monitoring, Maintenance & Recordkeeping Method (See Section II)
EU 1.37	40 CFR 63.465(e) (9/8/00)	Boeing must determine potential to emit from all solvent cleaning operations using the procedures described in paragraphs 40 CFR 63.465(e)(1) through (e)(3).	II.A.2(c) Documentation on File
EU 1.38	40 CFR 63.466(a)(1) (12/3/99)	For freeboard refrigeration device, Boeing must use a thermometer or thermocouple to measure and record the temperature at the center of the air blanket during idling modes weekly.	II.A.2(n) Vapor Degreaser Air Blanket Center Temperature
EU 1.39	40 CFR 63.466(c) (12/3/99)	Boeing must monitor the hoist speed monthly. If after the first year, no exceedances of the hoist speed are measured, may begin monitoring quarterly. If an exceedance of the hoist speed occurs during quarterly monitoring, must return to monthly monitoring until another year of compliance without an exceedance is demonstrated.	II.A.2(m) Vapor Degreaser Hoist Speed
EU 1.40	40 CFR 63.466(b)(1) (12/3/99)	Boeing shall monthly visually inspect that the cover is opening, closing properly, completely covers the cleaning machine opening when closed, and is free of cracks, holes, and other defects.	II.A.2(l) Vapor Degreaser Closed Cover
EU 1.41	40 CFR 63.466(g) (12/3/99)	Boeing may use alternative monitoring procedures for control devices listed in 40 CFR 63.466(a) through (e) approved by the Administrator.	NMR
EU 1.42	40 CFR 63.467(a)(1) (12/3/99)	Boeing shall keep owner's manuals, or if not available, written maintenance and operating procedures, for the solvent cleaning machine and control equipment, for the lifetime of the machine.	II.A.2(c) Documentation on File
EU 1.43	40 CFR 63.467(a)(2) (12/3/99)	Boeing shall keep the date of installation for the solvent cleaning machine and all of its control devices for the lifetime of the machine. If the exact date for installation is not known, a letter certifying that the cleaning machine and its control devices were installed prior to, or on, November 29, 1993, or after November 29, 1993, may be substituted.	II.A.2(c) Documentation on File
EU 1.44	40 CFR 63.467(a)(5) (12/3/99)	Boeing shall keep records of the halogenated HAP solvent content for each solvent used in a solvent cleaning machine subject to the provisions of this subpart for the lifetime of the machine.	II.A.2(c) Documentation on File

Reqmt. No.	Enforceable Requirement	Requirement Paraphrase (For Information Only)	Monitoring, Maintenance & Recordkeeping Method (See Section II)
EU 1.45	40 CFR 63.467(b)(1) (12/3/99)	Boeing shall keep results of control device monitoring (Closed Cover, Hoist Speed, and Vapor Blanket Center Temperature) required under 40 CFR 63.466 for 5 years.	II.A.2(c) Documentation on File
EU 1.46	40 CFR 63.467(b)(2) (12/3/99)	Boeing shall keep the information on the actions taken to comply with 40 CFR 63.463(e) for 5 years. This information shall include records of written or verbal orders for replacement parts, a description of the repairs made, and additional monitoring conducted to demonstrate that monitored parameters have returned to accepted levels.	II.A.2(c) Documentation on File
EU 1.47	40 CFR 63.467(b)(3) (12/3/99)	Boeing shall keep estimates of annual solvent consumption for each solvent cleaning machine for 5 years.	II.A.2(c) Documentation on File
EU 1.48	40 CFR 63.469 (6/5/95)	The Puget Sound Clean Air Agency may approve the use of equipment or procedures after they have been demonstrated to be equivalent to those prescribed for compliance within 40 CFR Part 63 Subpart T.	NMR
(c) Requirement Nos. EU 1.49 through EU 1.64 are the Puget Sound Clean Air Agency and WAC requirements for solvent metal cleaners.			
EU 1.49	Puget Sound Clean Air Agency Reg III:3.05(a) (1) (8/90) WAC 173-460-060(5)(a)(i) (8/21/98) (State Only)	The cover shall always remain closed except when processing work. The cover shall be closed to the maximum extent possible at all times.	II.A.2(d)(vii) Vapor Degreasers Maintenance
EU 1.50	Puget Sound Clean Air Agency Reg III:3.05(a) (2)&(b)(4) (8/90) WAC 173-460-060(5)(a)(ii) and (b)(iv) (8/21/98) (State Only)	The cleaner must have a parts draining facility such that the drained solvent returns to the solvent tank.	II.A.2(c) Documentation on File

Reqmt. No.	Enforceable Requirement	Requirement Paraphrase (For Information Only)	Monitoring, Maintenance & Recordkeeping Method (See Section II)
EU 1.51	Puget Sound Clean Air Agency Reg III:3.05(a)(4)(A)(i) (8/90) WAC 173-460-060(5)(a)(iv) (A) (8/21/98) (State Only)	The cleaner must have a high vapor cutoff thermostat with manual reset required.	II.A.2(d)(vii) Vapor Degreasers Maintenance
EU 1.52	Puget Sound Clean Air Agency Reg III:3.05(a)(4)(A)(ii) (8/90) WAC 173-460-060(5)(a)(iv) (B) (8/21/98) (State Only)	The cleaner must have a vapor-up thermostat which will allow spray operations only after the vapor zone has risen to the design level.	II.A.2(d)(vii) Vapor Degreasers Maintenance
EU 1.53	Puget Sound Clean Air Agency Reg III:3.05(a)(4)(B) (8/90)	The freeboard ratio must be greater than 0.75 or a refrigerated freeboard chiller shall be required.	II.A.2(c) Documentation on File, II.A.2(d)(vii) Vapor Degreasers
EU 1.54	Puget Sound Clean Air Agency Reg III:3.05(b)(1) (8/90) WAC 173-460-060(5)(b)(i) (8/21/98) (State Only)	Solvent shall not leak from any portion of the equipment.	II.A.2(d)(vii) Vapor Degreasers Maintenance
EU 1.55	Puget Sound Clean Air Agency Reg III:3.05(b)(2) (8/90) WAC 173-460-060(5)(b)(ii) (8/21/98) (State Only	Solvent shall be stored in closed containers and disposed of to prevent evaporation.	II.A.1(d) Work Practice Inspection

Reqmt. No.	Enforceable Requirement	Requirement Paraphrase (For Information Only)	Monitoring, Maintenance & Recordkeeping Method (See Section II)
EU 1.56	Puget Sound Clean Air Agency Reg III:3.05(b)(5)(A) (8/90) WAC 173-460-060(5)(c)(i) (8/21/98) (State Only)	Racked parts shall be allowed to fully drain.	II.A.1(d) Work Practice Inspection
EU 1.57	Puget Sound Clean Air Agency Reg III:3.05(b)(5)(B) (8/90) WAC 173-460-060(5)(c)(ii) (8/21/98) (State Only)	Parts must be degreased in vapor zone until condensation ceases.	II.A.1(d) Work Practice Inspection
EU 1.58	Puget Sound Clean Air Agency Reg III:3.05(b)(5)(C) (8/90) WAC 173-460-060(5)(c)(iii) (8/21/98) (State Only)	Spraying operations shall be done within the vapor layer.	II.A.1(d) Work Practice Inspection
EU 1.59	Puget Sound Clean Air Agency Reg III:3.05(b)(5)(D) (8/90) WAC 173-460-060(5)(c)(iv) (8/21/98) (State Only)	If using powered hoist, vertical speed of parts moved in and out of vapor zone must be less than 10 feet per minute.	II.A.2(m) Vapor Degreaser Hoist Speed

Reqmt. No.	Enforceable Requirement	Requirement Paraphrase (For Information Only)	Monitoring, Maintenance & Recordkeeping Method (See Section II)
EU 1.60	Puget Sound Clean Air Agency Reg III:3.05(b)(5)(E) (8/90) WAC 173-460-060(5)(c)(v) (8/21/98) (State Only)	The lip of the degreaser shall not be exposed to drafts greater than 50 feet per minute when cover is open.	II.A.2(d)(vii) Vapor Degreasers Maintenance
EU 1.61	Puget Sound Clean Air Agency Reg III:3.05(c) (1) (8/90)	Boeing shall conduct an analysis of available alternative technologies.	II.A.2(c) Documentation on File
EU 1.62	Puget Sound Clean Air Agency Reg III:3.05(c) (2)(A) (8/90)	Cover must open horizontally.	II.A.2(c) Documentation on File
EU 1.63	Puget Sound Clean Air Agency Reg III:3.05(c) (2)(B) (8/90) WAC 173-460-060(5)(a)(iv) (C) (8/21/98) (State Only)	Freeboard ratio must be greater than or equal to 1.00.	II.A.2(c) Documentation on File
EU 1.64	Puget Sound Clean Air Agency Reg III:3.05(c) (2)(C) (8/90)	Must employ refrigerated freeboard chiller.	II.A.2(d)(vii) Vapor Degreasers Maintenance

Reqmt. No.	**Enforceable Requirement**	**Requirement Paraphrase** (For Information Only)	**Monitoring, Maintenance & Recordkeeping Method** (See Section II)
(d) Requirement Nos. EU 1.65 and EU 1.66 are the Puget Sound Clean Air Agency O&M requirements for operating permit sources.			
EU 1.65	Puget Sound Clean Air Agency Reg I, 7.09(b) (9/12/96) *This requirement will be superseded upon adoption of the 9/10/1998 version of Reg I, 7.09(b) into the SIP* Puget Sound Clean Air Agency Reg I, 7.09(b) (9/10/98) *(State Only) This requirement shall become federally enforceable upon adoption into the SIP and will replace the 9/10/9812/96 version of Reg I,7.09(b)*	Boeing shall develop and implement an Operation and Maintenance Plan to assure continuous compliance with Puget Sound Clean Air Agency Regulations I, II, and III.	II.B Operation and Maintenance (O&M) Plan Requirements This monitoring method supersedes the monitoring method for this requirement listed in I.A.11
EU 1.66	Puget Sound Clean Air Agency Reg I: 9.20(a) (6/88)	Maintain equipment in good working order that has received an NOC Order of Approval.	II.A.2(d)(vii) Vapor Degreasers Maintenance II.A.2(l) Vapor Degreaser Closed Cover II.A.2(m) Vapor Degreaser Hoist Speed II.A.2(n) Vapor Degreaser Air Blanket Center Temperature II.A.1(c) Facility Inspections

(e) Requirement Nos. EU 1.67 is the Order of Approval Nos. 5973.			
EU 1.67	Order of Approval No. 5973 (8/8/95) (4)	Boeing shall achieve compliance with Subpart T – National Emissions Standards for Halogenated Solvent Cleaning, 40 CFR Part 63, no later than Dec. 2 1997.	II.A.2(c) Documentation on File
(f) Requirement No. EU 1.68 is the RCW requirement to maintain Order of Approval equipment in good working order.			
EU 1.68	RCW 70.94.152(7) 1996 (State Only)	Maintain equipment that has received an Order of Approval Order of Approval in good working order.	II.A.2(d)(vii) Vapor Degreasers Maintenance II.A.1(c) Facility Inspections These monitoring methods supersede the monitoring method for this requirement listed in I.A.10
(g) Requirement No. EU 1.69 is the Puget Sound Clean Air Agency adoption of 40 CFR Part 61 and 63.			
EU 1.69	Puget Sound Clean Air Agency Reg III: 2:02 (7/13/00) (State Only)	Adopts 40 CFR 63 by reference, and those requirements are listed elsewhere in this permit.	NMR

NMR = No Monitoring Required -- Monitoring is not required; however, if a noncompliant situation is observed, Boeing will initiate appropriate corrective action.

EXEMPTIONS, EXTENSIONS AND DETERMINATIONS GRANTED BY AGENCIES:

	Source	Description
1.	Puget Sound Clean Air Agency	For containers sized two gallons or less, clarifies when an exemption may be granted from PSCAA Regulation III Section 3.05. J Nolan letter dated August 27, 2001, to N. Welch re Applicability of PSCAA Regulation III, Section 3.05, Solvent Metal Cleaners. See Attachment 18

2. Chemical Process Tankline Operations

DESCRIPTION: *This section includes the equipment listed below and all activities associated with chemical process tankline and fume scrubber operations. This includes some hard chrome electroplating tank and chromic acid anodize tanks. These chrome tanks are in research & development laboratories, and thereby exempt (40 CFR 63.340(d) from the Hard and Decorative Chromium Electroplating and Chromium Anodizing Tanks NESHAP (40 CFR Part 63 Subpart N), and from Puget Sound Clean Air Agency Regulation III Section 3.01, governing hard and decorative chromium electroplating and chromium anodizing. Emissions from the chrome plating tanks are controlled with the use of polyballs on the surface of the tank and by packed bed wet scrubber No.2.*

Bldg. Col/dr	*MSS/ID#*	*Order of Approval No.*	*Install Date*	*Source Description*
10-71 Roof	*SCB004*	*8721*	*1986*	*16,030 cfm Packed bed scrubber system for E4 BMT research Lab No. 79*
10-71 Roof	*SCB005*	*6897*	*1993*	*7440 cfm Harrington Scrubber for E5 BMT research Lab No. 85*

Data in italics are for information only and not enforceable conditions of this permit.

COMPLIANCE REQUIREMENTS:

Reqmt. No.	Enforceable Requirement	Requirement Paraphrase (For Information Only)	Monitoring, Maintenance & Recordkeeping Method (See Section II)	Reference Test Method (See Section VIII)
a) Requirements EU 2.1 through EU 2.3are the Puget Sound Clean Air Agency requirements that apply to chemical process tankline operations.				
EU 2.1	Puget Sound Clean Air Agency Reg I, 7.09(b) (9/12/96) *This requirement will be superseded upon adoption of the 9/10/1998 version of Reg I, 7.09(b) into the SIP* Puget Sound Clean Air Agency Reg I, 7.09(b) (9/10/98) *(State Only) This requirement shall become federally enforceable upon adoption into the SIP and will replace the 9/12/96 version of Reg I, 7.09(b)*	Develop and implement an Operation and Maintenance Plan to assure continuous compliance with Puget Sound Clean Air Agency Regulations I, II, and III.	II.B Operation and Maintenance (O&M) Plan Requirements This monitoring method supersedes the monitoring method for this requirement listed in I.A.11	
EU 2.2	Puget Sound Clean Air Agency Reg I: 9.20(a) (6/9/88)	Maintain equipment in good working order that has received an NOC Order of Approval.	II.A.2(d)(vi) Laboratory Tankline Scrubber Maintenance II.A.1(c) Facility Inspections	

Reqmt. No.	Enforceable Requirement	Requirement Paraphrase (For Information Only)	Monitoring, Maintenance & Recordkeeping Method (See Section II)	Reference Test Method (See Section VIII)
EU 2.3	Puget Sound Clean Air Agency Reg I, 9.03 (9/08/1994) *This requirement will be superseded upon adoption of the 3/11/99 version of Reg I, 9.03 into the SIP* Puget Sound Clean Air Agency Reg. I, 9.03 (3/11/1999) *(State Only). This requirement will become federally enforceable upon adoption into the SIP and will replace the 9/08/94 version of Reg I, 9.03* WAC 173-400-040(1) (8/20/1993) *This requirement will be superseded upon adoption of the 9/15/01 version of WAC 173-400-040(1) into the SIP* WAC 173-400-040(1) (9/15/01) *(State Only). This requirement will become federally enforceable upon adoption into the SIP and will replace the 8/20/1993 version of WAC 173-400-040(1)*	Shall not emit air contaminants in excess of 20% opacity for more than 3 minutes per hour	II.A.2(d)(vi) Laboratory Tankline Scrubber Maintenance II.A.1(b) Complaint Response II.A.1(c) Facility Inspections These monitoring methods supersede the monitoring method for this requirement listed in I.A.1	Ecology Method 9A (See Section VIII)

Reqmt. No.	Enforceable Requirement	Requirement Paraphrase (For Information Only)	Monitoring, Maintenance & Recordkeeping Method (See Section II)	Reference Test Method (See Section VIII)
EU 2.4	Puget Sound Clean Air Agency Reg I, 9.09(a) (2/10/1994) *This requirement will be superseded upon adoption of the 4/9/98 version of Reg I, 9.09 into the SIP* Puget Sound Clean Air Agency Reg I, 9.09 (4/09/1998) *(State Only) This requirement will become federally enforceable and will be effective in this table upon adoption of the 4/9/1998 version of Reg I, 9.09 into the SIP* WAC 173-400-060 (8/20/93) *This requirement shall be superseded by the 9/15/01 version of WAC 173-400-060 upon its adoption into the SIP* WAC 173-400-060 (9/15/01) *(State Only). This requirement will become federally enforceable upon adoption into the SIP and will replace the 8/20/93 version of WAC 173-400-060*	Shall not emit particulate matter in excess of 0.05 gr/dscf from equipment used in a manufacturing process and general process units, uncorrected for excess air	II.A.2(d)(vi) Laboratory Tankline Scrubber Maintenance II.A.1(b) Complaint Response II.A.1(c) Facility Inspections These monitoring methods supersede the monitoring method for this requirement listed in I.A.2	Puget Sound Clean Air Agency Method 5 (See Section VIII)
b) Requirement No. EU 2.5 is the RCW requirement to maintain Order of Approval equipment in good working order.				
EU 2.5	RCW 70.94.152(7) 1996 (State Only)	Maintain equipment in good working order that has received an NOC Order of Approval.	II.A.2(d)(vi) Laboratory Tankline Scrubber Maintenance II.A.1(c) Facility Inspections	

Reqmt. No.	Enforceable Requirement	Requirement Paraphrase (For Information Only)	Monitoring, Maintenance & Recordkeeping Method (See Section II)	Reference Test Method (See Section VIII)
c) Requirement No. EU 2.6 is the Puget Sound Clean Air Agency Order of Approval Condition for Order of Approval No. 6897				
EU 2.6	Puget Sound Clean Air Agency Order of Approval No. 6897 (4/30/97)	This plating line shall be limited to research or laboratory operations as defined in 40 CFR 63.341(a)	II.A.1(c) Facility Inspections	
d) Requirements No. 2.7 though 2.8 are the Puget Sound Clean Air Agency Order of Approval Conditions for Order of Approval No. 8721, Lab 79, Scrubber SCB004				
EU 2.7	Puget Sound Clean Air Agency Order of Approval No. 8721 (3) (10/09/02)	Install and maintain gauges to measure the pH of the scrubber water and differential pressure across the scrubber. Within 90 days after the completion of the tankline modification project, the acceptable range for the pressure drop shall be clearly identified on or near the gauge, or on a pressure drop log.	II.A.2(d)(vi) Laboratory Tankline Scrubber Maintenance	
EU 2.8	Puget Sound Clean Air Agency Order of Approval No. 8721 (4) (10/09/02)	Within 90 days after the completion of the tankline modification project, Boeing shall begin collecting monthly differential pressure and pH readings. If the differential pressure or pH is not within the acceptable range, Boeing shall take corrective action as specified in the facility's Operations and Maintenance Plan.	II.A.2(d)(vi) Laboratory Tankline Scrubber Maintenance	

The following Orders of Approval have been canceled and superseded by amended Orders of Approval:

Order of Approval No. 6897, dated April 30, 1997, cancels and supersedes Order of Approval No. 4787, dated November 18, 1992.

Order of Approval No. 5973 dated August 8, 1995, cancels and supersedes Order of Approval No. 5973 dated July 6, 1995.

EXEMPTIONS, EXTENSIONS AND DETERMINATIONS GRANTED BY AGENCIES:

	Source	Description
1.	Puget Sound Clean Air Agency	Notice of Construction Requirements for Scrubbers and Baghouses. Discusses what types of changes are considered "substantial alterations" for scrubbers and baghouses. Letter dated October 10, 2001, Steve M. Van Slyke to Jade Hudson, the Boeing Company. See Attachment 16.

3. Coating, Cleaning, and Depainting Operations

DESCRIPTION: *This section includes all activities and equipment associated with surface coating, cleaning, and depainting operations. These operations include coating mixing, application, drying, and curing; spray gun cleaning; solvent wipe and solvent flush cleaning; depainting; and material and waste handling.*

Cleaning, primer application, and topcoat application operations subject to the Aerospace NESHAP (40 CFR Part 63 Subpart GG) are included in this section. Currently, the Renton facility depaints 6 or less completed aircraft each calendar year. Therefore, the depainting requirements of the Aerospace NESHAP do not apply to the facility. However, under the Alternate Operating Scenario shown below, the Renton facility would depaint more than 6 completed aircraft in a calendar year and thus be subject to the depainting requirements. Chemical maskant application operations subject to the Aerospace NESHAP are not conducted at the Renton facility and, therefore, are not included in this section.

The activities included in this section are conducted throughout the Renton facility. The spray coating units and equipment cleanup stations that are included in this section and permitted or otherwise registered with the Puget Sound Clean Air Agency are listed below. For the purpose of defining an "emission unit" in this permit, each piece of equipment listed below is considered a separate emission unit. The last column in this list indicates whether Aerospace NESHAP-regulated coatings containing inorganic HAPs are sprayed in the unit at the time of permit issuance. However, any of the booths listed below may have such coatings sprayed in them in the future.

Most of the spray coating units listed below are used in aerospace component coating operations. The units with an asterisk (*) next to their description are not normally used in aerospace component coating operations, but may be in the future.

Bldg.	*Col/Dr*	*MSS/ID No.*	*Order of Approval No.*	*Date Installed*	*Source Description*	*Aerospace NESHAP Coatings with Inorganic HAP Used in Unit?*
10-71	*BMT Lab No.87*	*PB0056**	*Reg.*	*1986*	*Dry Filter*	*No*
10-71	*D5 Lab No.77*	*PB0057**	*2826*	*1986*	*Dry Filter*	*No*
10-71	*Lab 70*	*PB0019*	*5066*	*1994*	*Dry Filter Spray booth*	*No*
4-20	*M8*	*PB0081, 82*	*5979*	*1995*	*Dry filter*	*No*
4-20	*M8*	*PB0083, 84*	*7296*	*1997*	*Dry filter, with NESHAP 3-stage filter*	*Yes*
4-20	*Q6*	*PB0085, 86*	*7355*	*1998*	*Dry filter, with NESHAP 3-stage filter*	*Yes*
4-21.2	*G29*	*PB0051*	*Reg.*	*1986*	*Dry filter, clean, seal & paint operation*	*No*
4-41	*Hangar*	*Z6002A*	*3142*	*1987*	*Spray Painting Hangar - 5 Dry Filter Booths*	*Yes*
4-42	*WA4*	*PB0006*	*3121*	*1990*	*Spray Coating Booth - Dry Filter No.6*	*Yes*
4-42	*WA6-WE6*	*PB0001,2,4,5*	*3121*	*1990*	*Spray Coating Booth - Dry Filter (4)*	*Yes*
4-42	*WC4*	*PB0009*	*3714*	*1991*	*Spray/Cure Booth No.9*	*Yes*
4-42	*WC4, WB4*	*PB0007,8*	*3121*	*1990*	*Spray Coating Booth - Dry Filter (2) No.7,8*	*Yes*
4-42	*WC6*	*PB0003*	*3714*	*1991*	*Spray/Cure Booth No.3*	*Yes*
4-45	*PE2.5*	*PB0087*	*8703*	*2002*	*Spray Coating Booth - Dry Filter*	*No*
4-79	*PE13*	*PB0039*	*Reg.*	*1986*	*Dry filter spray booth*	*Yes*
4-81	*H8*	*PB0035*	*3681*	*1991*	*Dry filter spray booth*	*Yes*
4-82	*J6*	*PB0055*	*Reg.*	*1986*	*Dry filter spray booth*	*Yes*
4-86		*PB0061-68*	*7155,PSD 97-02*	*1998,*	*PP1--PP8, Dry Filters*	*Yes*

Bldg.	*Col/Dr*	*MSS/ID No.*	*Order of Approval No.*	*Date Installed*	*Source Description*	*Aerospace NESHAP Coatings with Inorganic HAP Used in Unit?*
4-86	*A14*	*PB0060*	*5579,6363*	*1990*	*PB3, In- Spar - Dry Filter*	*Yes*
4-86	*B12*	*PB0065*	*3031,5579*	*1990*	*PP5, Spar - Dry Filter*	*Yes*
4-86	*B17*	*PB0058*	*3031,5579*	*1990*	*PB1, In-Spar - Dry Filter*	*Yes*
4-86	*B9*	*PB0061*	*3031,5579*	*1990*	*PP1, Spar - Dry Filter*	*Yes*
4-86	*C12*	*PB0066,*	*3031,5579*	*1990*	*PP6, Spar - Dry Filter*	*Yes*
4-86	*C9*	*PB0062*	*3031,5579*	*1990*	*PP2, Spar - Dry Filter*	*Yes*
4-86	*D12*	*PB0067*	*3031,5579*	*1990*	*PP7, Spar - Dry Filter*	*Yes*
4-86	*D17*	*PB0059,*	*3031,5579*	*1990*	*PB2, In-Spar - Dry Filter*	*Yes*
4-86	*D9*	*PB0063*	*3031,5579*	*1990*	*PP3, Spar - Dry Filter*	*Yes*
4-86	*E12*	*PB0068*	*3031,5579*	*1990*	*PP8, Spar - Dry Filter*	*Yes*
4-86	*E9*	*PB0064*	*3031,5579*	*1990*	*PP4, Spar - Dry Filter*	*Yes*
5-50	*A2*	*PB0047*	*3162,6159*	*1990,*	*Spray Coating Booth - Dry Filter (2)*	*Yes*
5-50	*Hangar*	*G6002C*	*3162*	*1986*	*Spray Painting Hangar*	*Yes*

Data in italics are for information only and not enforceable conditions of this permit.

COMPLIANCE REQUIREMENTS:

Reqmt. No.	Enforceable Requirement	Requirement Paraphrase (For Information Only)	Monitoring, Maintenance & Recordkeeping Method (See Section II)	Reference Test Method (See Section VIII)
(a) NESHAP General Provisions Requirement Nos. EU 3.1 through EU 3. 17 are the NESHAP General Provisions, 40 CFR 63 Subpart A, that apply to sources subject to the Aerospace NESHAP. Applicability of 40 CFR 63 Subpart A is defined in Table 1 to Subpart GG of Part 63. Table 1 supersedes this permit if an apparent conflict exists.				
EU 3. 1	40 CFR 63.1(c)(1), 63.4 (4/5/02)	Aerospace operations must comply with 40 CFR 63 Subpart A and GG.	NMR	

Reqmt. No.	Enforceable Requirement	Requirement Paraphrase (For Information Only)	Monitoring, Maintenance & Recordkeeping Method (See Section II)	Reference Test Method (See Section VIII)
EU 3. 2	40 CFR 63.5 (4/5/02)	Boeing shall comply with preconstruction review requirements.	NMR	
EU 3. 3	40 CFR 63.6(b)(2) (4/5/02)	New and reconstructed affected sources that have an initial startup after the effective date of 40 CFR 63 Subpart GG must comply with the requirements of 40 CFR 63 Subpart GG upon startup.	NMR	
EU 3. 4	40 CFR 63.6(e)(1) (i) & (iii) (4/5/02)	At all times, including startup, shutdown and malfunction, must operate and maintain affected sources consistent with good air pollution control practice. Correct malfunctions in accordance with startup, shutdown and malfunction plan as required by 40 CFR 63.6(e)(3). Note that additional O&M provisions are included under 40 CFR 63.743(b).	II.A.2(d)(ii) Spray Booth Maintenance II.A.2(i) Aerospace NESHAP Pressure Drop/Water Flow Rate Monitoring and Recordkeeping Procedure	
EU 3. 5	40 CFR 63.6(e)(3) (4/5/02)	If control equipment is used to control HAPs, Boeing shall develop and implement a Startup, Shutdown and Malfunction Plan, except for dry filters when Boeing follows the manufacturer's instructions.	II.A.2(c) Documentation on File	
EU 3. 6	40 CFR 63.6(f) (4/5/02)	The nonopacity emission standards set forth in 40 CFR 63 shall apply at all times except during periods of startup, shutdown and malfunction as set forth in 40 CFR Subpart A and GG.	II.A.2(d)(ii) Spray Booth Maintenance II.A.2(i) Aerospace NESHAP Pressure Drop/Water Flow Rate Monitoring and Recordkeeping Procedure	

Reqmt. No.	Enforceable Requirement	Requirement Paraphrase (For Information Only)	Monitoring, Maintenance & Recordkeeping Method (See Section II)	Reference Test Method (See Section VIII)
EU 3. 7	40 CFR 63.8(a)(1), (a)(2), (b)(1) (4/5/02)	Conduct monitoring. Monitoring shall be conducted as set forth in Subpart A and GG.	II.A.2(d)(ii) Spray Booth Maintenance II.A.2(i) Aerospace NESHAP Pressure Drop/Water Flow Rate Monitoring and Recordkeeping Procedure	
EU 3. 8	40 CFR 63.8(f) (4/5/02)	Boeing must receive permission from the Puget Sound Clean Air Agency before using an alternative monitoring procedure.	NMR	
EU 3. 9	40 CFR 63.9(b)(3)-(b)(5) (4/5/02)	Boeing shall notify the Puget Sound Clean Air Agency according to 40 CFR 63.9(b)(3)-(5), if it constructs or reconstructs a new affected source.	NMR	
EU 3. 10	40 CFR 63.9(i) (4/5/02)	Adjustment to time periods or postmark deadlines for submittal and review of required communications may be requested from and approved by the Puget Sound Clean Air Agency.	NMR	
EU 3. 11	40 CFR 63.9(j) (4/5/02)	Notification requirements. Any change in information already provided under 40 CFR 63.9 shall be sent to the Puget Sound Clean Air Agency within 15 days.	NMR	
EU 3. 12	40 CFR 63.10(a)(3)-(7) (4/5/02)	Must send reports to EPA and the Puget Sound Clean Air Agency according to 40 CFR 63.10(a)(3)-(7) and may request changes to report due dates.	NMR	
EU 3. 13	40 CFR 63.10(b)(1) (4/5/02)	Boeing shall retain records for five years. At a minimum, the most recent two years of data shall be retained on site. The remaining three years of data may be off site.	II.A.2(c) Documentation on File	

Reqmt. No.	Enforceable Requirement	Requirement Paraphrase (For Information Only)	Monitoring, Maintenance & Recordkeeping Method (See Section II)	Reference Test Method (See Section VIII)
EU 3. 14	40 CFR 63.10(b)(2) (4/5/02)	Boeing shall maintain relevant records in accordance with the rule - e.g., maintain occurrence and duration of startups, malfunctions, exceedances, maintenance, corrective actions and all other relevant information specified in the rule to demonstrate compliance with applicable NESHAP	NMR	
EU 3. 15	40 CFR 63.10(b)(3) (4/5/02)	If Boeing determines that Renton emits (or has the potential to emit, without considering controls) one or more hazardous air pollutants, but is not subject to a relevant standard or other requirement established under 40 CFR Part 63, Boeing shall keep a record of the applicability determination on site at the source for a period of 5 years after the determination, or until the source changes its operations to become an affected source, whichever comes first. The record of the applicability determination shall include an analysis (or other information) that demonstrates why Boeing believes the source is unaffected (e.g., because the source is an area source). The analysis (or other information) shall be sufficiently detailed to allow the Administrator to make a finding about the source's applicability status with regard to the relevant standard or other requirement. If relevant, the analysis shall be performed in accordance with requirements established in subparts of 40 CFR Part 63 for this purpose for particular categories of stationary sources. If relevant, the analysis should be performed in accordance with EPA guidance materials published to assist sources in making applicability determinations under section 112, if any.	NMR	
EU 3. 16	40 CFR 63.10(d)(1) (4/5/02)	Boeing shall submit reports in accordance with 40 CFR 63 Subpart GG.	NMR	

Reqmt. No.	Enforceable Requirement	Requirement Paraphrase (For Information Only)	Monitoring, Maintenance & Recordkeeping Method (See Section II)	Reference Test Method (See Section VIII)
EU 3. 17	40 CFR 63.10(f) (4/5/02)	Boeing must comply with the recordkeeping and reporting requirements in 40 CFR 63.10, unless a waiver is granted by the Puget Sound Clean Air Agency.	NMR	
(b) ANESHAP Applicability & Exemptions Requirement Nos. EU 3. 18 through EU 3. 30 are related to the applicability and exemptions of the Aerospace NESHAP.				
EU 3. 18	40 CFR 63.741(b) (9/1/98)	Boeing must comply with Subparts GG and A, except as specified in 40 CFR 63.743(a) and Table 1 of Subpart GG.	NMR	
EU 3. 19	40 CFR 63.741(a)-(d) (9/1/98)	Affected sources are specified in 40 CFR 63.741(c)(1) through (7). The activities subject to the Aerospace NESHAP requirements are limited to the manufacture or rework of aerospace vehicles or components as defined in the regulation. Where a dispute arises relating to the applicability of Subpart GG to a specific activity, Boeing shall demonstrate that the activity is not regulated under Subpart GG.	NMR	

Reqmt. No.	Enforceable Requirement	Requirement Paraphrase (For Information Only)	Monitoring, Maintenance & Recordkeeping Method (See Section II)	Reference Test Method (See Section VIII)
EU 3. 20	40 CFR 63.741(e), (f) (9/1/98)	The Aerospace NESHAP requirements are not applicable to: RCRA hazardous waste, specialty coatings, adhesives, adhesive bonding primers, sealant, research and development, quality control, laboratory testing activities, chemical milling, metal finishing, electrodeposition (except of paints), composites processing (except cleaning and coating of composite parts or components that become part of an aerospace vehicle or component as well as composite tooling that comes in contact with such composite parts or components prior to cure), electronic parts and assemblies (except cleaning and topcoating of completed assemblies), manufacture of aircraft transparencies, wastewater operations, parts and assemblies not critical to the vehicle's structural integrity or flight performance. Not applicable to primers, topcoats, chemical milling maskants, strippers and cleaning solvents with HAP and VOC less than 0.1 percent for carcinogens or 1.0 percent for noncarcinogens as determined from manufacturer's representations.	NMR	
EU 3. 21	40 CFR 63.741(g) (9/1/98)	The requirements for primers, topcoats, and chemical milling maskants in 40 CFR 63.745 and 40 CFR 63.747 do not apply to the use of low-volume coatings in these categories for which the annual total of each separate formulation used at a facility does not exceed 189 liter (L) (50 gallons [gal]), and the combined annual total of all such primers, topcoats, and chemical milling maskants used at a facility does not exceed 757 L (200 gal).	NMR	
EU 3. 22	40 CFR 63.741(h) (9/1/98)	Regulated activities associated with space vehicles are exempt from the requirements of the Aerospace NESHAP, except for depainting operations in 40 CFR 63.746.	NMR	
EU 3. 23	40 CFR 63.741(i) (9/1/98)	Waterborne coatings are exempt from 40 CFR 63.745(d)-(e), 63.747(d)-(e), 63.749(d) and (h), 63.750(c)-(h) and (k)-(m), 63.752(c) and (f), and 63.753(c) and (e).	II.A.2(c) Documentation on File	

Reqmt. No.	Enforceable Requirement	Requirement Paraphrase (For Information Only)	Monitoring, Maintenance & Recordkeeping Method (See Section II)	Reference Test Method (See Section VIII)
EU 3. 24	40 CFR 63.741(j) (9/1/98)	Aerospace NESHAP does not apply to rework on antique vehicles.	NMR	
EU 3. 25	40 CFR 63.743(c) (3/27/98)	Requirements for the use of air pollution control device not listed in this subpart.	NMR	
EU 3. 26	40 CFR 63.743(d) (3/27/98)	Facilities may choose to comply with averaging provisions herein rather than individual coating limits in 40 CFR 63.745 and 40 CFR 63.747.	NMR	
EU 3. 27	40 CFR 63.746(a) (9/1/98)	Aerospace NESHAP depainting requirements in 40 CFR 63.746 do not apply to a facility that depaints six or less completed aerospace vehicles in a calendar year.	NMR	
EU 3. 28	40 CFR 63.749(a) (3/27/98)	New and reconstructed affected sources that have an initial startup after the effective date of 40 CFR 63 Subpart GG must comply with the requirements of 40 CFR 63 Subpart GG upon startup.	NMR	
EU 3. 29	40 CFR 63.751(e) (12/8/00)	Boeing must receive permission from the Puget Sound Clean Air Agency before using an alternative monitoring procedure.	NMR	
EU 3. 30	40 CFR 63.751(f) (12/8/00)	Reduction of monitoring data. All emission data shall be converted into units specified in this subpart for reporting purposes. After conversion into units specified in this subpart, the data may be rounded to the same number of significant digits as used in this subpart to specify the emission limit.	NMR	

Reqmt. No.	Enforceable Requirement	Requirement Paraphrase (For Information Only)	Monitoring, Maintenance & Recordkeeping Method (See Section II)	Reference Test Method (See Section VIII)
(c) ANESHAP Cleaning Requirement Nos. EU 3. 31 through EU 3. 48 are the Aerospace NESHAP requirements related to the cleaning of aerospace parts and spray equipment.				
EU 3. 31	40 CFR 63.744 Table 1 (9/1/98)	Aqueous cleaners are ≥80 percent water, have flash points > 200°F and are miscible with water. Hydrocarbon based cleaners are mixtures of photochemically reactive hydrocarbons and oxygenated hydrocarbons, have a maximum vapor pressure of 7 mm Hg at 20°C, and contain no HAP.	NMR	
EU 3. 32	40 CFR 63.744(a) (9/1/98)	Must comply with housekeeping measures for cleaning operations unless using solvents that are identified in Table 1 of 40 CFR 63.744 as aqueous cleaners or hydrocarbon cleaners, or that meet the 40 CFR 63.741(f) de minimis levels.	NMR	
EU 3. 33	40 CFR 63.744(a)(1) (9/1/98)	Place cleaning solvent-laden cloth, paper, or any other absorbent applicators used for cleaning in bags or other closed containers upon completing their use. Use bags and containers of such design so as to contain the vapors of the cleaning solvent. "Completing their use" means when cleaning operation is completed or before leaving for a break or end shift, whichever comes first.	II.A.1(d) Work Practice Inspection	
EU 3. 34	40 CFR 63.744(a)(1) (9/1/98)	Cotton-tipped swabs used for very small cleaning operations are exempt from the requirements of 40 CFR 63.744(a)(1).	NMR	
EU 3. 35	40 CFR 63.744(a)(2) (9/1/98)	Fresh and spent cleaning solvents must be stored in closed containers.	II.A.1(d) Work Practice Inspection	
EU 3. 36	40 CFR 63.744(a)(3) (9/1/98)	Handling and transfer of cleaning solvents must be conducted in a manner as to minimize spills.	NMR	

Reqmt. No.	Enforceable Requirement	Requirement Paraphrase (For Information Only)	Monitoring, Maintenance & Recordkeeping Method (See Section II)	Reference Test Method (See Section VIII)
EU 3. 37	40 CFR 63.744(b) (9/1/98)	Cleaning solvent solutions that contain HAP or VOC below the de minimis levels specified in 40 CFR 63.741(f) are exempt from the requirements in paragraphs (b)(1), (b)(2), and (b)(3).	NMR	
EU 3. 38	40 CFR 63.744(b)(1) & (2) (9/1/98)	Hand-wipe cleaning solvent must meet the aqueous or hydrocarbon-based composition requirements, or have composite v.p. of 45 mm Hg or less @ 20°C.	II.A.2(g) Aerospace NESHAP Solvent Cleaner Monitoring and Recordkeeping Procedure	40 CFR 63.750(a), 63.750(b)
EU 3. 39	40 CFR 63.744(c) (9/1/98)	Must use a compliant gun cleaning method. Cleaning solvent solutions that contain HAP or VOC below the de minimis levels specified in 40 CFR 63.741(f) are exempt from the requirements in paragraphs (c)(1)-(4).	II.A.1(d) Work Practice Inspection	
EU 3. 40	40 CFR 63.744(d) (9/1/98)	Flush cleaning operations, excluding those in which Table 1 or semi-aqueous cleaning solvents are used; Boeing shall empty the used cleaning solvent each time aerospace parts, assemblies, or components of a coating unit (with the exception of spray guns) are flush cleaned into an enclosed container or collection system that is kept closed when not in use or into a system with equivalent emission control.	NMR	
EU 3. 41	40 CFR 63.744(e) (9/1/98)	The following cleaning operations are exempt from the requirements of 40 CFR 63.744(b) for hand-wipe cleaning: (1) Cleaning during the manufacture, assembly, installation, maintenance, or testing of components of breathing oxygen systems that are exposed to the breathing oxygen; (2) Cleaning during manufacture, assembly, installation maintenance or testing of parts, subassemblies, or assemblies that are exposed to strong oxidizers or reducers (e.g., nitrogen tetraoxide, liquid oxygen, or hydrazine);	NMR	

Reqmt No.	Enforceable Requirement	Requirement Paraphrase (For Information Only)	Monitoring, Maintenance & Recordkeeping Method (See Section II)	Reference Test Method (See Section VIII)
		(3) Cleaning and surface activation prior to adhesive bonding; (4) Cleaning of electronic parts and assemblies containing electronic parts; (5) Cleaning of aircraft and ground support equipment fluid systems that are exposed to the fluid, including air-to-air heat exchangers and hydraulic fluid system; (6) Cleaning of fuel cells, fuel tanks, and confined spaces; (7) Surface cleaning of solar cells, coated optics, and thermal control surfaces; (8) Cleaning during fabrication, assembly, installation and maintenance of upholstery, curtains, carpet, and other textile materials used in the interior of the aircraft; (9) Cleaning of metallic and nonmetallic materials used in honeycomb cores during the manufacture or maintenance of these cores, and cleaning of the completed cores used in the manufacture of aerospace vehicles or components; (10) Cleaning of aircraft transparencies, polycarbonate, or glass substrates; (11) Cleaning and cleaning solvent usage associated with research and development, quality control, and laboratory testing; (12) Cleaning operations, using nonflammable liquids, conducted within five feet of energized electrical systems. Energized electrical systems means any AC or DC electrical circuit on an assembled aircraft once electrical power is connected, including interior passenger and cargo areas, wheel wells and tail sections; and; (13) Cleaning operations identified as essential uses under the Montreal Protocol for which the Administrator has allocated essential use allowances or exemption in 40 CFR 82.4.		

Reqmt. No.	Enforceable Requirement	Requirement Paraphrase (For Information Only)	Monitoring, Maintenance & Recordkeeping Method (See Section II)	Reference Test Method (See Section VIII)
EU 3. 42	40 CFR 63.750(a) (10/17/00)	Boeing shall demonstrate compliance with solvent composition using manufacturer's data. The data shall identify all components of the cleaning solvent and shall demonstrate that one of the approved composition . definitions is met.	NMR	
EU 3. 43	40 CFR 63.750(b) (10/17/00)	Boeing shall follow 40 CFR 63.750(b) to determine the vapor pressure of cleaning solvents.	NMR	
EU 3. 44	40 CFR 63.752(b)(1) (9/1/98)	Boeing shall record the name, vapor pressure, and documentation showing the organic HAP constituents of each cleaning solvent used for affected cleaning operations at the facility.	II.A.2(g) Aerospace NESHAP Solvent Cleaner Monitoring and Recordkeeping Procedure	
EU 3. 45	40 CFR 63.752(b)(2) (9/1/98)	For complying with hand-wipe cleaner composition requirements specified in 63.744(b)(1), or for semi-aqueous cleaning solvent for flush cleaning, Boeing shall keep records of name, data/calculations, and annual volumes on file.	II.A.2(g) Aerospace NESHAP Solvent Cleaner Monitoring and Recordkeeping Procedure	
EU 3. 46	40 CFR 63.752(b)(3) (9/1/98)	For complying with hand-wipe cleaner vapor pressure limit (not complying with the composition requirements specified in 63.744(b)(1)), Boeing must keep records of name, vapor pressure, data/calculations/test results, and monthly volumes on file for five years (the most recent two years must be kept on site) as required by 40 CFR 63.10(b)(1).	II.A.2(g) Aerospace NESHAP Solvent Cleaner Monitoring and Recordkeeping Procedure	
EU 3. 47	40 CFR 63.752(b)(4) (9/1/98)	For using noncompliant hand-wipe cleaning solvent in exempt cleaning operations specified in 40 CFR 63.744(e), Boeing shall keep records on monthly volumes by operation and a master list of processes on file.	II.A.2(g) Aerospace NESHAP Solvent Cleaner Monitoring and Recordkeeping Procedure	

<table>
<tr><th>Reqmt. No.</th><th>Enforceable Requirement</th><th>Requirement Paraphrase (For Information Only)</th><th>Monitoring, Maintenance & Recordkeeping Method (See Section II)</th><th>Reference Test Method (See Section VIII)</th></tr>
<tr><td>EU 3. 48</td><td>40 CFR 63.752(b)(5) (9/1/98)</td><td>Boeing shall keep a record of all leaks from enclosed spray gun cleaners identified pursuant to 63.751(a) that includes the source identification, date leak was discovered and date leak was repaired for each leak found.</td><td>II.A.2(d)(i) Enclosed Gun Cleaning System</td><td></td></tr>
<tr><td colspan="5"><i>(d) ANESHAP Coating</i>
Requirement Nos. EU 3. 49 through EU 3. 56 are the Aerospace NESHAP requirements related to aerospace coating operations. The Aerospace NESHAP requirements only apply to aerospace primer and topcoat application operations as defined in 40 CFR 63.741(c)(2) & (3) and 40 CFR 63.742. Specialty coatings as defined in Appendix A of 40 CFR Part 63 Subpart GG are exempt from the requirements of 40 CFR 63.745 and 752(c). Structures that protrude from the fuselage, including wings and attached components, control surfaces, horizontal stabilizers, vertical fins, wing-to-body fairings, antennae, and landing gear and doors, have special coating requirements due to their flexion, aspect in the airstream, and practical limitations on access for inspection and recoating. Due to these considerations, the coatings applied generally require greater corrosion resistance and enhanced adhesion. Consequently, the coatings applied to these protruding structures and all their integral parts are considered to be a Commercial Exterior Aerodynamic Structural Primer specialty coating and, therefore, exempt from the requirements of 40 CFR 63.745 and 752(c) as allowed by 40 CFR 63.741(f).</td></tr>
<tr><td>EU 3. 49</td><td>40 CFR 63.741(i) (9/1/98)</td><td>For exempt waterborne coatings, Boeing shall maintain manufacturer's data on HAP/VOC content and annual purchase records for 5 years.</td><td>II.A.2(c) Documentation on File</td><td></td></tr>
<tr><td>EU 3. 50</td><td>40 CFR 63.745(a) (12/8/00)</td><td>Aerospace equipment that is no longer operational, intended for public display, and not easily capable of being moved is exempt from the requirements of 40 CFR 63.745, EU 3. 51 through EU 3. 55.</td><td>NMR</td><td></td></tr>
<tr><td>EU 3. 51</td><td>40 CFR 63.745(b) (12/8/00)</td><td>Boeing shall conduct handling and transfer of HAP-containing primers and topcoats in such a manner to minimize spills.</td><td>NMR</td><td></td></tr>
<tr><td>EU 3. 52</td><td>40 CFR 63.745(c) (12/8/00)</td><td>Boeing shall limit primer organic HAP/VOC content to 350 g/l or 650 g/l for large commercial aircraft and their components; topcoat organic HAP/VOC content to 420 g/l.</td><td>II.A.2(h) Aerospace NESHAP Coating Monitoring and Recordkeeping Procedure</td><td>EPA Method 24, See 40 CFR 63.750(c)-(f)</td></tr>
</table>

Reqmt. No.	Enforceable Requirement	Requirement Paraphrase (For Information Only)	Monitoring, Maintenance & Recordkeeping Method (See Section II)	Reference Test Method (See Section VIII)
EU 3. 53	40 CFR 63.745(e) (12/8/00)	Compliance with the organic HAP and VOC content limits specified in 40 CFR 63.745(c)(1) through (c)(4), EU 3. 52, shall be accomplished by using the methods specified in 40 CFR 63.745(e)(1) and (e)(2) either by themselves or in conjunction with one another. (1) Use primers and topcoats (including self-priming topcoats) with HAP and VOC content levels equal to or less than the limits specified in 40 CFR 63.745(c)(1) through (c)(4); or (2) Use the averaging provisions described in 40 CFR 63.743(d), EU 3. 26.	II.A.2(h) Aerospace NESHAP Coating Monitoring and Recordkeeping Procedure	
EU 3. 54	40 CFR 63.745(f)(1), (2) (12/8/00)	Specific primer/topcoat application techniques identified in 40 CFR 63.745(f)(1) are required; must be operated according to company procedures, locally specified operating procedures, or manufacturer's specifications whichever is most stringent. Modified guns must maintain transfer efficiency equivalent to HVLP.	II.A.1(d) Work Practice Inspection	
EU 3. 55	40 CFR 63.745(f)(3) (12/8/00)	Certain situations are exempt from the requirements of 40 CFR 63.745(f)(1), including the use of airbrush equipment, hand-held aerosol cans, touch-up and repair operations, and the use of an extension on the spray gun to properly reach limited access spaces.	NMR	
EU 3. 56	40 CFR 63.750(i) (10/17/00)	Boeing may apply for alternative application methods for primers and topcoats by following procedures in 40 CFR 63.750(i).	NMR	
(e) ANESHAP Coating Recordkeeping Requirement Nos. EU 3. 57 through EU 3. 60 are the Aerospace NESHAP recordkeeping requirements related to aerospace coating operations. These requirements only apply to aerospace primer and topcoat application operations as defined in 40 CFR 63.741(c)(2) & (3) and 40 CFR 63.742.				
EU 3. 57	40 CFR 63.752(c)(1) (9/1/98)	Boeing must keep records of name and VOC content for all primers and topcoats as received and as applied.	II.A.2(h) Aerospace NESHAP Coating Monitoring and Recordkeeping Procedure	

Reqmt. No.	Enforceable Requirement	Requirement Paraphrase (For Information Only)	Monitoring, Maintenance & Recordkeeping Method (See Section II)	Reference Test Method (See Section VIII)
EU 3. 58	40 CFR 63.752(c)(2) (9/1/98)	For compliant coatings, Boeing must keep records on organic HAP and VOC contents, as applied, data/calculations or Method 24 used to determine them, and monthly usage.	II.A.2(h) Aerospace NESHAP Coating Monitoring and Recordkeeping Procedure	
EU 3. 59	40 CFR 63.752(c)(3) (9/1/98)	For low-HAP/VOC uncontrolled primers as applied: (<=250 g/L HAP less water as applied) and VOC (<=250 g/L VOC less water & exempt solvents); site must keep annual purchase records, and data/calculations or Method 24 used to determine organic HAP content on file.	II.A.2(h) Aerospace NESHAP Coating Monitoring and Recordkeeping Procedure	
EU 3. 60	40 CFR 63.752(c)(4) (9/1/98)	For primers and topcoats complying with the organic HAP/VOC content level by averaging, site must keep monthly volume-weighted average masses of organic HAP/VOC emitted per unit volume of coating as applied as determined by procedures in 40 CFR 63.750(d) and (f), and all data, calculations, and test results used to determine these values.	II.A.2(h) Aerospace NESHAP Coating Monitoring and Recordkeeping Procedure	

<table>
<tr><th>Reqmt. No.</th><th>Enforceable Requirement</th><th>Requirement Paraphrase (For Information Only)</th><th>Monitoring, Maintenance & Recordkeeping Method (See Section II)</th><th>Reference Test Method (See Section VIII)</th></tr>
<tr><td colspan="5"><i>(f) ANESHAP Primer & Topcoat – Inorganic HAP</i>
Requirement Nos. EU 3. 61 through EU 3. 78 are the Aerospace NESHAP requirements related to aerospace primer and topcoat application operations (as defined in 40 CFR 63.741 and 742) where the primer or topcoat contains an inorganic HAP. These requirements only apply when an aerospace primer and topcoat containing an inorganic HAP is sprayed onto an aerospace part. The spray booths in which this activity occurred at the time of permit issuance are identified above in the emission unit description. Coatings that do not contain inorganic HAPs or coatings that are not primers or topcoats as defined in the Aerospace NESHAP are also be sprayed in these booths. Boeing may add other booths as being subject to the inorganic HAP requirements provided that Boeing shall, contemporaneously with making the change, record in a log at Boeing a record of the additional booths that are required to comply with the following requirements and the scenario under which they are operating.</td></tr>
<tr><td>EU 3. 61</td><td>40 CFR 63.743(a)(10) (3/27/98)</td><td>Boeing shall notify the Administrator and the Puget Sound Clean Air Agency on or before March 1 of each year requirements for (re)construction of booths or hangars, during the prior calendar year, with potential to emit less than 10 tons/yr of an individual inorganic HAP or less than 25 tons/yr of all inorganic HAP combined. Submission of a Notice of Construction and Application for Approval to the Puget Sound Clean Air Agency fulfills the above-mentioned initial notification requirements.</td><td>II.A.2(a) Approval by the Puget Sound Clean Air Agency, via NOC/Order of Approval</td><td></td></tr>
<tr><td>EU 3. 62</td><td>40 CFR 63.743(b) (3/27/98)</td><td>Boeing must develop and implement a startup, shutdown and malfunction plan required for water wash booths and dry particulate filter systems not operated per the manufacturer's instructions. In addition to the information required in 40 CFR 63.6, this plan shall also include the following provisions:
(1) The plan shall specify the operation and maintenance criteria for each air pollution control device or equipment and shall include a standardized checklist to document the operation and maintenance of the requirement;
(2) The plan shall include a systematic procedure for identifying malfunctions and for reporting them immediately to supervisory personnel: and
(3) The plan shall specify procedures to be followed to ensure that equipment or process malfunctions due to poor maintenance or other preventable conditions do not occur.</td><td>II.A.2(c) Documentation on File</td><td></td></tr>
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Reqmt. No.	Enforceable Requirement	Requirement Paraphrase (For Information Only)	Monitoring, Maintenance & Recordkeeping Method (See Section II)	Reference Test Method (See Section VIII)
EU 3. 63	40 CFR 63.743(b) (3/27/98)	Dry particulate filter systems operated per the manufacturer's instructions are exempt from a startup, shutdown and malfunction plan required by 40 CFR 63.6(e)(3).	NMR	
EU 3. 64	40 CFR 63.745(g)(1) (12/8/00)	Boeing shall apply aerospace primers and topcoats in a booth or hangar with airflow directed downward, onto or across and exhausted through one or more outlets.	II.A.1(c) Facility Inspections	
EU 3. 65	40 CFR 63.745(g)(2) (i)(A) (12/8/00)	For existing booths or hangars where primers or topcoats containing inorganic HAPs are spray applied, the air stream must be exhausted through a dry particulate filter system certified using Method 319 to meet or exceed the efficiency data points in Tables 1 and 2. Alternatively, may choose to comply with 40 CFR 63.745(g)(2)(i)(B), EU 3. 66, or (C), EU 3. 67.	II.A.2(c) Documentation on File	EPA Method 319 (See 40 CFR Part 63, Appendix A, July 1, 2001)
EU 3. 66	40 CFR 63.745(g)(2) (i)(B) (12/8/00)	For existing booths or hangars where primers or topcoats containing inorganic HAPs are spray applied, the air stream must be exhausted through a waterwash system that remains in operation during all coating application operations. Alternatively, may choose to comply with 40 CFR 63.745(g)(2)(i)(A), EU 3. 65.	II.A.2(i) Aerospace NESHAP Pressure Drop/Water Flow Rate Monitoring and Recordkeeping Procedure	
EU 3. 67	40 CFR 63.745(g)(2)(i)(C) (12/8/00)	For existing booths or hangars where primers or topcoats containing inorganic HAPs are spray applied, the air stream must be exhausted through an air pollution control system that meets or exceeds the efficiency data points in Tables 1 and 2 and is approved by the permitting authority. Alternatively, may choose to comply with 40 CFR 63.745(g)(2)(i)(A), EU 3. 65, or (B), EU 3. 66.	II.A.2(c) Documentation on File	
EU 3. 68	40 CFR 63.745(g)(2) (ii)(A) (12/8/00)	For new booths or hangars where primers or topcoats containing inorganic HAPs are spray applied, the air stream must be exhausted through a dry particulate filter system that is certified using Method 319 to meet or exceed the efficiency data points in Tables 3 and 4. Alternatively, may choose to comply with 40 CFR 63.745(g)(2)(ii)(B), EU 3. 69.	II.A.2(c) Documentation on File	EPA Method 319 (See 40 CFR Part 63, Appendix A, July 1, 2001)

Reqmt. No.	Enforceable Requirement	Requirement Paraphrase (For Information Only)	Monitoring, Maintenance & Recordkeeping Method (See Section II)	Reference Test Method (See Section VIII)
EU 3. 69	40 CFR 63.745(g)(2)(ii)(B) (12/8/00)	For new booths or hangars where primers or topcoats containing inorganic HAPs are spray applied, the air stream must be exhausted through an air pollution control system that meets or exceeds the efficiency data points in Tables 3 and 4 and is approved by the permitting authority. Alternatively, may choose to comply with 40 CFR 63.745(g)(2)(ii)(A), EU 3. 68.	II.A.2(a) Approval by the Puget Sound Clean Air Agency, via NOC/Order of Approval	
EU 3. 70	40 CFR 63.745(g)(2)(iii) (12/8/00)	Alternate control technology options for sources for which construction commenced after June 6, 1994, but before October 29, 1996.	II.A.2(a) Approval by the Puget Sound Clean Air Agency, via NOC/Order of Approval	
EU 3. 71	40 CFR 63.745(g)(2)(iv) (12/8/00)	For dry filter system, must maintain in good working order, Boeing must install a differential pressure gauge, continuously monitor the pressure drop across the filter and record once per shift, and take corrective action if outside the limits.	II.A.2(d)(ii) Spray Booth Maintenance, II.A.2(i) Aerospace NESHAP Pressure Drop/Water Flow Rate Monitoring and Recordkeeping Procedure	
EU 3. 72	40 CFR 63.745(g)(3) (12/8/00)	Boeing must shut down the spray operation if the pressure drop (as recorded pursuant to 63.752(d)(1)) or water flow (as recorded pursuant to 63.752(d)(2)) go outside of the range or if Boeing does not do scheduled maintenance. The operation shall not be resumed until the pressure drop or water flow rate is returned within the specified limit(s).	II.A.2(i) Aerospace NESHAP Pressure Drop/Water Flow Rate Monitoring and Recordkeeping Procedure	

Reqmt. No.	Enforceable Requirement	Requirement Paraphrase (For Information Only)	Monitoring, Maintenance & Recordkeeping Method (See Section II)	Reference Test Method (See Section VIII)
EU 3. 73	40 CFR 63.745(g)(4) (12/8/00)	The requirements of paragraphs (g)(1), EU 3. 64, through (g)(3), EU 3. 72, do not apply to: touchup of scratched surfaces or damaged paint; hole daubing for fasteners; touchup of trimmed edges; coating prior to joining dissimilar metal components; stencil operations performed by brush or air brush; section joining; touchup of bushing and other similar parts; sealant detackifying; painting parts in an area identified in a Title V permit, where the Puget Sound Clean Air Agency has determined that it is not technically feasible to paint the parts in a booth; and, use of hand-held spray can application methods. *{See Requirement No. EU 3. 106 for Puget Sound Clean Air Agency determinations.}*	NMR	
EU 3. 74	40 CFR 63.745(g)(2) (v) (12/8/00)	When water wash is used to control inorganic HAP emissions from the booth, Boeing must continuously monitor water flow rate and record once per shift.	II.A.2(i) Aerospace NESHAP Pressure Drop/Water Flow Rate Monitoring and Recordkeeping Procedure	
EU 3. 75	40 CFR 63.750(o) (10/17/00)	When dry filters are used to control inorganic HAP emissions from the booth, the filters must be certified using Method 319.	II.A.2(c) Documentation on File	
EU 3. 76	40 CFR 63.751(c)(1) (12/8/00)	When dry filters are used to control inorganic HAP, while primer or topcoat application operations are occurring, Boeing shall continuously monitor pressure drop or water flow rate as applicable across the system and read and record the pressure drop once per shift following the recordkeeping requirements of 40 CFR 63.752(d).	II.A.2(i) Aerospace NESHAP Pressure Drop/Water Flow Rate Monitoring and Recordkeeping Procedure	

Reqmt. No.	Enforceable Requirement	Requirement Paraphrase (For Information Only)	Monitoring, Maintenance & Recordkeeping Method (See Section II)	Reference Test Method (See Section VIII)
EU 3. 77	40 CFR 63.751(c)(2) (12/8/00)	When water wash is used to control inorganic HAP emissions from the booth, while primer and topcoat application operations are occurring, Boeing shall continuously monitor the water flow rate through the system and read and record the water flow rate once per shift following the recordkeeping requirements of 40 CFR 63.752(d).	II.A.2(i) Aerospace NESHAP Pressure Drop/Water Flow Rate Monitoring and Recordkeeping Procedure	
EU 3. 78	40 CFR 63.752(d) (12/8/00)	Boeing shall record pressure drop or water flow once each shift. Log shall include limits.	II.A.2(i) Aerospace NESHAP Pressure Drop/Water Flow Rate Monitoring and Recordkeeping Procedure	
(g) ANESHAP Waste Requirement No. EU 3. 79 is the Aerospace NESHAP requirement related to waste handling operations.				
EU 3. 79	40 CFR 63.748 (9/1/95)	Boeing shall conduct handling and transfer of HAP-containing RCRA wastes in such a manner to minimize spills.	NMR	
(h) ANESHAP Alternate Operating Scenario -- Completed Aircraft Depainting Requirement Nos. EU 3. 80 through EU 3. 90 apply if the facility depaints more than 6 completed aircraft in a calendar year. Depainting is defined in 40 CFR 63.742 and excludes hand and mechanical sanding and any other non-chemical process that does not involve blast media or other mechanisms that would result in air borne particle movement at high velocity. An aircraft is counted as depainted if it has all the fuselage, wings, vertical stabilizers and horizontal stabilizers connected as one assembled unit and has had paint chemically removed from substantially all of the outer surface of either the fuselage, or wings, or horizontal stabilizers, or vertical stabilizers.				
EU 3. 80	WAC 173-401-650(a) (11/4/93) (State Only)	Boeing shall, contemporaneously with making a change from one operating scenario to another, record in a log at the permitted facility a record of the scenario under which it is operating.	II.A.2(k) Aerospace NESHAP Depainting Monitoring and Recordkeeping Procedure	

Reqmt. No.	Enforceable Requirement	Requirement Paraphrase (For Information Only)	Monitoring, Maintenance & Recordkeeping Method (See Section II)	Reference Test Method (See Section VIII)
EU 3. 81	40 CFR 63.746(a)(1) (9/1/98)	40 CFR 63.746, EU 3. 81 to EU 3. 86, applies to depainting of outer surface areas of completed aerospace vehicles. Does not apply to the depainting of parts or units normally removed from the aerospace vehicle for depainting. Wings and stabilizers are always subject to the requirements of this section regardless of whether their removal is considered normal practice for depainting.	NMR	
EU 3. 82	40 CFR 63.746(a)(2) (9/1/98)	Aerospace vehicles or components that are intended for public display, no longer in operation, and not easily capable of being moved are exempt from the requirements of this section.	NMR	
EU 3. 83	40 CFR 63.746(a)(3) (9/1/98)	The following depainting operations are exempt from the requirements of 40 CFR 63.746, EU 3. 81 to EU 3. 86: (i) depainting of radomes, and (ii) depainting of parts, subassemblies, and assemblies normally removed from the primary aircraft structure before depainting.	NMR	
EU 3. 84	40 CFR 63.746(b)(1) (9/1/98)	New or existing aerospace depainting operations shall emit no organic HAP from chemical stripping formulations and agents or chemical paint softeners.	II.A.2(k) Aerospace NESHAP Depainting Monitoring and Recordkeeping Procedure	
EU 3. 85	40 CFR 63.746(b)(3) (9/1/98)	New or existing depainting operations shall not, on an annual average basis, use more than 26 gallons of organic HAP-containing chemical strippers or alternatively 190 pounds of organic HAP per commercial aircraft depainted; or more than 50 gallons of organic HAP-containing chemical strippers or alternatively 365 pounds of organic HAP per military aircraft depainted for spot stripping and decal removal.	II.A.2(k) Aerospace NESHAP Depainting Monitoring and Recordkeeping Procedure	40 CFR 63.750(j)
EU 3. 86	40 CFR 63.746(b)(5) (9/1/98)	Mechanical and hand sanding operations are exempt from the requirements in 40 CFR 63.746(b)(4)	NMR	

Reqmt. No.	Enforceable Requirement	Requirement Paraphrase (For Information Only)	Monitoring, Maintenance & Recordkeeping Method (See Section II)	Reference Test Method (See Section VIII)
EU 3. 87	40 CFR 63.750(j) (10/17/00)	For sources complying with 40 CFR 63.746(b)(3), EU 3. 85, must determine volume of organic HAP-containing chemical strippers or alternatively the weight of organic HAP used per aircraft using the procedures specified in 40 CFR 63.750(j)(1) through (3).	NMR	
EU 3. 88	40 CFR 63.752(e)(1) (9/1/98)	For all chemical strippers used in depainting operations subject to 40 CFR 63.746, EU 3. 81 to EU 3. 86, record the name of each chemical stripper and the monthly volumes of each organic HAP containing stripper used or monthly weight of organic HAP-material used for spot stripping and decal removal.	II.A.2(k) Aerospace NESHAP Depainting Monitoring and Recordkeeping Procedure	
EU 3. 89	40 CFR 63.752(e)(4) (9/1/98)	For each type of aircraft depainted, a listing of the parts, subassemblies, and assemblies normally removed from the aircraft before depainting. Prototype, test model or aircraft that exist in low numbers are exempt from this requirement.	II.A.2(k) Aerospace NESHAP Depainting Monitoring and Recordkeeping Procedure	
EU 3. 90	40 CFR 63.752(e)(6) (9/1/98)	For spot stripping and decal removal, the volume of organic HAP-containing chemical stripper or weight of organic HAP used, the annual average volume or organic HAP-containing chemical stripper or weight of organic HAP used per aircraft, the annual number of aircraft stripped, and all data and calculations used shall be recorded.	II.A.2(k) Aerospace NESHAP Depainting Monitoring and Recordkeeping Procedure	
(j) Requirement Nos. EU 3. 91 through EU 3. 97 are the Puget Sound Clean Air Agency Regulation I and II requirements for spray coating operations.				
EU 3. 91	Puget Sound Clean Air Agency Reg II: 3.09(a) (12/9/93)	Regulation II: 3.09 applies to operations in which coatings are applied to aerospace components. Aerospace component means the fabricated part, assembly of parts, or completed unit of any aircraft, helicopter, missile, or space vehicle.	NMR	

Reqmt. No.	Enforceable Requirement	Requirement Paraphrase (For Information Only)	Monitoring, Maintenance & Recordkeeping Method (See Section II)	Reference Test Method (See Section VIII)
EU 3. 92	Puget Sound Clean Air Agency Reg II: 3.09(b) (12/9/93)	Application of the following coatings in excess of the following limits is unlawful: Commercial Aerospace Topcoat: 420 gm VOC/Liter Military Aerospace Topcoat: 420 gm VOC/Liter Commercial Aerospace Primer: 350 gm VOC/Liter Military Aerospace Primer: 350 gm VOC/Liter Temporary Protective Coating: 250 gm VOC/Liter Commercial Aerospace Topcoat and Primer is defined in Regulation II as BMS 10-11 Type II and BMS 10-11 Type I, respectively. Military Aerospace Topcoat and Primer are defined in Regulation II as the current version of MIL-C-85285 and MIL-P-85582, respectively.	II.A.2(b) VOC Content Monitoring and Recordkeeping Procedure	EPA Method 24 (See 40 CFR Part 60, Appendix A, July 1, 2001)
EU 3. 93	Puget Sound Clean Air Agency Reg II: 3.09(c) (12/9/93)	The coatings in Regulation II, 3.09(b) must be applied by HVLP spray equipment (0.1 to 10 psig air pressure for atomization), electrostatic spray equipment, or other acceptable coating application methods listed in Regulation II, 3.09(c), EU 3. 92.	II.A.1(d) Work Practice Inspection	
EU 3. 94	Puget Sound Clean Air Agency Reg II: 3.09(d) (12/9/93)	Boeing must collect and minimize the evaporation of VOC containing materials used for cleanup of spray equipment, including paint lines. VOC-containing cleanup material for spray equipment must be stored in closed containers.	II.A.1(d) Work Practice Inspection	
EU 3. 95	Puget Sound Clean Air Agency Reg II: 3.09(e) (12/9/93)	Containers used for the storage or disposal of VOC containing materials shall be kept closed except when being cleaned or when materials are being added, mixed, or removed. Closed containers for solvent rag or paper disposal are required. Disposal is required when the cleaning operation is completed or before leaving for a break or end of shift, whichever comes first.	II.A.1(d) Work Practice Inspection	

Reqmt. No.	Enforceable Requirement	Requirement Paraphrase (For Information Only)	Monitoring, Maintenance & Recordkeeping Method (See Section II)	Reference Test Method (See Section VIII)
EU 3. 96	Puget Sound Clean Air Agency Reg I: 9.16(a) (6/13/91) *This requirement will be superseded upon adoption of the 7/12/01 version of Reg I: 9.16 into the SIP*	It is unlawful to use spray equipment to apply any VOC-containing material, including any negligibly reactive compound, unless the operation is conducted inside an enclosed spray area that is registered with the Agency and incorporates either dry filters or water wash curtains to control the overspray or the use of another technique that has received the prior written approval of the Control Officer. The exhaust from the spray area shall be vented to the atmosphere through a vertical stack or through the use of another technique that has received the prior written approval of the Control Officer.	II.A.1(c) Facility Inspections, II.A.2(c) Documentation on File	
EU 3. 97	Puget Sound Clean Air Agency Reg I: 9.16(b) (6/13/91) *This requirement will be superseded upon adoption of the 712/01 version of Reg I: 9.16 into the SIP*	The provisions of Section 9.16 shall not apply to: (1) the use of hand-held aerosol cans, (2) touch-up operations, (3) the coating of marine vessels in dry docks, (4) the coating of bridges, water towers, buildings or similar structures, (5) insecticide, pesticide, or fertilizer spray equipment, (6) the coating of items that cannot be reasonably handled in an enclosed spray area, provided the operation has received the prior written approval of the Control Officer. *{See Requirement No. EU 3. 106 for Puget Sound Clean Air Agency determinations.}*	NMR	

Reqmt. No.	Enforceable Requirement	Requirement Paraphrase (For Information Only)	Monitoring, Maintenance & Recordkeeping Method (See Section II)	Reference Test Method (See Section VIII)
(i) Motor vehicles Requirement Nos. EU 3. 98 through EU 3. 103 are the Puget Sound Clean Air Agency requirements that apply to motor vehicle and mobile equipment coating operations. Motor vehicle and mobile equipment coating operations are not normally conducted in the spray coating units used in aerospace component coating operations.				
EU 3. 98	Puget Sound Clean Air Agency Reg. II:3.04(a) & (b), (12/9/93)	Motor vehicle and mobile equipment coating VOC content must not exceed the limits in Reg II 3.04(a) and (b).	II.A.1(d) Work Practice Inspection II.A.2(b) VOC Content Monitoring and Recordkeeping Procedure	
EU 3. 99	Puget Sound Clean Air Agency Reg. II:3.04(c) (12/9/93)	Motor vehicle and mobile equipment specialty coating VOC content must not exceed 840 g/L.	II.A.1(d) Work Practice Inspection II.A.2(b) VOC Content Monitoring and Recordkeeping Procedure	
EU 3. 100	Puget Sound Clean Air Agency Reg. II:3.04(d) (12/9/93)	VOC content of coating must be displayed on container or available on file for inspection.	II.A.2(c) Documentation on File	
EU 3. 101	Puget Sound Clean Air Agency Reg. II:3.04(e) (12/9/93)	HVLP (0.1 to 10 psig air pressure for atomization), electrostatic, or other acceptable coating application method must be employed.	II.A.1(d) Work Practice Inspection	
EU 3. 102	Puget Sound Clean Air Agency Reg. II:3.04(f) (12/9/93)	Boeing must collect and minimize the evaporation of VOC-containing materials used for cleanup of spray equipment, including paint lines. VOC containing cleanup material for spray equipment collected in closed containers.	II.A.1(d) Work Practice Inspection	

Reqmt. No.	Enforceable Requirement	Requirement Paraphrase (For Information Only)	Monitoring, Maintenance & Recordkeeping Method (See Section II)	Reference Test Method (See Section VIII)
EU 3. 103	Puget Sound Clean Air Agency Reg. II:3.04(g) (12/9/93)	VOC containing material must be stored in closed containers and disposed of properly.	II.A.1(d) Work Practice Inspection	
(j) O&M Requirement Nos. EU 3. 104 and EU 3. 105 are the Puget Sound Clean Air Agency O&M requirements for operating permit sources.				
EU 3. 104	Puget Sound Clean Air Agency Reg I: 7.09(b) (9/12/96) *This requirement will be superseded upon adoption of the 9/10/1998 version of Reg I, 7.09(b) into the SIP* Puget Sound Clean Air Agency Reg I, 7.09(b) *9/10/98 (State Only) This requirement shall become federally enforceable upon adoption into the SIP and will replace the 9/12/96 version of Reg I, 7.09(b)*	Boeing shall develop and implement an O&M plan to assure continuous compliance with Puget Sound Clean Air Agency Regulations I, II, and III.	II.B Operation and Maintenance (O&M) Plan Requirements This monitoring method supersedes the monitoring method for this requirement listed in I.A.11	

Reqmt. No.	Enforceable Requirement	Requirement Paraphrase (For Information Only)	Monitoring, Maintenance & Recordkeeping Method (See Section II)	Reference Test Method (See Section VIII)
EU 3. 105	Puget Sound Clean Air Agency Reg I: 9.20 (6/9/88)	All equipment must be maintained in good working order.	II.A.2(d)(ii) Spray Booth Maintenance II.A.1(c) Facility Inspections These monitoring methods supersede the monitoring method for this requirement listed in I.A.10	

Reqmt. No.	Enforceable Requirement	Requirement Paraphrase (For Information Only)	Monitoring, Maintenance & Recordkeeping Method (See Section II)	Reference Test Method (See Section VIII)
(k) Spraying coatings outside of a spray enclosure Requirement Nos. EU 3. 106 and EU 3. 107 are the Order of Approval No. 7565 permit conditions for spray coating operations conducted outside of spray enclosures at the Boeing facility.				
EU 3. 106	Order of Approval No.7565 (3) (2/24/99)	Boeing shall limit spray coating operations outside of a spray enclosures to operations such as: (a) Coating areas that were covered by holding fixtures, tooling, or protective masking during original painting operations, (b) Coating over sealants applied throughout the manufacturing process, (c) Coating areas which are imperfections like poor coverage, scratched, damaged paint, runs in paint, fish eyes, etc., (d) Coating areas on large subassemblies normally scheduled to be painted in ventilated enclosures, but required to travel due to out-of-sequence work, (e) Coating areas of fasteners, components, assemblies, subassemblies, or surfaces that are joined, replaced, damaged, repaired, or trimmed, (f) Coating prior to joining dissimilar metal components, (g) Stencil, decorative, or temporary marking operations, (h) Touchup of bushings and other similar parts, (i) Sealant detackifying, (j) Coating operations on the assembly flightline.	II.A.1(c) Facility Inspections	

Reqmt. No.	Enforceable Requirement	Requirement Paraphrase (For Information Only)	Monitoring, Maintenance & RecordKeeping Method (See Section II)	Reference Test Method (See Section VIII)
EU 3. 107	Order of Approval No. 7565 (4) (2/26/99)	Boeing shall not cause or allow fallout from spray painting operations such that the presence of the fallout remains visible at or near any building exhaust.	II.A.1(c) Facility Inspections	
(l) Order of Approval No. 5066 Requirement No. EU 3. 108 is the Order of Approval No 5066 permit condition that applies to Spray Booth PB0019 at the 10-52 Bldg.				
EU 3. 108	Order of Approval No. 5066 (5/23/95)	A gauge to indicate the static pressure differential across the exhaust filters will be installed and maintained for each spray booth. The acceptable range for the gages must be marked on the gage.	II.A.2(d)(ii) Spray Booth Maintenance	
(m) PSD 97-02 Requirement Nos. EU 3. 109 through EU 3. 114 are the PSD 97-02 permit conditions that apply to all spray booths in the Bldg.4-86.				
EU 3. 109	PSD-97-02 (1) (1/14/98)	Emission of VOC form the 4-86 building shall not exceed 3.0 tons per day. Compliance with the daily VOC emission limit shall be assured by limiting daily production rate of the 4-86 Building to no more than 12 aircraft wings per day. Identification of wing production rates shall be based on records for wings completing the final painting process in the 4-86 building.	II.A.2(o) Annual Emission Estimates Required by PSD or Order of Approval Permit Condition	
EU 3. 110	PSD-97-02 (2) (1/14/98)	Emission of VOC from the 4-86 building shall not exceed 242 tons per year. VOC emission rates from the 4-86 Building shall be calculated using a mass balance approach, taking into account production parameters such as material purchase and usage, waste disposal and appropriate application of control efficiency assumptions; or other equivalent method as approved by PSAPCA.	II.A.2(o) Annual Emission Estimates Required by PSD or Order of Approval Permit Condition	

Reqmt. No.	Enforceable Requirement	Requirement Paraphrase (For Information Only)	Monitoring, Maintenance & Recordkeeping Method (See Section II)	Reference Test Method (See Section VIII)
EU 3. 111	PSD-97-02 (3) (1/14/98)	Boeing Commercial Airplanes shall report to PSAPCA, in a manner approved by PSAPCA, the maximum number of airplane wings produced on any day and the total amount of VOC emissions from the 4-86 Building in accordance with the requirements of WAC 173-401-615.	II.A.2(c) Documentation on File II.A.2(o) Annual Emission Estimates Required by PSD or Order of Approval Permit Condition	
EU 3. 112	PSD-97-02 (4) (1/14/98)	The following work practices shall be employed in the 4-86 Building: a) Spent solvent cleaning rags shall be deposited in closed containers operated in accordance with Chapter 173-303 WAC for the accumulation and disposal of solvent wipes. b) Bulk application of solvents shall be by low-pressure hose, unless such solvents contain at least 60 percent water as applied. c) High transfer efficiency coating application methods such as electrostatic/ electrodeposition, high volume low pressure (HVLP), dip, flow, brush/roll or other equivalent methods approved by PSAPCA shall be used. d) Paint guns shall be cleaned by a method approved by PSAPCA.	II.A.1(d) Work Practice Inspection II.A.2(c) Documentation on File	
EU 3. 113	PSD-97-02 (5) (1/14/98)	Each occurrence of calculated emissions in excess of established limits shall be reported at least monthly within thirty days of the end of each calendar month to PSAPCA. The information shall include but not be limited to the following: a) The date(s) of occurrence. b) Magnitude of the emission or process parameters excess. c) The duration of the excess. d) The probable cause. e) Any corrective actions taken or planned. f) any other agency contacted.	II.A.2(c) Documentation on File	
EU 3. 114	PSD-97-02 (7) (1/14/98)	Any activity, which is undertaken by the company or others, in a manner that is inconsistent with the application and this determination, shall be subject to Ecology enforcement under applicable regulations.	NMR	

Reqmt. No.	Enforceable Requirement	Requirement Paraphrase (For Information Only)	Monitoring, Maintenance & Recordkeeping Method (See Section II)	Reference Test Method (See Section VIII)
(n) Averaging scheme for exterior commercial primers Requirements EU 3. 115 through EU 3. 116 are General Order No. 8073 permit conditions that apply to Boeing				
EU 3. 115	General Order No. 8073 (1) (3/9/00)	May use any combination of uncontrolled primers, including waterborne primers, at one or more emission units, within that same facility, where aerospace exterior commercial priming operations occur that are subject to 40 CFR 63.745(c), providing that certain conditions are met.	II.A.2(j) Averaging Scheme for Exterior Commercial	
EU 3. 116	General Order No. 8073 (2) (3/9/00)	(a) Records of monthly volume-weighted avg. mass of organic HAP (b) Records of the monthly volume-weighted average mass of VOC	II.A.2(j) Averaging Scheme for Exterior Commercial	
(o) Order of Approval No. 6363 Requirement No EU 3. 117 is the Order of Approval permit condition that applies to PB5001 in Bldg. 4-86.				
EU 3. 117	Order of Approval No. 6363 (4)	Butyl carbitol solution or any other aqueous, semiaqueous or hydrocarbon based solvent meeting the requirements of 40 CFR 63.744 shall be used for in-spar cleaning operations in the 4-86 bldg.	II.A.1(d) Work Practice Inspection	
(p) Order of Approval No. 5579 Requirement No. EU 3. 118 is the NOC Order of Approval No. 5579 permit condition that applies to 4-86 booths.				
EU 3. 118	Order of Approval No. 5579, (5) (9/12/94)	Boeing shall utilize any DOT-approved container, in accordance with the requirements of WAC 173-303, DOT 49 CFR, and PSAPCA Regulation II Section 3.09(e), for the accumulation and disposal of solvent wipes .	II.A.1(d) Work Practice Inspection	

Reqmt. No.	Enforceable Requirement	Requirement Paraphrase (For Information Only)	Monitoring, Maintenance & Recordkeeping Method (See Section II)	Reference Test Method (See Section VIII)
(q) Order of Approval No. 7155 Requirement No EU 3. 119 is the NOC Order of Approval NO. 7155 permit condition that applies at building 4-86.				
EU 3. 119	Order of Approval No. 7155 (3) (1/6/98)	Boeing shall comply with WDOE's Prevention of Significant Deterioration Permit PSD 97-02	NMR	
(r) Order of Approval No. 7296 Requirement Nos. EU 3. 120 through EU 3. 123 are the Order of Approval 7296, at PB0083 & 84 at building 4-20, column M8				
EU 3. 120	Order of Approval No. 7296 (3) (12/22/97)	Boeing shall install and maintain a gauge to measure the pressure drop across the spray booth exhaust filters. Within 90 days after beginning operations, the acceptable range for the gauge shall be clearly marked on or nearby the gauge.	II.A.2(d)(ii) Spray Booth Maintenance	
EU 3. 121	Order of Approval No. 7296 (4) (12/22/97)	Beginning on or before September 1, 1998, once during each shift that the spray booths are used, Boeing shall determine and record if the pressure drop across the exhaust filters is in the acceptable range.	II.A.2(d)(ii) Spray Booth Maintenance	
EU 3. 122	Order of Approval No. 7296 (5) (12/22/97)	If the pressure drop is not within the acceptable range, Boeing shall take corrective action as specified in the facility's Operation and Maintenance Plan	II.A.2(i) Aerospace NESHAP Pressure Drop/Water Flow Rate Monitoring and Recordkeeping Procedure	
EU 3. 123	Order of Approval No. 7296 (6) (12/22/97)	Boeing shall comply with 40 CFR 63 Subpart GG Aerospace NESHAP by September 1, 1998	II.A.2(c) Documentation on File	

Reqmt. No.	Enforceable Requirement	Requirement Paraphrase (For Information Only)	Monitoring, Maintenance & Recordkeeping Method (See Section II)	Reference Test Method (See Section VIII)
(s) Order of Approval No. 7355 Requirements Nos. EU 3. 124 through EU 3. 126 are the Order of Approval No. 7355, at Paint Booth PB0085 and 86 at building 4-20, column Q6.				
EU 3. 124	Order of Approval No. 7355 (3) (5/13/98)	Boeing (Renton) shall install and maintain gauges to measure the pressure drop across the Aerospace NESHAP compliant dry filter system, or other equivalent filtration system certified to meet or exceed the efficiency data points found in Tables 3 and 4 of Section 63.745 for new sources using USEPA method 319, or each spray booth. Within 90 days after beginning operations, the acceptable ranges for the gauges shall be clearly marked on or nearby the gauges.	II.A.2(d)(ii) Spray Booth Maintenance	
EU 3. 125	Order of Approval No. 7355 (4) (5/13/98)	On and after September 1, 1998, or upon start-up, whichever is later, once during each shift that the spray booths are used, Boeing (Renton) shall determine and record if the pressure drop across the Aerospace NESHAP compliant dry filter system is in the acceptable range.	II.A.2(i) Aerospace NESHAP Pressure Drop/Water Flow Rate Monitoring and Recordkeeping Procedure	
EU 3. 126	Order of Approval No. 7355 (5) (5/13/98)	If the pressure drop is not within the acceptable range, shall take corrective action as specified in the facility's Operation and Maintenance Plan	II.A.2(i) Aerospace NESHAP Pressure Drop/Water Flow Rate Monitoring and Recordkeeping Procedure	

Reqmt. No.	Enforceable Requirement	Requirement Paraphrase (For Information Only)	Monitoring, Maintenance & Recordkeeping Method (See Section II)	Reference Test Method (See Section VIII)
(t) Order of Approval No. 8703 Requirements Nos. EU 3.127 through EU 3.129 are Order of Approval No. 8703 requirements for a paint booth at building 4-45.				
EU 3. 127	Order of Approval No. 8703 (3) (08/02/02)	Boeing Renton shall install and maintain a gauge to measure the pressure drop across the exhaust filters of the spray booth. The acceptable range for the gauge shall be marked on or nearby the gauge.	II.A.2(d)(ii) Spray Booth Maintenance	
EU 3. 128	Order of Approval No. 8703 (4) (08/02/02)	Boeing Renton shall record if the pressure drop across the exhaust filters is in the acceptable pressure drop range once each week that the spray booth is used.	II.A.2(d)(ii) Spray Booth Maintenance	
EU 3. 129	Order of Approval No. 8703 (5) (08/02/02)	If the pressure drop is not within the acceptable range, Boeing shall take corrective action as specified in the facility's Operation and Maintenance Plan.	II.A.2(d)(ii) Spray Booth Maintenance	
(u) PSD 88-4 Requirement Nos. EU 3. 130 through EU 3. 134 are the PSD-88-4 Amendment No. 1 at the Building 4-41 Paint Hangar				
EU 3. 130	PSD-88-4 Amendment 1 (1) (5/17/95)	Emissions of VOC from the 4-41 building shall not exceed 124 tons per year.	II.A.2(o) Annual Emission Estimates Required by PSD or Order of Approval Permit Condition	
EU 3. 131	PSD-88-4 Amendment 1 (2) (5/17/95)	Boeing Commercial Airplanes shall report the total amount of solvents contained in the cleaning solutions and paints used in the 4-41 building and the VOC emissions from the 4-41 building annually to the Puget Sound Air Pollution Control Agency.	II.A.2(o) Annual Emission Estimates Required by PSD or Order of Approval Permit Condition	

Reqmt. No.	Enforceable Requirement	Requirement Paraphrase (For Information Only)	Monitoring, Maintenance & Recordkeeping Method (See Section II)	Reference Test Method (See Section VIII)
EU 3. 132	PSD-88-4 Amendment 1 (3) (5/17/95)	The following work practices shall be employed in the 4-41 building. a) Spent solvent cleaning rags shall be deposited in closed containers operated in accordance with chapter 173-303 WAC for the accumulation and disposal of solvent wipes. b) Bulk application of solvent shall be by low pressure hose. c) High transfer efficiency coating application methods such as electrostatic/ electrodeposition, HVLP, dip, flow, brush/roll shall be used. d) Paint guns shall be cleaned by method approved by PSAPCA.	II.A.1 Facility-Wide Monitoring II.A.1(d) Work Practice Inspection	
EU 3. 133	PSD-88-4 Amendment 1 (4) (5/17/95)	All Building 4-41 operations shall comply with Regulation II of the Puget Sound Air Pollution Control Agency.	II.A.2(h) Aerospace NESHAP Coating Monitoring and Recordkeeping Procedure II.A.1 Facility-Wide Monitoring II.A.1(d) Work Practice Inspection	
EU 3. 134	PSD-88-4 Amendment 1 (6) (5/17/95)	Any (building 4-41) activity, which is undertaken by the company or others, in a manner that is inconsistent with the application and this determination, shall be subject to Ecology enforcement under applicable regulations.	NMR	
(v) RCW Requirements Requirement No. EU 3. 135 is the RCW requirement to maintain order of approval equipment in good working order.				
EU 3. 135	RCW 70.94.152(7) 1996 (State	Maintain equipment that has received an Order of Approval in good working order	II.A.2(d)(ii) Spray Booth Maintenance	

Reqmt. No.	Enforceable Requirement	Requirement Paraphrase (For Information Only)	Monitoring, Maintenance & Recordkeeping Method (See Section II)	Reference Test Method (See Section VIII)
	Only)		II.A.1(c) Facility Inspections	
(w) Puget Sound Clean Air Agency adoption of 40 CFR Part 61 and 63 Requirement No. EU 3. 136 is the Puget Sound Clean Air Agency adoption of 40 CFR Part 61 and 63.				
EU 3. 136	Puget Sound Clean Air Agency Reg III: 2:02 (9/13/01)	Adopts 40 CFR 63 by reference and those requirements are listed elsewhere in this permit.	NMR	
(x) Puget Sound Clean Air Agency Regulation I Requirement Nos. EU 3. 137 through EU 3. 139 are the Puget Sound Clean Air Agency Regulation I requirements for spray coating operations.				
EU 3. 137	Puget Sound Clean Air Agency Reg I: 9.16(b) (7/12/01) (State Only) *This requirement will become federally enforceable upon adoption into the SIP and will replace the 6/13/91 version of Reg I: 9.16.*	The following activities are exempt from the provisions of Reg I: 9.16(c) and (d): 1) Application of architectural or maintenance coatings to stationary structures. 2) Aerospace coating operations subject to 40 CFR Part 63 Subpart GG, including all activities and materials listed in 40 CFR 63.741(f). 3) Use of HVLP guns in certain situations described in Reg I: 9.16(b)(3)(A) through (E). 4) Use of air brush spray equipment with 0.5 to 2.0 CFM airflow and 2 fluid ounce or less cup capacity. 5) Use of hand-held aerosol spray cans with 1 quart or less capacity. 6) Indoor application of automotive undercoating materials using organic solvents with flash points in excess of 100F.	NMR	

Reqmt. No.	Enforceable Requirement	Requirement Paraphrase (For Information Only)	Monitoring, Maintenance & Recordkeeping Method (See Section II)	Reference Test Method (See Section VIII)
EU 3. 138	Puget Sound Clean Air Agency Reg I: 9.16(c) (7/12/01) (State Only) *This requirement will become federally enforceable upon adoption into the SIP and will replace the 6/13/91 version of Reg I: 9.16.*	Unlawful to allow spray-coating inside a structure, or spray-coating of any motor vehicles or components, unless the spray-coating is conducted inside an enclosed spray area employing paint arresters or water-wash curtains to control overspray. All emissions shall be vented through an unobstructed vertical exhaust vent.	II.A.1(c) Facility Inspections II.A.1(d) Work Practice Inspection	
EU 3. 139	Puget Sound Clean Air Agency Reg I: 9.16(d) (7/12/01) (State Only) *This requirement will become federally enforceable upon adoption into the SIP and will replace the 6/13/91 version of Reg I: 9.16.*	General Requirements for Outdoor Spray-Coating Operations. It shall be unlawful for any person subject to the provisions of this section to cause or allow spray-coating outside an enclosed structure unless reasonable precautions are employed to minimize the overspray. Reasonable precautions include, but are not limited to the use of: (1) Enclosures and curtailment during high winds; and (2) High-volume low-pressure (HVLP), low-volume low-pressure (LVLP), electrostatic, or air-assisted airless spray equipment. Airless spray equipment may be used where low viscosity and high solid coatings preclude the use of higher-transfer efficiency spray equipment.	II.A.1(c) Facility Inspections, II.A.1(d) Work Practice Inspection II.A.2(a) Approval by the Puget Sound Clean Air Agency, via NOC/Order of Approval	

NMR = No Monitoring Required -- Monitoring is not required; however, if a noncompliant situation is observed, Boeing will initiate appropriate corrective action.

DESCRIPTION OF REFERENCE TEST METHODS:

24 = Determination of volatile matter content, water content, density, volume solids, and weight solids of surface coatings.

Exception: Any waterborne coating for which the manufacturer's supplied data demonstrate that organic HAP and VOC contents are less than or equal to the organic HAP and VOC content limits for its coating type, as specified in 40 63.745(c) and 63.747(c), is exempt from the following requirements of this subpart: 40 CFR 63.745(d)-(e), 63.747(d)-(e), 63.749(d) and (h), 63.750(c)-(h) and (k)-(m), 63.752(c) and (f), and 63.753(c) and (e). [40 CFR 63.741(i)]

319 = Determination of filtration efficiency for paint overspray arresters.

EXEMPTIONS, EXTENSIONS AND DETERMINATIONS GRANTED BY AGENCIES:

	Source	Description
1.	Puget Sound Clean Air Agency	Letter, March 18, 1993, A. Lee PSCAA to M. Babich, Boeing, Approval of Non-Vertical Exhaust for 10-59 Building Spray Booths No. 14-16 as exempt from PSCAA I: 9.16(c). See Attachment 1.
2.	Puget Sound Clean Air Agency	For the flightline and the buildings listed below, exempts items that cannot be reasonably handled in an enclosed spray area from the requirements of Regulation I, Section 9.16. (a) Letter dated November 30, 1992, D.S. Kircher to B.J. Thompson, PSAPCA Approval for Exemption to the Requirements of Regulation I, Section 9.16 "Spray coating Operations" See Attachment 2. (b) Letter dated February 1, 1993, D. Kircher to L. Babich; Subject: PSAPCA Approval for Exemption to the Requirements of Regulation I, Section 9.16 "Spray Coating Operations." See Attachment 3.

	Source	Description
3.	Puget Sound Clean Air Agency	Hand-wipe cleaning operations (Aerospace NESHAP 40 CFR Part 63 Subpart GG) where wiping, scrubbing, mopping or other hand actions are used are specifically not included as "flush cleaning." Letter dated August 1, 1996, A. C. Lee to C. Morris, Airplane Cleaning Operations Boeing Renton Facility. See Attachment 4.
4.	US EPA	Preval systems are aerosol cans and are not subject to 40 CFR 63 Subpart GG. Letter dated October 14, 1998, D. E. Hardesty to J. M. Willenberg, Preval Spray Units Applicability to the Aerospace NESHAP. See Attachment 5.
5.	Puget Sound Clean Air Agency	Aerospace NESHAP requirements for coatings with inorganic HAPs do not apply to coatings with inorganic HAP concentrations less than 0.1% for carcinogens and 1.0% for non-carcinogens. Letter dated February 19, 1999, J. M. Willenberg to The Boeing Company, Boeing Commercial Airplane Group Aerospace NESHAP Paint Booth Requirements. See Attachment 6.
6.	US EPA	Aerospace NESHAP requirements for coatings with inorganic HAPs do not apply to coatings with inorganic HAP concentrations less than 0.1% for carcinogens and 1.0% for non-carcinogens. Letter dated April 2, 1999, B. Thie to The Boeing Company, Aerospace Rule Interpretation. See Attachment 7.
7.	Puget Sound Clean Air Agency	Construction permit is required when a new control technology is implemented at a paint booth or when changes result in an increase in emissions. Letter dated January 9, 1998, J. M. Willenberg to The Boeing Company, Notice of Construction (NOC) Order of Approval Requirements for Paint Spray Booths. See Attachment 8.
8.	Puget Sound Clean Air Agency	Small containers with a capacity of two gallons or less containing acetone are exempt from Puget Sound Clean Air Agency Regulation III Section 3.05 and WAC 173-460-060(5). Letter dated August 10, 1999, D. S. Kircher to The Boeing Company, Small Container Used for Immersion Cleaning with Acetone. See Attachment 9.

	Source	Description
9.	Puget Sound Clean Air Agency	Regulation III, Section 3.05 does not apply to cleaning equipment used exclusively to clean spray guns or nonmetal parts. Letter dated May 8, 1995, D. S. Kircher to H. Kimball, Rule Applicability for Cold Solvent Cleaners. See Attachment 10.
10.	Puget Sound Clean Air Agency	Equivalency Determination for Safety Kleen Models 1107 and 1111 Gun Cleaning Systems with Gun Cleaning Techniques in 40 CFR 63.744(c). Letter dated June 14, 2000, J. M Willenberg, Puget Sound Clean Air Agency to R. Bennett, The Boeing Company. See Attachment 11.
11.	Puget Sound Clean Air Agency	Mobile equipment under Puget Sound Clean Air Agency Regulation II Section 3.04 is intended to mean equipment that is licensed or likely to be licensed to operate on a public roadway. Letter dated January 30, 2001, J.M. Willenberg, Puget Sound Clean Air Agency to E. Cierebiej, The Boeing Company. See Attachment 12.
12.	Puget Sound Clean Air Agency	Letter, January 15, 1998, N. Shulman, PSCAA, to D. Moore, Boeing, Subject: Clarifies that to be able to certify compliance for 63.750(a) and 63.750(c)(1) manufacturer's supplied data is sufficient. For the Aerospace NESHAP, PSCAA only envisions requiring reference method 24 testing if there is evidence that the manufacturer's data may be erroneous. See Attachment 13.
13	Puget Sound Clean Air Agency	Jay M Willenberg letter dated May 20, 1999 to Frank Migaiolo re Acceptable Pressure Drop Limits for Dry Filter Banks Subject to the Aerospace NESHAP. See Attachment 15.
14	Puget Sound Clean Air Agency	Clarifies when reference testing is required. N Shulman letter dated January 15, 1998, to D. Moore re Solvent Composition Requirements in Aerospace NESHAP. See Attachment 17.
15	Puget Sound Clean Air Agency	Clarifies that spray gun cleaning operations subject to a NESHAP or NSPS that are new to an area require a Notice of Construction only when spray gun cleaning

	had not previously existed in the area. J Willenberg letter dated January 18, 2002, to R. Bennett re "New Source" Requirements for Spray Gun Cleaning Operations. See Attachment 19.
16 Puget Sound Clean Air Agency	Clarifies that removing paint from metal spatulas is a paint removal activity and as such is not subject to PSCAA Regulation III Section 3.05. S Van Slyke letter January 16, 2002, to N Welch re Solvent Metal Cleaners for Paint Removal. See Attachment 20.
17 Puget Sound Clean Air Agency	Clarifies rule applicability for spray coating operations at Boeing Renton and North Boeing Field flight lines. J Willenberg letter June 6, 1995, to L. Babich re Approval of Exemption Request from Spray Coating Regulation I, Section 9.16(b)(6). See Attachment 21.

The following Orders of Approval have been canceled and superseded by amended Orders of Approval:

Order of Approval No. 3485 dated August 10, 1995, cancels and supersedes Order of Approval No. 3485 dated May 4, 1990.

Order of Approval No. 5066 dated May 23, 1995, cancels and supersedes Order of Approval No. 5066 dated August 9, 1993.

Order of Approval No. 5579 dated September 12, 1994, cancels and supersedes Order of Approval No. 3031 dated March 15, 1988.

Order of Approval No. 6363, dated January 17, 1996, cancels and supercedes Order of Approval No. 3950 dated June 25, 1991.

Order of Approval No. 7155, dated January 6, 1998, cancels and supercedes Order of Approval No. 5579, dated September 12, 1994.

4. Fuel Burning Equipment – NON-NSPS

DESCRIPTION: *This emission unit consists of activities and equipment associated with steam and hot water boiler operations, including fuel combustion, continuous emission monitors, and material and waste handling. The primary fuel is natural gas. These boilers are not subject to 40 CFR 60 Subpart Dc (10 - 100 million Btu/hour) or 40 CFR 60 Subpart Db (>100 million Btu/hour). The boilers are affected sources under the Boiler and Process Heater NESHAP, 40 CFR 63 Subpart DDDDD. They are considered existing large liquid fueled boilers for purposes of 40 CFR 63 Subpart DDDDD. Only units that classify as "existing" are listed under this emission unit. "New" boilers and process heaters that are subject to 40 CFR 63 Subpart DDDDD are listed under emission unit 5.*

For purposes of defining an "emission unit" in this permit, each boiler listed below is considered a separate emission unit.

Bldg	*Col./Dr.*	*MSS/IDNo.*	*Order of Approval No.*	*Install Date*	*Source Description*
4-89		*BOIL01, 2, 3*	*5521*	*1966*	*175 MMBtu/Hr., (3), No. 6 residual oil backup fuel*
5-50	*A6*	*BOIL05*	*6190*	*1963*	*25 MMBtu/Hr, distillate oil backup fuel.*
5-50	*A6*	*BOIL06*	*Reg.*	*1963*	*25 MMBtu/Hr, distillate oil backup fuel.*

Data in italics are for information only and are not enforceable conditions of this permit.

COMPLIANCE REQUIREMENTS:

Reqmt. No.	**Enforceable Requirement**	**Requirement Paraphrase** (For Information Only)	**Monitoring, Maintenance & Recordkeeping Method** (See Section II)	**Reference Test Method** (See Section VIII)
a) Requirements No. 4.1 through 4.6 are the Puget Sound Clean Air Agency requirements for fuel burning equipment				
EU 4.1	Puget Sound Clean Air Agency Reg I: 9.03 (9/08/1994) *This requirement will be superseded upon*	Shall not emit air contaminants in excess of 20% opacity for more than 3 minutes per hour	II.A.2(d)(iv) Boiler Maintenance II.A.1(b) Complaint Response	Ecology Method 9A (See Section VIII)

Reqmt. No.	Enforceable Requirement	Requirement Paraphrase (For Information Only)	Monitoring, Maintenance & Recordkeeping Method (See Section II)	Reference Test Method (See Section VIII)
	adoption of the 3/11/99 version of Reg I: 9.03 into the SIP *Puget Sound Clean Air Agency Reg. I: 9.03* (3/11/1999) *(State Only). This requirement will become federally enforceable upon adoption into the SIP and will replace the 9/08/94 version of Reg I: 9.03* WAC 173-400-040(1) (8/20/1993) *This requirement will be superseded upon adoption of the 9/15/01 version of WAC 173-400-040(1) into the SIP* WAC 173-400-040(1) (9/15/01) *(State Only). This requirement will become federally enforceable upon adoption into the SIP and will replace the 8/20/1993 version of WAC 173-400-040(1)*		II.A.1(c) Facility Inspections These monitoring methods supersede the monitoring method for this requirement listed in I.A.1	

Reqmt. No.	Enforceable Requirement	Requirement Paraphrase (For Information Only)	Monitoring, Maintenance & Recordkeeping Method (See Section II)	Reference Test Method (See Section VIII)
EU 4.2	Puget Sound Clean Air Agency Reg I: 9.09(a) (2/10/1994) *This requirement will be superseded upon adoption of the 4/9/98 version of Reg I: 9.09 into the SIP* Puget Sound Clean Air Agency Reg I: 9.09 (4/09/1998) *(State Only) This requirement will become federally enforceable and will be effective in this table upon adoption of the 4/9/1998 version of Reg I: 9.09 into the SIP*	Shall not emit particulate matter in excess of 0.05 gr/dscf corrected to 7% O_2 from fuel burning equipment and combustion sources (applies to the equipment that produces hot air, hot water, steam, or other heated fluids by external combustion of fuel. Examples include indirect-fired drying ovens and space heaters and water heaters).	II.A.2(d)(iv) Boiler Maintenance II.A.1(b) Complaint Response II.A.1(c) Facility Inspections These monitoring methods supersede the monitoring method for this requirement listed in I.A.3	Puget Sound Clean Air Agency Method 5 (See Section VIII)

Reqmt. No.	Enforceable Requirement	Requirement Paraphrase (For Information Only)	Monitoring, Maintenance & Recordkeeping Method (See Section II)	Reference Test Method (See Section VIII)
EU 4.3	WAC 173-400-050 (3/22/91) *This requirement will be superseded upon adoption of the 9/15/01 version of WAC 173-400-050 into the SIP.* WAC 173-400-050 (9/15/01)*(State Only). This requirement will become federally enforceable upon adoption into the SIP and will replace the 3/22/91 version of WAC 173-400-050)*	Shall not emit particulate matter in excess of 0.10 gr/dscf corrected to 7% O2 from fuel burning equipment and combustion sources. (Applies to the equipment that produces hot air, hot water, steam, or other heated fluids by external combustion of fuel, such as boilers and water heaters.)	II.A.2(d)(iv) Boiler Maintenance II.A.1(b) Complaint Response II.A.1(c) Facility Inspections These monitoring methods supersede the monitoring method for this requirement listed in I.A.3	EPA Method 5 (See 40 CFR Part 60, Appendix A, July 1, 2001)
EU 4.4	Puget Sound Clean Air Agency Reg I: 9.08(a) (4/14/94) RCW 70.94.610 (1991) State Only	It shall be unlawful for any person to cause or allow combustion of oil that exceeds any of the following maximum limits unless allowed by a Puget Sound Clean Air Agency Order of Approval issued under Reg I: 6.07: • Ash 0.1% • Sulfur, used oil 1.0% • Sulfur, fuel oil 2.00% • Lead 100 ppm • Arsenic 5 ppm • Cadmium 2 ppm • Chromium 10 ppm • Total halogens 1,000 ppm • PCBs 2 ppm • Flash point 100 °F	II.A.2(e) Purchase Specification	Ash ASTM D482-00A, Sulfur ASTM D3120-96, Halogens EPA SW846, 9076, PCB EPA SW846, 8080, Lead EPA 600/4-81-045, 200.7

Reqmt. No.	Enforceable Requirement	Requirement Paraphrase (For Information Only)	Monitoring, Maintenance & Recordkeeping Method (See Section II)	Reference Test Method (See Section VIII)
EU 4.5	Puget Sound Clean Air Agency Reg I: 7.09(b) (9/12/96) *This requirement will be superseded upon adoption of the 9/10/1998 version of Reg I, Section 7.09(b) into the SIP* Puget Sound Clean Air Agency Reg I, 7.09(b) *9/10/98 (State Only) This requirement shall become federally enforceable upon adoption into the SIP and will replace the 9/12/96 version of Reg I, Section 7.09(b)*	Develop and implement an O&M plan to assure continuous compliance with Puget Sound Clean Air Agency Regulations I, II, and III.	II.B Operation and Maintenance (O&M) Plan Requirements This monitoring method supersedes the monitoring method for this requirement listed in I.A.11	
EU 4.6	Puget Sound Clean Air Agency Reg I: 9.20 (6/88) RCW 70.94.152(7) (1996) State only	Maintain equipment in good working order.	II.A.2(d)(iv) Boiler Maintenance II.A.1(c) Facility Inspections These monitoring methods supersede the monitoring method for this requirement listed in I.A.10	

Reqmt. No.	Enforceable Requirement	Requirement Paraphrase (For Information Only)	Monitoring, Maintenance & Recordkeeping Method (See Section II)	Reference Test Method (See Section VIII)
b) Requirement No. EU 4.7 is the Order of Approval No. 6190 requirement that applies to BOIL05 in the 5-50 Bldg, when burning fuel oil.				
EU 4.7	Order of Approval No. 6190 (4) (9/20/95)	Fuel oil supplied at the burner shall be No. 2 or lighter and shall have a sulfur content of no more than 0.5 percent by weight.	II.A.2(f) Fuel Oil Sulfur Content Monitoring Procedure	
c) Requirement Nos. EU 4.8 through EU 4.10 are the Order of Approval No. 5521 requirements that apply to BOIL01, BOIL02, BOIL03 in the 4-89 building, when burning residual oil.				
EU 4.8	Puget Sound Clean Air Agency Order of Approval 5521 (4) (08/29/94)	When burning residual oil Boeing shall operate and maintain a monitoring system for measuring excess oxygen, as an alternate mean of demonstrating compliance with Regulation I, Section 12.02(a)(4).	II.A.2(p) Excess oxygen monitoring	
EU 4.9	Puget Sound Clean Air Agency Order of Approval 5521 (5) (08/29/94)	Boeing shall monitor and maintain the excess oxygen at greater than 2 % except during startup, shutdown, or malfunctions of the boilers. Boeing shall maintain the excess oxygen records from fuel oil burn only for a minimum of 2 years.	II.A.2(p) Excess oxygen monitoring	
EU 4.10	Puget Sound Clean Air Agency Order of Approval 5521 (6) (08/29/94)	Boeing will install a Continuous Opacity Monitor if the annual usage of residual oil for maintenance or inventory turnover activities exceeds 350,000 gallons. This requirement does not pertain to natural gas curtailment or equipment/component failure.	II.A.2(c) Documentation on File II.A.2(r) Order of Approval No. 5521, Condition No. 6	
d) Requirements Nos. EU 4.11 through EU 4.13 are the requirements of the Industrial, Commercial, Institutional Boilers and Process Heaters NESHAP (40 CFR 63 Subpart DDDDD).				
EU 4.11	40 CFR 63.7490(a)(1) (9/13/04)	The affected source of this subpart is the collection of all existing industrial, commercial, and institutional boilers and process heaters within a subcategory located at a major source.	NMR	

Reqmt. No.	Enforceable Requirement	Requirement Paraphrase (For Information Only)	Monitoring, Maintenance & Recordkeeping Method (See Section II)	Reference Test Method (See Section VIII)
EU 4.12	40 CFR 63.7506(b) (9/13/04)	Existing large gaseous and liquid fuel units are subject to only the initial notification requirements in 40 CFR 63.9(b) (i.e., they are not subject to the emission limits, work practice standards, performance testing, monitoring, SSMP, site-specific monitoring plans, recordkeeping and reporting requirements of this subpart or any other requirements in subpart A of 40 CFR Part 63)	II.A.2(c) Documentation on File	
EU 4.13	40 CFR 63.7545(b) (9/13/04)	Existing large gaseous and liquid fuel units: As specified in 40 CFR 63.9(b)(2), sources that started up before November 12, 2004 must submit an Initial Notification not later than 120 days after November 12, 2004.	II.A.2(c) Documentation on File	
e) Requirement No. EU 4.14 is the general NESHAP (40 CFR 63 Subpart A) requirement.				
EU 4.14	40 CFR 63.9(j) (5/30/03)	Notification requirements. Any change in information already provided under 40 CFR 63.9 shall be sent to the Puget Sound Clean Air Agency within 15 days.	NMR	
f) Requirement No. EU 4.15 is the Puget Sound Clean Air Agency adoption of 40 CFR Part 63.				
EU 4.15	Puget Sound Clean Air Agency Reg III: 2:02 (9/26/02) Puget Sound Clean Air Agency Reg. I: 3.25 (9/22/05)	Adopts 40 CFR 63 by reference; specific requirements are listed elsewhere in the permit.	NMR	

Exemption

Puget Sound Clean Air Agency.	The 4-89 building boilers burn residual oil as backup fuel, and have implemented an Alternate Opacity Monitoring Plan via NOC Order of Approval 5521 (08/94). Per section 9.04(f) of PSCAA Reg. I (04/99), these boilers are thus excluded from PSCAA Reg. I section 9.04.

5. Fuel Burning Equipment Subject to NSPS

DESCRIPTION: *This emission unit consists of fuel burning devices that are subject to NSPS requirements under 40 CFR 60 Subpart Dc. Boiler and process heaters that are considered to be "new" sources under 40 CFR 63 Subpart DDDDD are also included.*

Bldg.	*Col./Dr.*	*MSS/ID#*	*Order of Approval #*	*Install Date*	*Source Description*
4-89		*BOIL04*	*9068*	*2004*	*64 MMBtu/hr gas fired boiler (no backup fuel), low NOx burners, flue gas recirculation; subject to both 40 CFR 60 Subpart Dc and 40 CFR 63 Subpart DDDDD.*

Data in italics are for information only and are not enforceable conditions of this permit.

COMPLIANCE REQUIREMENTS:

Reqmt. No.	**Enforceable Requirement**	**Requirement Paraphrase** (For Information Only)	**Monitoring, Maintenance & Recordkeeping Method** (See Section II)	**Reference Test Method** (See Section VIII)
a) Requirements No. 5.1 through 5.6 are the Puget Sound Clean Air Agency requirements for fuel burning equipment.				
EU 5.1	Puget Sound Clean Air Agency Reg I: 9.03 (9/08/1994) *This requirement will be superseded upon adoption of the 3/11/99 version of Reg I: 9.03 into the SIP* *Puget Sound Clean Air Agency Reg. I: 9.03* (3/11/1999) *(State Only). This requirement will become federally enforceable upon*	Shall not emit air contaminants in excess of 20% opacity for more than 3 minutes per hour *(See EU 5.51 for additional opacity requirements from Order of Approval)*	II.A.2(d)(iv) Boiler Maintenance II.A.1(b) Complaint Response II.A.1(c) Facility Inspections These monitoring methods supersede the monitoring method for this requirement listed in I.A.1	Ecology Method 9A (See Section VIII)

Reqmt. No.	Enforceable Requirement	Requirement Paraphrase (For Information Only)	Monitoring, Maintenance & Recordkeeping Method (See Section II)	Reference Test Method (See Section VIII)
	adoption into the SIP and will replace the 9/08/94 version of Reg I: 9.03 WAC 173-400-040(1) (8/20/1993) *This requirement will be superseded upon adoption of the 9/15/01 version of WAC 173-400-040(1) into the SIP* WAC 173-400-040(1) (9/15/01) *(State Only). This requirement will become federally enforceable upon adoption into the SIP and will replace the 8/20/1993 version of WAC 173-400-040(1)*			
EU 5.2	Puget Sound Clean Air Agency Reg I: 9.09(a) (2/10/1994) *This requirement will be superseded upon adoption of the 4/9/98 version of Reg I: 9.09 into the SIP* Puget Sound Clean Air Agency Reg I: 9.09 (4/09/1998) *(State Only) This*	Shall not emit particulate matter in excess of 0.05 gr/dscf corrected to 7% O_2 from fuel burning equipment and combustion sources (applies to the equipment that produces hot air, hot water, steam, or other heated fluids by external combustion of fuel. Examples include indirect-fired drying ovens and space heaters and water heaters).	II.A.2(d)(iv) Boiler Maintenance II.A.1(b) Complaint Response II.A.1(c) Facility Inspections These monitoring methods supersede the monitoring method for this	Puget Sound Clean Air Agency Method 5 (See Section VIII)

Reqmt. No.	Enforceable Requirement	Requirement Paraphrase (For Information Only)	Monitoring, Maintenance & Recordkeeping Method (See Section II)	Reference Test Method (See Section VIII)
	requirement will become federally enforceable and will be effective in this table upon adoption of the 4/9/1998 version of Reg I: 9.09 into the SIP		requirement listed in I.A.3	
EU 5.3	WAC 173-400-050 (3/22/91) *This requirement will be superseded upon adoption of the 9/15/01 version of WAC 173-400-050 into the SIP.* WAC 173-400-050 (9/15/01)*(State Only). This requirement will become federally enforceable upon adoption into the SIP and will replace the 3/22/91 version of WAC 173-400-050)*	Shall not emit particulate matter in excess of 0.10 gr/dscf corrected to 7% O2 from fuel burning equipment and combustion sources. (Applies to the equipment that produces hot air, hot water, steam, or other heated fluids by external combustion of fuel, such as boilers and water heaters.)	II.A.2(d)(iv) Boiler Maintenance II.A.1(b) Complaint Response II.A.1(c) Facility Inspections These monitoring methods supersede the monitoring method for this requirement listed in I.A.3	EPA Method 5 (See 40 CFR Part 60, Appendix A, July 1, 2001)
EU 5.4	Puget Sound Clean Air Agency Reg I: 9.20(a) (6/9/88) RCW 70.94.152(7) 1996 (State Only)	Maintain equipment in good working order that has received an NOC Order of Approval	II.A.2(d)(iv) Boiler Maintenance II.A.1(c) Facility Inspections	
EU 5.5	Puget Sound Clean Air Agency Reg I:	Develop and implement an O&M plan to assure continuous compliance with Puget Sound Clean Air Agency Regulations I, II,	II.B Operation and Maintenance (O&M) Plan	

Reqmt. No.	Enforceable Requirement	Requirement Paraphrase (For Information Only)	Monitoring, Maintenance & Recordkeeping Method (See Section II)	Reference Test Method (See Section VIII)
	7.09(b) (9/12/96) *This requirement will be superseded upon adoption of the 9/10/1998 version of Reg I, Section 7.09(b) into the SIP* Puget Sound Clean Air Agency Reg I, 7.09(b) *9/10/98 (State Only) This requirement shall become federally enforceable upon adoption into the SIP and will replace the 9/12/96 version of Reg I, Section 7.09(b)*	and III.	Requirements This monitoring method supersedes the monitoring method for this requirement listed in I.A.11	
b) Requirements Nos. EU 5.6 through EU 5.24 are the General Provisions for the Standards of Performance for New Stationary Sources (40 CFR 63 Subpart A).				
EU 5.6	40 CFR 60.1(a) (10/8/97)	40 CFR Part 60 applies to any stationary source which contains an affected facility, the construction or modification of which is commenced after the date of publication in Part 60 of any standard applicable to the facility.	NMR	
EU 5.7	40 CFR 60.4 (1/24/06)	All requests, reports, applications, submittals, and other communications to Puget Sound Clean Air Agency pursuant to 40 CFR Part 60 shall be submitted in duplicate to Region 10, Director, Air and Waste Management Division, U.S. Environmental Protection Agency, 1200 Sixth Avenue, Seattle, WA 98101.	NMR	
EU 5.8	40 CFR 60.7(a)(4) (2/12/99)	Must notify Puget Sound Clean Air Agency of any physical or operational change to an existing facility, which may increase the	NMR	

Reqmt. No.	Enforceable Requirement	Requirement Paraphrase (For Information Only)	Monitoring, Maintenance & Recordkeeping Method (See Section II)	Reference Test Method (See Section VIII)
	40 CFR 60.48c(a) (10/17/00)	emission rate of any air pollutant to which a standard applies unless exempted under 40 CFR 60.14(e).		
EU 5.9	40 CFR 60.7(b) (2/12/99)	Must maintain records of the occurrence and duration of any startup, shutdown, or malfunction in the operation of an affected facility; any malfunction of the air pollution control equipment; or any periods during which a continuous monitoring system or monitoring device is inoperative.	II.A.2(c) Documentation on File	
EU 5.10	40 CFR 60.7(f) (2/12/99)	Must maintain a file of all measurements, including continuous monitoring system, monitoring device, and performance testing measurements; all continuous monitoring system performance evaluations; all continuous monitoring system or monitoring device calibration checks; adjustments and maintenance performed on these systems or devices; and all other information required by 40 CFR Part 60 recorded in a permanent form suitable for inspection. The file shall be retained for at least two years following the date of such measurements, maintenance, reports, and records.	II.A.2(c) Documentation on File	
EU 5.11	40 CFR 60.7(g) (2/12/99)	If notification substantially similar to that in 40 CFR 60.7(a) is required by the state or local agency, sending the Administrator a copy of that notification will satisfy the requirement of 40 CFR 60.7(a).	NMR	
EU 5.12	40 CFR 60.7(h) (2/12/99)	Individual subparts of 40 CFR Part 60 may include specific provisions, which clarify or make inapplicable the provisions set forth in 40 CFR 60.7.	NMR	
EU 5.13	40 CFR 60.11(d) (10/17/00)	At all times, including periods of startup, shutdown, and malfunction, Boeing shall, to the extent practicable, operate and maintain the equipment, including associated air pollution control equipment, in a manner consistent with good air pollution control practice for minimizing emissions. Determination of whether acceptable operating and maintenance procedures are being used will be based on information	II.A.2(d)(iv) Boiler Maintenance	

Reqmt. No.	Enforceable Requirement	Requirement Paraphrase (For Information Only)	Monitoring, Maintenance & Recordkeeping Method (See Section II)	Reference Test Method (See Section VIII)
		available to the Administrator which may include, but is not limited to, monitoring results, opacity observations, review of operations and maintenance procedures, and inspection of the source.		
EU 5.14	40 CFR 60.12 (3/8/74)	Boeing shall not build, erect, install, or use any article, machine, equipment or process, the use of which conceals an emission which would otherwise constitute a violation of an applicable (40 CFR Part 60) standard. Such concealment includes, but is not limited to, the use of gaseous diluents to achieve compliance with an opacity standard or with a standard, which is based on the concentration of a pollutant in the gases discharged to the atmosphere.	NMR	
EU 5.15	40 CFR 60.14(a) (10/17/00)	Any physical or operational change to an existing facility which results in an increase in the emission rate to the atmosphere of any pollutant to which a standard applies shall be considered a modification within the meaning of Section 111 of the Act. Upon modification, an existing facility shall become an affected facility.	NMR	
EU 5.16	40 CFR 60.14(c) (10/17/00)	Addition of an affected facility to a stationary source shall not by itself bring within the applicability of 40 CFR Part 60 any other facility within the source.	NMR	
EU 5.17	40 CFR 60.14(e) (10/17/00)	Examples listed in 40 CFR 60.14(e) shall not be considered modifications under 40 CFR Part 60.	NMR	
EU 5.18	40 CFR 60.14(f) (10/17/00)	Special provisions in an applicable subpart shall supersede this section.	NMR	
EU 5.19	40 CFR 60.14(g) (10/17/00)	Within 180 days of a change subject to 40 CFR 60.14(a), compliance with all applicable standards must be achieved.	NMR	
EU 5.20	40 CFR 60.15(a) (12/16/75)	An existing facility upon reconstruction becomes an affected facility.	NMR	
EU 5.21	40 CFR 60.15(b) (12/16/75)	Reconstruction means the replacement of components of an existing facility that the fixed capital cost exceeds 50% of the cost	NMR	

Reqmt. No.	Enforceable Requirement	Requirement Paraphrase (For Information Only)	Monitoring, Maintenance & Recordkeeping Method (See Section II)	Reference Test Method (See Section VIII)
		required to construct a comparable new facility and it is technologically and economically feasible to meet the applicable standards.		
EU 5.22	40 CFR 60.15(c) (12/16/75)	Fixed capital cost means the capital needed to provide all the depreciable components.	NMR	
EU 5.23	40 CFR 60.15(d) (12/16/75)	If the fixed capital cost exceeds 50%, the facility must notify the Administrator of the proposed replacement 60 days before construction is commenced.	NMR	
EU 5.24	40 CFR 60.19 (2/12/98)	Reports and notifications required by 40 CFR Part 60 must be submitted according to 40 CFR 60.19.	NMR	
c) Requirement Nos. EU 5.25 through EU 5.27 are the applicable requirements of the NSPS for Small Industrial-Commerical-Institutional Steam Generating Units (40 CFR 60 Subpart Dc).				
EU 5.25	40 CFR 60.40c(a) (5/8/96)	40 CFR Part 60 Subpart Dc applies to each steam generating unit for which construction, modification, or reconstruction is commenced after June 9, 1989 and that has a maximum design heat input capacity of 100 million Btu/hour or less, but greater than or equal to 10 million Btu/hour.	NMR	
EU 5.26	40 CFR 60.48c(g) (10/17/00)	Boeing shall record and maintain records of the amounts of each fuel combusted during each day. *[Note: Recordkeeping reduction per Notice of Construction Order of Approval 9068. See Condition No. 4 of Order of Approval 9068 for alternative monitoring approval]*	II.A.2(s) Fuel Monitoring for BOIL04	
EU 5.27	40 CFR 60.48c(i) (10/17/00)	All required records required by 40 CFR 60 Subpart Dc shall be maintained for a period of two years following the date of such record.	II.A.2(c) Documentation on File	
d) Requirement Nos. EU 5.28 through EU 5.37 are the requirements of the Industrial, Commercial, Institutional Boilers and Process Heaters NESHAP (40 CFR 63 Subpart DDDDD).				
EU 5.28	40 CFR 63.7490(a)(2) (9/13/04)	The affected source of this subpart is each new or reconstructed industrial, commercial, or institutional boiler or process heater located at a major source.	NMR	

Reqmt. No.	Enforceable Requirement	Requirement Paraphrase (For Information Only)	Monitoring, Maintenance & Recordkeeping Method (See Section II)	Reference Test Method (See Section VIII)
EU 5.29	40 CFR 63.7490(b) (9/13/04)	A boiler or process heater is new if it commenced construction after January 13, 2003.	NMR	
EU 5.30	40 CFR 63.7495(a) (9/13/04)	For new boilers or process heaters, must comply with subpart by November 12, 2004 or upon startup of boiler or process heater, whichever is later.	II.A.2(t) Testing requirements for BOIL04 - CO	
EU 5.31	40 CFR 63.7500(a)(1) (9/13/04) 40 CFR 63 Subpart DDDDD Table 1 (9/13/04)	The boiler must meet the CO emission limits in Table 1 of 40 CFR 63 Subpart DDDDD (400 ppm by volume on a dry basis corrected to 3 percent oxygen (3- run average)).	II.A.2(t) Testing requirements for BOIL04 - CO	EPA Method 10 (See 40 CFR Part 60, Appendix A, 5/15/06)
EU 5.32	40 CFR 63.7505(a) (4/20/06)	Boeing must be in compliance with the emission limits (including operating limits) at all times, except during periods of startup, shutdown, and malfunction.	II.A.2(t) Testing requirements for BOIL04 - CO	EPA Method 10 (See 40 CFR Part 60, Appendix A, 5/15/06)
EU 5.33	40 CFR 63.7505(b) (4/20/06)	Boeing must always operate and maintain the affected source according to the provisions in 40 CFR 63.6(e)(1)(i) (EU 5.39).	II.A.2(d)(iv) Boiler Maintenance	
EU 5.34	40 CFR 63.7505(c) (4/20/06)	Boeing shall demonstrate compliance with the CO emission limit using performance testing.	II.A.2(t) Testing requirements for BOIL04 - CO	EPA Method 10 (See 40 CFR Part 60, Appendix A, 5/15/06)
EU 5.35	40 CFR 63.7505(d) (4/20/06)	Boeing shall develop a site specific monitoring plan.	II.A.2(c) Documentation on File	
EU 5.36	40 CFR 63.7505(e) (4/20/06)	Boeing shall develop a written startup, shutdown, and malfunction plan (SSMP) according to the provisions in 40 CFR 63.6(e)(3) (EU 5.40).	II.A.2(c) Documentation on File	
EU 5.37	40 CFR 63.7510(a), (c), & (g) (9/13/04) 40 CFR	Boeing shall conduct an initial CO performance test according to 40 CFR 63.7520 and Table 5 no later 180 days after startup of the source.	II.A.2(c) Documentation on File	EPA Method 10 (See 40 CFR Part 60, Appendix A,

Reqmt. No.	Enforceable Requirement	Requirement Paraphrase (For Information Only)	Monitoring, Maintenance & Recordkeeping Method (See Section II)	Reference Test Method (See Section VIII)
	63.7530(a) (9/13/04)			5/15/06)
EU 5.38	40 CFR 63.7515(a) & (e) (9/13/04) 40 CFR 63.7535(b) (9/13/04)	Boeing shall conduct annual CO performance tests according to 40 CFR 63.7520. Annual performance tests must be completed between 10 and 12 months after the previous performance test.	II.A.2(t) Testing requirements for BOIL04 - CO	EPA Method 10 (See 40 CFR Part 60, Appendix A, 5/15/06)
e) Requirements EU 5.38 through EU 5.44 are the general NESHAP (40 CFR 63 Subpart A) requirements				
EU 5.39	40 CFR 63.6(e)(1)(i)	At all times, including startup, shutdown, and malfunction, must operate and maintain affected sources consistent with good air pollution control practice. Correct malfunctions as soon as practicable after their occurrence.	II.A.2(d)(iv) Boiler Maintenance	
EU 5.40	63.6(e)(3)	Boeing shall develop a written SSMP that describes, procedures for operating and maintaining the source during periods of startup, shutdown, and malfunction; and a program of corrective action for malfunctioning process, air pollution control, and monitoring equipment used to comply with the relevant standard. The SSMP does not need to address any scenario that would not cause the source to exceed an applicable emission limitation in the relevant standard.	II.A.2(c) Documentation on File	
EU 5.41	40 CFR 63.9(b) (5/30/03)	Boeing shall notify the Puget Sound Clean Air Agency according to 40 CFR 63.9(b) if it constructs or reconstructs a new affected source.	NMR	
EU 5.42	40 CFR 63.9(j) (5/30/03)	Notification requirements. Any change in information already provided under 40 CFR 63.9 shall be sent to the Puget Sound Clean Air Agency within 15 days.	NMR	
EU 5.43	40 CFR 63.10(a)(3)-(7) (4/20/06)	Boeing must send the reports according to 40 CFR 63.10(a)(3)-(7) and can request alternate reporting dates.	NMR	
EU 5.44	40 CFR 63.10(f)	Boeing must comply with the recordkeeping	NMR	

Reqmt. No.	Enforceable Requirement	Requirement Paraphrase (For Information Only)	Monitoring, Maintenance & Recordkeeping Method (See Section II)	Reference Test Method (See Section VIII)
	(4/20/06)	and reporting requirements in 40 CFR 63.10 unless a waiver is granted by the Puget Sound Clean Air Agency.		
EU 5.45	40 CFR 63.10(d)(1) (4/20/06)	Boeing shall submit reports in accordance with 40 CFR 63 Subpart DDDDD.	NMR	
f) Requirements EU 5.46 through EU 5.51 are the Order of Approval No. 9068 conditions that apply to boiler BOIL04 in Building 4-89.				
EU 5.46	Order of Approval No. 9068 Condition 3 (12/1/04)	The boiler shall be fired only on natural gas.	II.A.2(a) Approval by the Puget Sound Clean Air Agency, via NOC/Order of Approval	
EU 5.47	Order of Approval No. 9068 Condition 4 (12/1/04)	The boiler shall meet all applicable requirements of 40 CFR 60 Subpart Dc. Records of fuel usage pursuant to this requirement and 40 CFR 60.48c(g) shall be maintained on a monthly basis and may be in the form of fuel bills or meter readings or any other records that adequately document fuel use.	II.A.2(s) Fuel Monitoring for BOIL04 II.A.2(c) Documentation on File	
EU 5.48	Order of Approval No. 9068 Condition 5 (12/1/04)	The boiler shall meet all applicable requirements of 40 CFR 63 Subpart DDDDD.	II.A.2(c) Documentation on File II.A.2(t) Testing requirements for BOIL04	
EU 5.49	Order of Approval No. 9068 Condition 6 (12/1/04)	The boiler exhaust stack shall not emit nitrogen oxides (NOx) in excess of 9 parts per million on a dry, volumetric basis corrected to 3% O_2 as determined by EPA Method 7E (40 CFR Part 60, Appendix A) or equivalent method approved by the Puget Sound Clean Air Agency.	II.A.2(t) Testing requirements for BOIL04	EPA Method 7E
EU 5.50	Order of Approval No. 9068 Condition 7 (12/1/04)	The boiler exhaust stack shall not emit carbon monoxide (CO) in excess of 50 parts per million on a dry, volumetric basis corrected to 3% O_2 as determined by EPA Method 10 (40 CFR Part 60, Appendix A)	II.A.2(t) Testing requirements for BOIL04	EPA Method 10

Reqmt. No.	Enforceable Requirement	Requirement Paraphrase (For Information Only)	Monitoring, Maintenance & Recordkeeping Method (See Section II)	Reference Test Method (See Section VIII)
		or equivalent method approved by the Puget Sound Clean Air Agency.		
EU 5.51	Order of Approval No. 9068 Condition 8 (12/1/04)	The opacity of emissions from the boiler shall not exceed 5% for a period or periods aggregating more than 3 minutes in any 1 hour, as determined by Washington Department of Ecology (Ecology) Method 9A.	II.A.2(t) Testing requirements for BOIL04	WA Department of Ecology Method 9A
g) Requirements No. EU 5.52 and EU 5.53 are the Puget Sound Clean Air Agency adoption of 40 CFR Part 60 and 63.				
EU 5.52	Puget Sound Clean Air Agency Reg. I Section 6.11 (09/25/02) Puget Sound Clean Air Agency Reg. I: 3.25 (9/22/05)	Adopts 40 CFR 60 by reference; specific requirements are listed elsewhere in the permit.	NMR	
EU 5.53	Puget Sound Clean Air Agency Reg III: 2:02 (9/26/02) Puget Sound Clean Air Agency Reg. I: 3.25 (9/22/05)	Adopts 40 CFR 63 by reference; specific requirements are listed elsewhere in the permit.	NMR	

DESCRIPTION OF REFERENCE TEST METHODS:

Ecology Method 9A =	Visual Determination of Opacity Emissions
EPA Method 10 =	Determination of Carbon Monoxide Emissions
EPA Method 7E =	Determination of Nitrogen Oxide Emissions

EXEMPTIONS, EXTENSIONS AND DETERMINATIONS GRANTED BY AGENCIES:

	Source	Description
1.	Puget Sound Clean Air Agency	Letter dated September 13, 2004, from Steve Van Slyke, Puget Sound Clean Air Agency, to Jeff KenKnight, EPA, regarding reduction in recordkeeping for BOIL04 fuel usage records maintained pursuant to 40 CFR 60.48c(g). See Attachment 25.

6. Waste Water Treatment Operations

DESCRIPTION: *This emission unit consists of all activities and equipment associated with waste water treatment operations, including chemical and physical treatment methods, storage, material and waste handling, and air emission control equipment. This site will not receive process wastewaters from offsite that are subject to the 40 CFR 63.680 Subpart DD, NESHAP for Off-Site Waste and Recovery Operations.*

Bldg.	*Col./Dr.*	*MSS/ID*	*Order of Approval No.*	*Install Date*	*Source Description*
4-79	*Outside, west*	*None*	*7455*	*1998*	*900 cfm groundwater air stripper*
4-83	*Outside*	*SF0013*	*2551*	*1987*	*2000 cfm process wastewater air stripper*
5-50,	*Outside, east*	*SF0031,*	*2894*	*1990*	*2000 cfm process wastewater air stripper*

Data in italics are for information only and are not enforceable conditions of this permit.

COMPLIANCE REQUIREMENTS:

Reqmt. No.	Enforceable Requirement	Requirement Paraphrase (For Information Only)	Monitoring, Maintenance & Recordkeeping Method (See Section II)
Requirements No. 6.1 through 6.2 are the Puget Sound Clean Air Agency requirements for the wastewater treatment facility.			
EU 6.1	Puget Sound Clean Air Agency Reg I: 7.09(b) (9/12/96) This requirement will be superseded upon adoption of the 9/10/1998 version of Reg I, Section 7.09(b) into the SIP Puget Sound Clean Air Agency Reg I, 7.09(b) (9/10/98) *(State Only) This requirement shall become federally enforceable upon adoption into the SIP and will replace the 9/12/96 version of Reg I, Section 7.09(b)*	Develop and implement an Operation and Maintenance Plan to assure continuous compliance with Puget Sound Clean Air Agency Regulations I, II, and III.	II.B Operation and Maintenance (O&M) Plan Requirements This monitoring method supersedes the monitoring method for this requirement listed in I.A.11
EU 6.2	Puget Sound Clean Air Agency Reg I: 9.20(a) (6/9/88) RCW 70.94.152(7) 1996 (State Only)	Maintain equipment in good working order that has received an NOC Order of Approval	II.A.1(c) Facility Inspections

Reqmt. No.	**Enforceable Requirement**	**Requirement Paraphrase** (For Information Only)	**Monitoring, Maintenance & Recordkeeping Method** (See Section II)
Requirement No. EU 6.3 is the Order of Approval No. 7455 requirement that applies to the air stripper at the wastewater treatment facility.			
EU 6.3	Puget Sound Clean Air Agency Order of Approval No. 7455 (3) (07/09/98)	The annual average flow rate of groundwater through the air stripper shall no exceed 60 gallons per minute (gpm). Boeing shall record the number of gallons, as measured by two totalizes, on a monthly basis to calculate the annual average flow rate (gpm). These records shall be made available to PSAPCA personnel upon request. Records shall be maintained for 5 years.	II.A.2(c) Documentation on File

NMR = No Monitoring Required -- Monitoring is not required; however, if a noncompliant situation is observed, Boeing will initiate appropriate corrective action.

The following Order of Approval has been canceled and superseded by an amended Order of Approval:

Order of Approval No. 7455 dated July 9, 1998, cancels and supersedes Order of Approval 3426 dated February 25, 1990.

7. Cyclones, Baghouses, and Other Particulate Control Operations

DESCRIPTION: *This section includes all cyclones, baghouses, and other equipment, which exhaust to the outside and control particulate emissions from the various activities including carpentry, machining of metal or nonmetal parts, housecleaning, and wood shredding operations. For the purpose of defining an emission unit in this permit, each piece of equipment is considered a separate emission unit.*

Bldg.	*Col./Dr.*	*MSS/IDNo.*	*Order of Approval No.*	*Install Date*	*Source Description*
4-20	*Ext., E. wall*	*VS0001-3 VS0005,6*	*2130*	*1980*	*Vacuum System, Cyclone (5) - 475 cfm*
4-81	*A7.5*	*DUC108*	*5847*	*1995*	*Kevlar grind, Torit filter- 21000 cfm*
4-82	*Q5*	*DUC053*	*5974*	*1995*	*Kevlar saw and dry filter- 1500 cfm*
4-86	*D27*	*DUC099*	*7614*	*1999*	*Torit, Composite grind – 7800 cfm*
10-72	*Ext. W. wall*	*VS0012*	*Reg.*	*1979*	*Waste Separator -30 Tubular(Cyclone) -1250cfm*
10-72	*Ext. W wall*	*VS0044*	*Reg.*	*1982*	*Vacuum Producer & Bag Separator – 6000 cfmr*
4-45	*Outside*	*DUC201*	*Notified*	*2002*	*Sanding baghouse, exhausts indoor - 4000 cfm*

Note: Abbreviations: Ext. means exterior to the building, i.e. Outside. Dr. means door.

Data in italics are for information only and are not enforceable conditions of this permit.

COMPLIANCE REQUIREMENTS:

Reqmt. No.	Enforceable Requirement	Requirement Paraphrase (For Information Only)	Monitoring, Maintenance & Recordkeeping Method (See Section II)	Reference Test Method (See Section VIII)
(a) Requirement Nos. EU 7.1 through EU 7.4 are the Puget Sound Clean Air Agency O&M requirements for operating permit sources.				
EU 7.1	Puget Sound Clean Air Agency Reg I, 9.03 (9/08/1994) *This requirement will be superseded upon adoption of the 3/11/99 version of Reg I, 9.03 into the SIP* Puget Sound Clean Air Agency Reg. I, 9.03 (3/11/1999) *(State Only). This requirement will become federally enforceable upon adoption into the SIP and will replace the 9/08/94 version of Reg I, 9.03* WAC 173-400-040(1) (8/20/1993) *This requirement will be superseded upon adoption of the 9/15/01 version of WAC 173-400-040(1) into the SIP* WAC 173-400-040(1) *(9/15/01)(State Only). This requirement will become federally enforceable upon adoption into the SIP and will replace the 8/20/1993 version of WAC 173-400-040(1)*	Shall not emit air contaminants in excess of 20% opacity for more than 3 minutes per hour	II.A.2(d)(v) Cyclone, Baghouse and Dust Filter Maintenance II.A.1(b) Complaint Response II.A.1(c) Facility Inspections These monitoring methods supersede the monitoring method for this requirement listed in I.A.1	Ecology Method 9A (See Section VIII)

Reqmt. No.	Enforceable Requirement	Requirement Paraphrase (For Information Only)	Monitoring, Maintenance & Recordkeeping Method (See Section II)	Reference Test Method (See Section VIII)
EU 7.2	Puget Sound Clean Air Agency Reg I, 9.09(a) (2/10/1994) *This requirement will be superseded upon adoption of the 4/9/98 version of Reg I, 9.09 into the SIP* Puget Sound Clean Air Agency Reg I, 9.09 (4/09/1998) *(State Only) This requirement will become federally enforceable and will be effective in this table upon adoption of the 4/9/1998 version of Reg I, 9.09 into the SIP* WAC 173-400-060 (8/20/1993) *This requirement will be superseded upon adoption of the 9/15/01 version of WAC 173-400-060 upon its adoption into the SIP* WAC 173-400-060 (9/15/01) *(State Only). This requirement will become federally enforceable upon adoption into the SIP and will replace the 8/20/1993 version of WAC 173-400-060*	Shall not emit in excess of 0.05gr/dscf from equipment used in a manufacturing process and general process units, uncorrected for excess air	II.A.2(d)(v) Cyclone, Baghouse and Dust Filter Maintenance II.A.1(b) Complaint Response II.A.1(c) Facility Inspections These monitoring methods supersede the monitoring method for this requirement listed in I.A.2	Puget Sound Clean Air Agency Method 5 (See Section VIII)

Reqmt. No.	Enforceable Requirement	Requirement Paraphrase (For Information Only)	Monitoring, Maintenance & Recordkeeping Method (See Section II)	Reference Test Method (See Section VIII)
EU 7.3	Puget Sound Clean Air Agency Reg I: 7.09(b) *9/12/96 This requirement will be superseded upon adoption of the 9/10/1998 version of Reg I, 7.09(b) into the SIP* Puget Sound Clean Air Agency Reg I, 7.09(b) *9/10/98 (State Only) This requirement shall become federally enforceable upon adoption into the SIP and will replace the 9/12/96 version of Reg I, 7.09(b)*	Develop and implement an Operation and Maintenance Plan to assure continuous compliance with Puget Sound Clean Air Agency Regulations I, II, and III.	II.B Operation and Maintenance (O&M) Plan Requirements This monitoring method supersedes the monitoring method for this requirement listed in I.A.11	
EU 7.4	Puget Sound Clean Air Agency Reg I: 9.20(a) (6/9/88) RCW 70.94.152(7) 1996 State Only	Maintain equipment in good working order that has received an NOC Order of Approval.	II.A.2(d)(v) Cyclone, Baghouse and Dust Filter Maintenance II.A.1(c) Facility Inspections	
(b) Requirement No. EU 7.5 is the Order of Approval No. 5847 permit condition that applies to the dust collector system inside building 4-81 at column A7.5, MSS/Id No. DUC 108				
EU 7.5	Order of Approval No. 5847 (4) (3/7/95)	A gauge to indicate the static pressure differential across the exhaust filters will be installed and maintained for the dust collector. Within 90 days after beginning equipment operations, the acceptable range shall be clearly marked on or nearby the gage.	II.A.2(d)(v) Cyclone, Baghouse and Dust Filter Maintenance	

EXEMPTIONS, EXTENSIONS AND DETERMINATIONS GRANTED BY AGENCIES:

	Source	Description
1.	Puget Sound Clean Air Agency	Letter, June 22, 1995, Jay Willenberg, Puget Sound Clean Air Agency, to Janette Ramos, Boeing, exemption from registration granted/NOC not required for dust collector in building 4-82. See Attachment 14.
2.	Puget Sound Clean Air Agency	Notice of Construction Requirements for Scrubbers and Baghouses. Discusses what types of changes are considered "substantial alterations" for scrubbers and baghouses. Letter dated October 10, 2001, Steve M. Van Slyke to Jade Hudson, the Boeing Company. See Attachment 16.

8. Composite Processing Operations

DESCRIPTION: *This section includes all activities and equipment associated with composite processing operation. Products containing the styrene monomer are in body fillers in tools, and require no specific equipment.*

Bldg.	*Col./Dr.*	*MSS/ID*	*Order of Approval*	*Install Date*	*Source Description*
			8085	*4/19/00*	*Non-spray application of styrene containing products*

Data in italics are for information only and are not enforceable conditions of this permit.

COMPLIANCE REQUIREMENTS:

Reqmt. No.	**Enforceable Requirement**	**Requirement Paraphrase** (For Information Only)	**Monitoring, Maintenance & Recordkeeping Method** (See Section II)	**Reference Test Method** (See Section VIII)
EU 8.1	Puget Sound Clean Air Agency Reg I: 7.09(b) (9/12/96) *This requirement will be superseded upon adoption of the 9/10/1998 version of Reg I, 7.09(b) into the SIP* Puget Sound Clean Air Agency Reg I, 7.09(b) (9/10/98) *(State Only) This requirement shall become federally enforceable upon adoption into the SIP and will replace the 9/12/96 version of Reg I, 7.09(b)*	Develop and implement an Operation and Maintenance Plan to assure continuous compliance with Puget Sound Clean Air Agency Regulations I, II, and III.	II.B Operation and Maintenance (O&M) Plan Requirements This monitoring method supersedes the monitoring method for this requirement listed in I.A.11	
EU 8.2	Puget Sound Clean Air Agency Reg I: 9.20(a) (6/9/88) RCW 70.94.152(7) 1996 (State Only)	Maintain equipment in good working order that has received an NOC Order of Approval.	II.B Operation and Maintenance (O&M) Plan Requirements II.A.1(c) Facility Inspections	

Reqmt. No.	Enforceable Requirement	Requirement Paraphrase (For Information Only)	Monitoring, Maintenance & Recordkeeping Method (See Section II)	Reference Test Method (See Section VIII)
EU 8.3	Puget Sound Clean Air Agency Reg I, 9.03 (9/08/1994) *This requirement will be superseded upon adoption of the 3/11/99 version of Reg I, 9.03 into the SIP* Puget Sound Clean Air Agency Reg. I, 9.03 (3/11/1999) *(State Only). This requirement will become federally enforceable upon adoption into the SIP and will replace the 9/08/94 version of Reg I, 9.03* WAC 173-400-040(1) (8/20/1993) *This requirement will be superseded upon adoption of the 9/15/01 version of WAC 173-400-040(1) into the SIP* WAC 173-400-040(1) *(9/15/01)(State Only). This requirement will become federally enforceable upon adoption into the SIP and will replace the 8/20/1993 version of* WAC 173-400-040(1)	Shall not emit air contaminants in excess of 20% opacity for more than 3 minutes per hour	II.A.1(b) Complaint Response II.A.1(c) Facility Inspections These monitoring methods supersede the monitoring method for this requirement listed in I.A.1	Ecology Method 9A (See Section VIII)

Reqmt. No.	Enforceable Requirement	Requirement Paraphrase (For Information Only)	Monitoring, Maintenance & Recordkeeping Method (See Section II)	Reference Test Method (See Section VIII)
EU 8.4	Puget Sound Clean Air Agency Reg I, 9.09(a) (2/10/1994) *This requirement will be superseded upon adoption of the 4/9/98 version of Reg I, 9.09 into the SIP* Puget Sound Clean Air Agency Reg I, 9.09 (4/09/1998) *(State Only) This requirement will become federally enforceable and will be effective in this table upon adoption of the 4/9/1998 version of Reg I, 9.09 into the SIP* WAC 173-400-060 (8/20/1993) *This requirement will be superseded upon adoption of the 9/15/01 version of WAC 173-400-060 upon its adoption into the SIP* WAC 173-400-060 (9/15/01)) *(State Only). This requirement will become federally enforceable upon adoption into the SIP and will replace the 8/20/1993 version of WAC 173-400-060*	Shall not emit in excess of 0.05gr/dscf from equipment used in a manufacturing process and general process units, uncorrected for excess air.	II.A.1(b) Complaint Response II.A.1(c) Facility Inspections These monitoring methods supersede the monitoring method for this requirement listed in I.A.2	Puget Sound Clean Air Agency Method 5 (See Section VIII)

<table>
<tr><th>Reqmt. No.</th><th>Enforceable Requirement</th><th>Requirement Paraphrase (For Information Only)</th><th>Monitoring, Maintenance & Recordkeeping Method (See Section II)</th><th>Reference Test Method (See Section VIII)</th></tr>
<tr><td>EU 8.5</td><td>Puget Sound Clean Air Agency Regulation II: 3.08(b) (12/93)</td><td>It shall be unlawful to apply polyester resin, vinylester resin, gelcoat, or any other resin unless the operation is conducted inside an enclosed area that is registered with the Agency. The exhaust shall be vented to the atmosphere through a vertical stack. (See EU 8.7 through EU 8.9 for an alternate means of compliance with requirement for an enclosed area with a vertical stack.) Spray operations require a dry filter to control overspray.</td><td>II.A.1(d) Work Practice Inspection</td><td></td></tr>
<tr><td>EU 8.6</td><td>Puget Sound Clean Air Agency Regulation II: 3.08(f) (12/93)</td><td>Closed containers shall be used for storage or disposal of VOC-containing materials. Such containers shall be kept closed except when being cleaned or when materials are being added, mixed, or removed. Closed containers for solvent rag or paper disposal are required.</td><td>II.A.1(d) Work Practice Inspection</td><td></td></tr>
<tr><td colspan="5">As an Alternate Means of Compliance, as allowed by Regulation I, Section 3.23, to comply with Regulation II, Section 3.08(b) to conduct non-spray application of products containing styrene, outside of a spray enclosure, in areas other than enclosed, vertically exhausted booths throughout the facility shall comply with Requirements No. EU 8.7 through EU 8.9.</td></tr>
<tr><td>EU 8.7</td><td>Order of Approval No. 8085, (3) (4/19/2000)</td><td>Boeing Renton shall implement an odor compliant response procedure to handle any incoming odor complaints from the public and the action taken to resolve the odor complaint. Boeing shall provide these records to the Agency upon request.</td><td>II.A.1(b) Complaint Response</td><td></td></tr>
<tr><td>EU 8.8</td><td>Order of Approval No. 8085, (4) (4/19/2000)</td><td>For spray coating applications of polyester resin, vinylester resin, gelcoat, or any other resin, Boeing shall conduct these activities only in an enclosed booth vented to the ext. and equipped with a dry filter to control over spray.</td><td>II.A.1(d) Work Practice Inspection</td><td></td></tr>
</table>

Reqmt. No.	Enforceable Requirement	Requirement Paraphrase (For Information Only)	Monitoring, Maintenance & Recordkeeping Method (See Section II)	Reference Test Method (See Section VIII)
EU 8.9	Order of Approval No. 8085, (5) (4/19/2000)	Boeing Renton shall limit application of products containing styrene outside of a ventilated booth enclosure to brush or other hand-application methods.	II.A.1(d) Work Practice Inspection	

9. Motor Vehicle Fueling Operations

DESCRIPTION: *This section consists of all activities and equipment associated with motor vehicle fueling operations, including fuel receiving, fuel storage, fuel dispensing, and material and waste handling. The two gasoline stations at the facility consists of a three gasoline pumps and two underground storage tanks for gasoline. Gasoline throughput at the stations is less than 600,000 gallons annually.*

Bldg.	*Location.*	*MSS/ID No.*	*Order of Approval No.*	*Install Date*	*Source Description*
4-73	*Outside east*	*URE076*	*3485, 6061*	*1989*	*10,000 gallon underground tank gasoline dispensing, stage 1 and stage 2 VRE.*
5-02	*Outside south*	*URE075*	*3484*	*1989*	*2000 gallon underground tank, unleaded gasoline dispensing, stage 1 VRE.*

Data in italics are for information only and are not enforceable conditions of this permit.

COMPLIANCE REQUIREMENTS:

Reqmt. No.	Enforceable Requirement	Requirement Paraphrase (For Information Only)	Monitoring, Maintenance & Recordkeeping Method (See Section II)
EU 9.1	Puget Sound Clean Air Agency Reg II: 2.07(b) (2/10/94) *This requirement will be superseded upon adoption of the 12/09/99 version of Reg II: 2.07(b) into the SIP*	Boeing shall not cause or allow the transfer of gasoline from a transport tank into a stationary storage tank unless • The tank is equipped with a submerged fill pipe and a Stage 1 system that is CARB certified. • The transport tank is equipped to balance vapors. • All vapor return lines are connected between the transport tank and the stationary storage tank and the Stage 1 system is operating.	II.A.2(d)(viii) Gasoline Delivery Certification and Inspection II.A.2(c) Documentation on File

Reqmt. No.	Enforceable Requirement	Requirement Paraphrase (For Information Only)	Monitoring, Maintenance & Recordkeeping Method (See Section II)
EU 9.2	Puget Sound Clean Air Agency Reg II: 2.07(b) (12/09/99) (State Only) *This requirement will become federally enforceable upon adoption into the SIP and will replace the 2/10/94 version of II: 2.07(b)*	Boeing shall not cause or allow the transfer of gasoline from a transport tank into a stationary storage tank unless • The tank is equipped with a submerged fill pipe and a Stage 1 system that is CARB certified. • The Stage 1 system is visually inspected after each product delivery and any equipment found to be defective shall be repaired or replaced as soon as possible but no later than 7 days after the inspection.	II.A.2(d)(viii) Gasoline Delivery Certification and Inspection II.A.2(c) Documentation on File
EU 9.3	Puget Sound Clean Air Agency Reg. II: 2.08(b) (6/13/1991) *This requirement will be superseded upon adoption of the 12/9/99 version of Reg. II: 2.07(b) into the SIP*	Current inspection sticker must be displayed on transport tank vehicle or current leak test certification for transport tank must be on file prior to filling storage tank	II.A.2(d)(viii) Gasoline Delivery Certification and Inspection
EU 9.4	Puget Sound Clean Air Agency Reg. II: 2.08(d)(1) (6/13/91) *This requirement will be superseded upon adoption of the 12/9/99 version of Reg. II: 2.07(b) into the SIP*	Vapor recovery system operated during transfer so gasoline vapor < LEL	II.A.2(d)(viii) Gasoline Delivery Certification and Inspection
EU 9.5	Puget Sound Clean Air Agency Reg. II: 2.08(d)(2) (6/13/91) *This requirement will be superseded upon adoption of the 12/9/99 version of Reg. II: 2.07(b) into the SIP*	No liquid leaks > 3 drops/minute during transfer and no more than 10 ml of liquid drainage per disconnect	II.A.2(d)(viii) Gasoline Delivery Certification and Inspection

Reqmt. No.	Enforceable Requirement	Requirement Paraphrase (For Information Only)	Monitoring, Maintenance & Recordkeeping Method (See Section II)
EU 9.6	Puget Sound Clean Air Agency Reg I: 7.09(b) (9/12/96) *This requirement will be superseded upon adoption of the 9/10/1998 version of Reg I, 7.09(b) into the SIP* Puget Sound Clean Air Agency Reg I, 7.09(b) (9/10/98) *(State Only) This requirement shall become federally enforceable upon adoption into the SIP and will replace the 9/12/96 version of Reg I, 7.09(b)*	Develop and implement an Operation and Maintenance Plan to assure continuous compliance with Puget Sound Clean Air Agency Regulations I, II, and III.	II.B Operation and Maintenance (O&M) Plan Requirements This monitoring method supersedes the monitoring method for this requirement listed in I.A.11
EU 9.7	Puget Sound Clean Air Agency Reg I: 9.20 (6/9/88)	Maintain equipment in good working order.	II.A.2(d)(viii) Gasoline Delivery Certification and Inspection II.A.1(c) Facility Inspections These monitoring methods supersede the monitoring method for this requirement listed in I.A.10
EU 9.8	RCW 70.94.152(7) 1996 (State Only)	Maintain equipment in good working order that has received an Order of Approval.	II.A.1(c) Facility Inspections II.A.2(d)(viii) Gasoline Delivery Certification and Inspection

NOC Order of Approval No. 6061, gasoline station at URE076, near building 4-73.			
EU 9.9	Puget Sound Clean Air Agency Order of Approval No. 6061 (4) (8/30/95)	In accordance with Regulation 3.23, Boeing is hereby granted approval of an 'Alternate Means of Compliance', with PSAPCA Regulation II, Section 2.07(e)(3), as specified in Condition No. 5, EU 9.10.	NMR
EU 9.10	Puget Sound Clean Air Agency Order of Approval No. 6061 (5) (8/30/95)	Boeing shall inspect all bellows-type nozzles on a monthly basis, and if determined to be defective, the bellows-type nozzle will be taken out of service until replaced or repaired.	II.A.2(d)(viii) Gasoline Delivery Certification and Inspection

The following Orders of Approval have been canceled and superseded by amended Orders of Approval:

Order of Approval No. 6061 dated August 30, 1995, cancels and supersedes Order of Approval No. 6061 dated July 7, 1995.

10. Storage Tanks

DESCRIPTION: *This section consists of the storage tanks listed below that have been permitted under a Notice of Construction and/or are subject to 40 CFR Part 60 Subpart Kb. For the purpose of defining an emission unit in this permit, each tank listed below is considered a separate emission unit.*

Bldg.	*Location.*	*MSS/IDNo.*	*Order of Approval No.*	*Install Date*	*Source Description*
4-89	*Outside, West*	*ARE183*	*4678*	*1992*	*160,000 gal. tank, No. 6 Fuel oil backup*
4-89	*Outside, West*	*ARE128*	*Reg.*	*1986*	*12,000 gal. tank, diesel fuel for transportation*
5-45	*Apron C fuel farm*	*URE077-80*	*4253*	*1991*	*40,000 gal. tanks (4), underground, Jet A fuel*
5-45	*Apron C*	*URE081*	*4255*	*1993*	*15,000 gal. tank, underground, diesel for transportation*
5-45	*Apron C*	*URE082*	*4254*	*1993*	*15,000 gal. tank, underground, recycled Jet A*
5-50		*URE086*	*Reg.*	*1962*	*25,000 gal. tank, underground, diesel fuel for boilers*

Data in italics are for information only and are not enforceable conditions of this permit.

COMPLIANCE REQUIREMENTS:

Reqmt. No.	**Enforceable Requirement**	**Requirement Paraphrase** (For Information Only)	**Monitoring, Maintenance & Recordkeeping Method** (See Section II)
(a) Requirement Nos. EU 9.1 and 9.2 are the Standards of Performance for Volatile Organic Liquid Storage Vessels. These requirements only apply to all storage tanks which are subject to regulation under 40 CFR 60 Subpart Kb. From the above list, the tanks subject to 40 CFR 60 Subpart Kb are: ARE183, ARE128, URE077-80, URE081, URE083-85, and URE082.			
EU 10.1	40 CFR 60.116b(a) (12/14/00)	Records required under 40 CFR 60.116b(b) shall be kept for the life of the source.	II.A.2(c) Documentation on File
EU 10.2	40 CFR 60.116b(b) (12/14/00)	Boeing shall keep readily accessible records showing the dimensions of the storage vessel and analysis showing the capacity of the storage vessel.	II.A.2(c) Documentation on File

Reqmt. No.	Enforceable Requirement	Requirement Paraphrase (For Information Only)	Monitoring, Maintenance & Recordkeeping Method (See Section II)
(b) Requirements Nos. EU 10.3 and EU 10.4 are the Puget Sound Clean Air Agency general requirements.			
EU 10.3	Puget Sound Clean Air Agency Reg I: 7.09(b) (9/12/96) *This requirement will be superseded upon adoption of the 9/10/1998 version of Reg I, 7.09(b) into the SIP* Puget Sound Clean Air Agency Reg I, 7.09(b) (9/10/98) *(State Only) This requirement shall become federally enforceable upon adoption into the SIP and will replace the 9/12/96 version of Reg I, 7.09(b)*	Develop and implement an Operation and Maintenance Plan to assure continuous compliance with Puget Sound Clean Air Agency Regulations I, II, and III.	II.B Operation and Maintenance (O&M) Plan Requirements This monitoring method supersedes the monitoring method for this requirement listed in I.A.11
EU 10.4	Puget Sound Clean Air Agency Reg I: 9.20(a) (6/9/88) RCW 70.94.152(7) 1996 State Only	Maintain equipment in good working order that has received an NOC Order of Approval.	II.A.2(d)(iii) Above Ground Fuel Storage Tank *Note: this method applies only for above-ground tanks* II.A.1(c) Facility Inspections

11. Wood Furniture Manufacturing

DESCRIPTION: *This section consists of wood furniture manufacturing activities. These activities have been permitted under a Notice of Construction and/or are subject to 40 CFR Part 63 Subpart JJ. For the purpose of defining an emission unit in this permit, each piece of equipment listed below is considered a separate emission unit.*

Bldg.	*Col/Dr*	*MSS/ID#*	*Order of Approval #*	*Date Installed*	*Source Description*
4-45	*B3*	*NA*	*NA*	*2002*	*Facilities Carpentry Shop*
4-45	*D2*	*PB0087*	*8703*	*2002*	*Facilities Paint Shop*

Data in italics are for information only and are not enforceable conditions of this permit.

APPLICABLE REQUIREMENTS:

Reqmt. No.	**Enforceable Requirement**	**Requirement Paraphrase** (For Information Only)	**Monitoring, Maintenance & Recordkeeping Method** (See Section II)
40 CFR 63 Subpart JJ			
EU 11.1	40 CFR 63.800(a) (6/3/97)	Renton shall maintain purchase or usage records demonstrating that the source meets the definition in 63.801.	II.A.2(q) Wood furniture manufacture

12. Stationary Reciprocating Internal Combustion Engines Subject to 40 CFR Part 63, subpart ZZZZ

DESCRIPTION: This section includes all stationary reciprocation internal combustion engines that are affected sources for the Reciprocating Internal Combustion Engine (RICE) NESHAP, 40 CFR 63 Subpart ZZZZ.

Bldg.	*Col./Dr.*	*MSS/ID#*	*Order of Approval #*	*Install Date*	*Source Description*
4-89	*Outside*	*EG0042*	*9084*	*2005*	*Caterpillar Model 3456 diesel fired emergency stationary generator rated at 764 hp.*
10-82		*EG0013*			*513 hp emergency generator*
10-80		*EG0045*	*9487*		*779 hp emergency generator*

Data in italics are for information only and are not enforceable conditions of this permit.

APPLICABLE REQUIREMENTS:

Reqmt. No.	Enforceable Requirement	Requirement Paraphrase (For Information Only)	Monitoring, Maintenance & Recordkeeping Method (See Section II)
a) Requirement Nos. EU 12.1 through 12.3 discuss RICE NESHAP applicability for existing, new, and reconstructed emergency RICE			
EU 12.1	40 CFR 63.6585 (6/15/04)	Owners or operators of stationary RICE at a major source of HAP emissions (except if the stationary RICE is being tested at a stationary RICE test cell/stand) are subject to Subpart ZZZZ.	NMR
EU 12.2	40 CFR 63.6590(a) (6/15/04)	An affected source is any existing, new, or reconstructed stationary RICE with a site-rating of more than 500 brake horsepower.	NMR
EU 12.3	40 CFR 63.6590(a)(1-3) (6/15/04)	A stationary RICE is existing if it commenced construction or reconstruction before Dec. 19, 2002. A stationary RICE is new if it commenced construction on or after Dec. 19, 2002. A stationary RICE is reconstructed if it meets the definition of reconstruction in 40 CFR 63.2 and reconstruction is commenced on or after December 19, 2002.	NMR

Reqmt. No.	Enforceable Requirement	Requirement Paraphrase (For Information Only)	Monitoring, Maintenance & Recordkeeping Method (See Section II)
b) Requirement No. EU 12.4 is the NESHAP provision that applies to existing emergency RICE (EG0013 and EG0015)			
EU 12.4	40 CFR 63.6590(b)(3) (6/15/04)	An existing emergency stationary RICE does not have to meet the requirements of Subpart ZZZZ and of Subpart A. No initial notification is required.	NMR
c) Requirements Nos. EU 12.5 through EU 12.7 are the NESHAP provisions that apply to new and reconstructed stationary emergency RICE (EG0042 and EG0045)			
EU 12.5	40 CFR 63.6590(b)(1)(i) (6/15/04)	New or reconstructed emergency stationary RICE do not have to meet the requirements of this subpart and of subpart A of 40 CFR Part 63 except for the initial notification requirements of 40 CFR 63.6645(d).	II.A.2(c) Documentation on File
EU 12.6	40 CFR 63.6645(d) (6/15/04)	If you are required to submit an initial notification but are otherwise not affected by the requirements of this subpart, in accordance with 40 CFR 63.6590(b), the notification should include the information in 40 CFR 63.9(b)(2)(i) through (v), and a statement that the stationary RICE has no additional requirements and explain the basis of the exclusion (for example, that it operates exclusively as an emergency stationary RICE).	NMR
d) Requirements No. 12.7 and 12.8 are General Notification Requirements, 40 CFR 63 Subpart A			
EU 12.7	40 CFR 63.9(b)(4)-(5) (5/30/03)	Boeing shall notify the Puget Sound Clean Air Agency according to 40 CFR 63.9(b)(4)-(5) if it constructs or reconstructs a new affected source.	NMR
EU 12.8	40 CFR 63.9(j) (5/30/03)	Notification requirements. Any change in information already provided under 40 CFR 63.9 shall be sent to the Puget Sound Clean Air Agency within 15 days.	NMR
e) Requirements No. 12.9 through 12.12 are Puget Sound Clean Air Agency requirements.			

Reqmt. No.	Enforceable Requirement	Requirement Paraphrase (For Information Only)	Monitoring, Maintenance & Recordkeeping Method (See Section II)
EU 12.9	Puget Sound Clean Air Agency Reg I: 9.03 (9/08/1994) *This requirement will be superseded upon adoption of the 3/11/99 version of Reg I: 9.03 into the SIP* *Puget Sound Clean Air Agency Reg. I: 9.03 (3/11/1999) (State Only). This requirement will become federally enforceable upon adoption into the SIP and will replace the 9/08/94 version of Reg I: 9.03* WAC 173-400-040(1) (8/20/1993) *This requirement will be superseded upon adoption of the 9/15/01 version of WAC 173-400-040(1) into the SIP* *WAC 173-400-040(1) (9/15/01) (State Only). This requirement will become federally enforceable upon adoption into the SIP and will replace the 8/20/1993 version of WAC 173-400-040(1)*	Shall not emit air contaminants in excess of 20% opacity for more than 3 minutes per hour	II.A.1(a) Opacity Monitoring II.A.1(b) Complaint Response II.A.1(c) Facility Inspections II.A.2(d)(ix) Emergency Generators subject to RICE These monitoring methods supersede the monitoring method for this requirement listed in I.A.1

Reqmt. No.	Enforceable Requirement	Requirement Paraphrase (For Information Only)	Monitoring, Maintenance & Recordkeeping Method (See Section II)
EU 12.10	Puget Sound Clean Air Agency Reg I: 7.09(b) (9/12/96) *This requirement will be superseded upon adoption of the 9/10/1998 version of Reg I, 7.09(b) into the SIP* Puget Sound Clean Air Agency Reg I, 7.09(b) *9/10/98 (State Only) This requirement shall become federally enforceable upon adoption into the SIP and will replace the 9/12/96 version of Reg I, 7.09(b)*	Boeing shall develop and implement an O&M plan to assure continuous compliance with Puget Sound Clean Air Agency Regulations I, II, and III.	II.B Operation and Maintenance (O&M) Plan Requirements This monitoring method supersedes the monitoring method for this requirement listed in I.A.11
EU 12.11	Puget Sound Clean Air Agency Reg I: 9.20 (6/88) RCW 70.94.152(7) (1996) State only	Maintain equipment in good working order.	II.A.2(d)(ix) Emergency Generators subject to RICE II.A.1(a) Opacity Monitoring II.A.1(c) Facility Inspections These monitoring methods supersede the monitoring method for this requirement listed in I.A.10
EU 12.12	Puget Sound Clean Air Agency Reg III: 2:02 (9/26/02) Puget Sound Clean Air Agency Reg. I: 3.25 (9/22/05)	Adopts 40 CFR 63 by reference; specific requirements are listed elsewhere in the permit.	NMR

Reqmt. No.	Enforceable Requirement	Requirement Paraphrase (For Information Only)	Monitoring, Maintenance & Recordkeeping Method (See Section II)
f) Requirements Nos. EU 12.13 and 12.14 are the Order of Approval 9084 permit conditions that apply to emergency generator EG0042.			
EU 12.13	Order of Approval No. 9084, (3) (11/11/04)	The generator shall meet the definition of an emergency stationary reciprocating internal combustion engine in 40 CFR 63.6675, including being operated no more than 50 hours per year in non-emergency non-maintenance service.	II.A.2(u) Emergency Stationary RICE II.A.2(c) Documentation on File
EU 12.14	Order of Approval No. 9084, (5) (11/11/04)	The generator shall burn diesel fuel with a maximum of 500 ppm sulfur	II.A.2(v) RICE fuel sulfur content II.A.2(c) Documentation on File
g) Requirement Nos. EU 12.15 and 12.16 are the Order of Approval 9487 permit conditions that apply to emergency generator EG0045.			
EU 12.15	Order of Approval No. 9487, (3) (8/11/06)	The generator shall be operated only to provide emergency electric power to the 10-80 building during an electrical supply outage, and up to 50 hours per year for the purpose of maintenance checks and readiness testing, provided that the tests are recommended by the manufacturer, the vendor, or the insurance company associated with the engine.	II.A.2(u) Emergency Stationary RICE II.A.2(c) Documentation on File
EU 12.16	Order of Approval No. 9487, (5) (8/11/06)	The diesel-electric generator set shall burn diesel fuel with a maximum of 15 ppm sulfur.	II.A.2(v) RICE fuel sulfur content II.A.2(c) Documentation on File

C. Operations without Specific Applicable Requirements

DESCRIPTION: *This section contains insignificant emission units as defined in WAC 173-401 and other equipment and activities that do not have specific applicable requirements as listed elsewhere in this permit. Insignificant emission units that are categorically exempt under WAC 173-401-532 are not listed in this section. This section includes:*

- Ventilating systems, including fume hoods, not designed to prevent or reduce air contaminant emissions.
- Fuel burning equipment that has a maximum input rate of:
  - less than 0.5 million Btu per hour (0.15 million joules per second) burning waste-derived fuel; or
  - less than 10 million Btu per hour (3 million joules per second) burning natural gas, propane, or butane; or
  - less than 1 million Btu per hour (0.3 million joules per second) burning any other fuel
- Insecticide, pesticide, or fertilizer spray equipment
- Internal combustion engines less than the size thresholds of the proposed United States Environmental Protection Agency (EPA) New Source Performance Standards (NSPS) 40 CFR Part 60 Subpart FF (Stationary Internal Combustion Engines, 44 CFR 43152 7/23/79) or the promulgated EPA NSPS 40 CFR Part 60 Subpart GG (Stationary Gas Turbines)
- Laboratory equipment used exclusively for chemical or physical analyses
- Laundry dryers without control equipment
- Dryers or ovens used solely to accelerate evaporation
- Routing, turning, carving, cutting, and drilling equipment used for metal, wood, plastics, rubber, leather, or ceramics which does not release air contaminants to the ambient air
- Storage tanks:

  (A) that do not store substances capable of emitting air contaminants; or

  (B) with a rated capacity of 1,000 gallons (3,780 liters) or less used for storage of gasoline; or

  (C) with a rated capacity of less than 10,000 gallons (38,000 liters) used for storage of volatile organic compounds; or

  (D) with a rated capacity of less than 40,000 gallons (150,000 liters) used for storage of volatile organic compounds with a true vapor pressure less than 0.01 kPa (0.002 psia

- Sanitary or storm drainage systems

- Welding, brazing, or soldering equipment
- Asphalt roofing and laying equipment (not including manufacturing or storage)
- Restaurants and other retail food-preparing establishments
- Cold solvent cleaners using a solvent with a true vapor pressure less than or equal to 4.2 kPa (0.6 psia)
- Retail printing operations (not including web presses)
- Spray painting or blasting equipment used at a temporary location to clean or paint bridges, water towers, buildings, or similar structures
- Any source that has been determined through review by the Control Officer not to warrant a "Notice of Construction and Application for Approval," due to the minimal amount and nature of air contaminants produced and potential to contribute to air pollution, with special reference to effects on health, economic and social factors, and physical effects on property
- Metal forming (pull-out, tube bending, and hydraulic forming press), metal joining or metal separating operations
- Manufacturing research and development, quality control and product testing operations
- Detail part assembly
- Wipe solvent cleaning for non-aerospace parts
- Aqueous and emulsion cleaning
- Non-styrene composite processing
- Groundwater remediation operations
- Accumulation and collection of hazardous waste other than for aerospace parts manufacture
- Material and waste handling, except as listed elsewhere in this permit
- Chemical mixing
- Curing ovens
- Solvent cleaning of non-aerospace or non-motor vehicle parts
- Spray gun cleaning equipment used for non-aerospace or non-motor vehicle parts
- Small industrial vacuum systems that vent ext.
- Touch-up spray, hand-held aerosol can spray, of non-aerospace or non-motorized vehicle parts ext. of a booth
- Remote reservoir solvent cleaners

- Miscellaneous abrasive blast units not requiring an Order of Approval
- Paint mixing
- Paint mixing room ventilation
- Hand applied alodine
- Boric Sulfuric Acid Anodize systems
- Alodine systems
- Engraving, including laser engraving of aluminum
- Storage tanks not regulated under 40 CFR Part 60 Subpart K, Ka, or Kb

Emission units and activities that are defined as insignificant on the basis of size or production rate in accordance with WAC 173-401-533 are listed below:

Regulatory Citation		IEU Present at the Facility?	
WAC 173-401-533	Description	Yes	No
(2)(a)	Operation, loading and unloading of storage tanks and storage vessels, with lids or other appropriate closure and less than two hundred sixty gallon capacity (35 cft), heated only to the minimum extent to avoid solidification if necessary.	X	
(2)(b)	Operation, loading and unloading of storage tanks, not greater than one thousand one hundred gallon capacity, with lids or other appropriate closure, not for use with hazardous air pollutants (HAPs), maximum (max.) vp 550mm Hg.	X	
(2)(c)	Operation, loading and unloading of VOC storage tanks (including gasoline storage tanks), ten thousand gallons capacity or less, with lids or other appropriate closure, vp not greater than 80mm Hg at 21°C.	X	
(2)(d)	Operation, loading and unloading storage of butane, propane, or liquefied petroleum gas (LPG), storage tanks, vessel capacity under forty thousand gallons.	X	
(2)(e)	Combustion source less than five million Btu/hr. exclusively using natural gas, butane, propane and/or LPG.	X	
(2)(f)	Combustion source, less than five hundred thousand Btu/hr., using any commercial fuel containing less than 0.4% by weight sulfur for coal or less than 1% by weight sulfur for other fuels.	X	
(2)(g)	Combustion source, of less than one million Btu/hr. if using kerosene, No. 1 or No. 2 fuel oil.		X

Regulatory Citation		IEU Present at the Facility?	
WAC 173-401-533	Description	Yes	No
(2)(h)	Combustion source, not greater than five hundred thousand Btu/hr. if burning used oil and not greater than four hundred thousand Btu/hr. if burning waste wood or waste paper.		X
(2)(i)	Welding using not more than one ton per day of welding rod.	X	
(2)(j)	Foundry sand molds, unheated and using binders with less than 0.25% free phenol by sand weight.		X
(2)(k)	"Parylene" coaters using less than five hundred gallons of coating per year.		X
(2)(l)	Printing and silk-screening, using less than two gallon/day of any combination of the following: Inks, coatings, adhesives, fountain solutions, thinners, retarders, or nonaqueous cleaning solutions.		X
(2)(m)	Water cooling towers and ponds, not using chromium-based corrosion inhibitors, not used with barometric jets or condensers, not greater than ten thousand gpm, not in direct contact w/ gaseous or liquid process streams containing regulated air pollutants.	X	
(2)(n)	Combustion turbines, of less than 500 HP.	X	
(2)(o)	Batch solvent distillation, not greater than fifty-five gallons batch capacity.	X	
(2)(p)	Municipal and industrial water chlorination facilities of not greater than twenty million gallons per day capacity. The exemption does not apply to waste water treatment.		X
(2)(q)	Surface coating, using less than two gallons per day.	X	
(2)(r)	Space heaters and hot water heaters using natural gas, propane or kerosene and generating less than five million Btu/hr.	X	
(2)(s)(i)	Tanks, vessels, and pumping equipment, with lids or other appropriate closure for storage or dispensing of aqueous solutions of inorganic salts, bases and acids excluding 99% or greater H2SO4 or H3PO4.	X	
(2)(s)(ii)	Tanks, vessels, and pumping equipment, with lids or other appropriate closure for storage or dispensing of aqueous solutions of inorganic salts, bases and acids excluding 70% or greater HNO3.	X	
(2)(s)(iii)	Tanks, vessels, and pumping equipment, with lids or other appropriate closure for storage or dispensing of aqueous solutions of inorganic salts, bases and acids excluding 30% or greater HCl.	X	
(2)(s)(iv)	Tanks, vessels, and pumping equipment, with lids or other appropriate closure for storage or dispensing of aqueous solutions of inorganic salts, bases and acids excluding more than one liquid phase where the top phase is more than one percent VOCs.	X	

Regulatory Citation WAC 173-401-533	Description	IEU Present at the Facility?	
		Yes	No
(2)(t)	Equipment used exclusively to pump, load, unload or store high boiling organic material, material with initial boiling point (IBP) not less than 150°C. or vapor pressure (vp) not more than 5mm Hg at 21°C. with lids or other appropriate closure.	X	
(2)(u)	Smokehouses under twenty square feet.		X
(2)(v)	Milling and grinding activities, using paste-form compounds with less than one percent VOCs.	X	
(2)(w)	Rolling, forging, drawing, stamping, shearing, or spinning hot or cold metals.	X	
(2)(x)	Dip coating operations, using materials with less than one percent VOCs.		X
(2)(y)	Surface coating, aqueous solution or suspension containing less than one percent VOCs.	X	
(2)(z)	Cleaning and stripping activities and equipment, using solutions having less than one percent VOCs by weight. On metallic substrates, acid solutions are not considered for listing as insignificant.	X	
(2)(aa)	Storage and handling of water based lubricants for metal working where the organic content of the lubricant is less than ten percent.	X	
(2)(bb)	Municipal and industrial waste water chlorination facilities of not greater than one million gallons per day capacity.		X

Data in italics are for information only and are not enforceable conditions of this permit.

COMPLIANCE REQUIREMENTS:

No emission unit specific federally enforceable requirements apply other than generally applicable requirements of the state implementation plan. Generally applicable requirements of the state implementation plan are those federally enforceable requirements that apply universally to all emission units or activities without reference to specific types of emission units or activities. General requirements of Section I.A. apply.

INAPPLICABLE REQUIREMENTS:

The following requirements do not apply to paint gun cleaners, cleaners with vapor pressure less than or equal to 0.6 psia, or cleaners used exclusively on non-metal parts, per Attachment 10. Remote reservoir cleaners using solvent are not considered regulated cold solvent cleaners.

Requirement	Description and Justification
1) Puget Sound Clean Air Agency Reg. III: 3.05 (8/90)	Solvent metal cleaner rules.
2) WAC 173-460-060(5)(1/94)	Same as Puget Sound Clean Air Agency Reg III: 3.05(a)

II. MONITORING, MAINTENANCE AND RECORDKEEPING PROCEDURES

A. *Minimum Monitoring and Maintenance Requirements*

Boeing must follow the applicable requirements listed below when referenced by an applicable requirement from Section I.A or I.B of this permit. The tests performed to satisfy the requirements of any monitoring method under Section II of this permit are monitoring tests and are not considered "compliance tests" for purposes of Section V.N.(1)(iii)of this permit. [WAC 173-401-615, 10/17/02]

1. Facility-Wide Monitoring

(a) Opacity Monitoring

Boeing shall conduct visible emission inspections of the facility at least once per calendar quarter. Inspections are to be performed while the facility is in operation during daylight hours. If during a quarterly visible emissions inspection, visible emissions other than uncombined water are observed from a single unit or activity, Boeing shall as soon as practicable but within 24 hours of the initial observation:

- Take corrective action, which may include shutting down the unit or activity until it can be repaired, until there are no visible emissions (or until the unit or activity is demonstrated to be in compliance with all applicable opacity limitations in the permit using the reference test method); or,

- Determine the opacity using the reference test method, or

- Observe for a minimum of 15 minutes, or until visible emissions have been observed for a total of 45 seconds, whichever is a shorter period. If visible emissions other than uncombined water are observed from a single unit or activity lasting longer than 45 seconds during a 15 minute interval, Boeing may continue to observe visible emissions for an additional 45 minutes or until visible emissions have been observed for a total of 3 minutes in the hour, whichever is a shorter period. If visible emissions are observed for a total of 3 minutes during the 60 minute observation, or if visible emissions have been observed for a total of 45 seconds during the 15 minute observation and Boeing did not elect to continue the visible emission inspection as described above, Boeing shall, as soon as practicable but within 24 hours of the initial observation either;

    - Take corrective action, which may include shutting down the unit or activity until it can be repaired, until there are no visible emissions (or until the unit or activity is demonstrated to be in compliance with all applicable opacity limitations in the permit using the reference test method); or,

    - Alternatively, determine the opacity using the reference test method.

Failure to take action as described above must be reported under Section V.M Compliance certifications or V.Q Reporting of this permit.

If Boeing observes visible emissions from an emergency generator or generator for fire suppression pumps, Boeing shall check to make sure that the generator is operated and maintained properly and either shut it down within 3 hours or observe visible emissions using WDOE Method 9A within 30 days.

All observations using the opacity reference test method shall be reported according to V.Q.4 Method 9A Reports.

[WAC 173-401-615(1)(b), 10/17/02]

(b) Complaint Response

Boeing shall record and commence an investigation of air pollution complaints as soon as practicable, but no later than three working days after receipt by Boeing. Boeing shall identify complaints regarding these emissions as follows:

i. Any emissions that are, or likely to be, injurious to human health, plant or animal life, or property, or which unreasonably interfere with enjoyment of life and property; or

ii. Any fugitive dust emissions, or

iii. Any track-out onto paved roads open to the public, or

iv. Any emissions of odor-bearing air contaminants, or

v. Complaints regarding other applicable requirements.

Boeing shall investigate the complaint and determine if there was noncompliance with an applicable requirement of this permit. If it is determined that there is such noncompliance, Boeing shall as soon as practicable but no later than within 24 hours of determination of noncompliance, either correct the problem, shut down the noncompliant operation until it is repaired or corrected, or report according to Section V.Q.5 Report of Problems not Corrected Within 24 hours. Failure to investigate the complaint as described above is a deviation of this permit. If noncompliance is determined, failure to either correct the noncompliance, shut down the unit or activity within 24 hours, or report according to Section V.Q.5 Report of Problems not Corrected Within 24 hours is a deviation of this permit and must be reported under Section V.M Compliance certifications or V.Q Reporting of this permit. [WAC 173-401-615(1)(b), 10/17/02]

(c) Facility Inspections

Boeing shall conduct a facility inspection at least once per calendar quarter. These inspections shall include checking for prohibited activities under Section III of the permit and activities that require additional approval under Section IV of the permit. The inspections shall also examine the general state of compliance with the facility-wide applicable requirements and the general effectiveness of the Operation & Maintenance (O&M) Plan.

Boeing shall, as soon as practicable but no later than 24 hours after identification, correct any potential compliance problems with respect to applicable requirements for which this section II.A.1(c) is an applicable monitoring method for significant emission units or activities identified by these quarterly inspections, or any other time, shut down the unit or activity until the problem can be corrected, or report according to Section V.Q.5 Report of Problems not Corrected Within 24 hours. If Boeing observes potential compliance problems for which there are no monitoring requirements under an applicable requirement and corrects that problem within 24 hours, Boeing does not need to report the deviation under Section V.M Compliance certifications or V.Q Reporting and does not need to record such action under Section V.O.1.4 of this permit. Boeing shall also promptly repair defective insignificant emission units.

[WAC 173-401-615(1)(b), 10/17/02]

(d) Work Practice Inspection

Boeing shall conduct facility-wide inspections of work practice activities that are applicable requirements at least once per calendar quarter. Work practices shall be randomly sampled during the facility-wide inspection and observed for consistency with permit requirements. Boeing shall, as soon as practicable but within 24 hours of identification, correct any potential compliance problems with respect to applicable requirements for which this section II.A.1(d) is an applicable monitoring method identified by these quarterly inspections, or any other time, shut down the unit or activity to which the work practice applies until the problem can be corrected, or report according to Section V.Q.5 Report of Problems not Corrected Within 24 hours. If Boeing observes potential compliance problems for which there are no monitoring requirements under an applicable requirement and corrects that problem within 24 hours, Boeing does not need to report the deviation under Section V.M Compliance certifications or V.Q Reporting and does not need to record such action under Section V.O.1.4 of this permit, except that deviations from the spray gun cleaning requirements under 40 CFR 63.744(c) must be reported in the Aerospace NESHAP semi-annual report in accordance with Section V.Q.3(b)(3). Examples of such requirements that do not have monitoring requirements include, but are not limited to 40 CFR 63.744(a)(1) (EU 3. 33) *Place cleaning solvent-laden cloth, paper or any other absorbent applicator used for cleaning in bags or other closed containers upon completing their use*, and 40 CFR 63.744(a)(3) (EU 3. 36) *Handling and transfer of cleaning solvents conducted in a manner to minimize spills.* For the purpose of determining compliance with the work practice requirements of 40 CFR 63.744(a)(1) (EU 3. 33) for solvent rag management, "completing their use" means upon completion of the cleaning operation, before leaving for a break, or the end of a shift, whichever comes first.

[WAC 173-401-615(1)(b), 10/17/02]

(e) Maintenance and Repair of Insignificant Emission Units

Boeing shall use good industrial practices to maintain insignificant emission units. For such equipment[1], Boeing shall also promptly repair defective equipment or alternatively shutdown the unit until the defective equipment can be repaired. Records under Section V.O.1.4 are not required for such equipment except when such equipment is inspected under II.A.1(c) Facility Inspections and a problem requiring prompt repair is discovered during the inspection.

[WAC 173-401-615(1)(b), 10/17/02]

(f) Fugitive Dust, Track-Out, and Odor Bearing Contaminants

Boeing shall conduct inspections of the facility for odor bearing contaminants and emissions of any air contaminant in sufficient quantities and of such characteristics and duration as is, or is likely to be, injurious to human health, plant or animal life, or property, or which unreasonably interfere with enjoyment of life and property at least once per calendar quarter. Boeing shall also conduct inspections to monitor for fugitive dust and track-out from the facility at least once per calendar quarter. If a deviation from the applicable requirements identified in this permit for which this section II.A.1(f) is an applicable monitoring method is observed during a quarterly inspection, or any other time, Boeing shall within 24 hours of identification implement corrective actions to eliminate the deviation promptly, shut down, the unit or activity at which the deviation occurs until the deviation can be corrected, or report according to Section V.Q.5 Report of Problems not Corrected Within 24 hours.

[WAC 173-401-615(1)(b), 10/17/02]

2. Specific Monitoring

In this section, if any equipment is not in use during the specified monitoring period, then no monitoring is required for that time period[2] and the absence of monitoring is not a permit deviation.

(a) Approval by the Puget Sound Clean Air Agency, via NOC/Order of Approval

Boeing has presented the pertinent information to the Puget Sound Clean Air Agency via a Notice of Construction/Application for Approval (NOC) and the Puget Sound

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[1] Puget Sound Clean Air Agency Regulation I, Section 1.07(s) states, "EQUIPMENT means any stationary or portable device or any part thereof that emits or may emit any air contaminant into the atmosphere."

[2] *See Attachment 22 for clarification of weekly and monthly frequencies.*

Clean Air Agency has issued an Order of Approval indicating approval of this operation or activity. Boeing shall remain in compliance with the Order of Approval. [WAC 173-401-615(1)(b), 10/17/02]

(b) VOC Content Monitoring and Recordkeeping Procedure

Boeing shall maintain manufacturer's Materials Safety Data Sheets (MSDS), or other manufacturer-supplied data on the VOC content of Commercial Aerospace Primers (BMS 10-11, Type I) and Topcoats (BMS 10-11, Type II), Aerospace Temporary Protective Coatings, Corrosion Inhibiting Compound (CIC) coatings used on aerospace parts, and motor vehicles/mobile equipment coatings. Boeing shall maintain a list of the coatings described above that are used on site. Boeing shall update this list at least annually. Boeing shall make this information available to the Puget Sound Clean Air Agency upon request. [WAC 173-401-615(1)(b), 10/17/02]

(c) Documentation on File

Boeing shall maintain documents in its files for at least five years from the date of record, which demonstrate compliance with the requirement. Boeing shall make the documents available to the Puget Sound Clean Air Agency upon request. [WAC 173-401-615(1)(b), 10/17/02]

(d) Equipment Maintenance

Boeing shall, at a minimum, perform all the following maintenance activities at the frequency specified below.

(i) ***Enclosed Gun Cleaning System Maintenance***

Boeing shall visually inspect the seals and all other potential sources of leaks associated with each enclosed gun spray cleaner system at least once per month. Each inspection shall occur while the system is in operation. If leaks are found during the monthly inspection, repairs shall be made as soon as practicable, but no later than 15 days after the leak was found. If the leak is not repaired by the 15th day after detection, the cleaning solvent shall be removed, and the enclosed cleaner shall be shut down until the leak is repaired or its use is permanently discontinued. [40 CFR 63.744(c)(1)(ii), 9/1/98, 40 CFR 63.751(a), 12/8/00]

(ii) ***Spray Booth Maintenance***

- For dry booths, Boeing shall check the primary[3] dry filter systems, where visible, for proper seating and complete coverage over the exhaust plenum. For wet booths, Boeing shall check for a continuous curtain coverage, visible water flow, or adequate water flow meter reading. If the inspection is required by an Order of Approval permit condition, the inspection shall be conducted according to the frequency specified in the Order of Approval. Otherwise, the inspection shall be conducted at least monthly or at time of use if booth is used less frequently than once per month, except as provided under Section V.P Data recovery of this permit. If filter or curtain coverage is acceptable for all inspections of a particular booth for a one-year period, the inspection frequency for that booth may be reduced to once per calendar quarter. If coverage is unacceptable during quarterly inspections, monthly inspections shall be reinstated and Boeing shall, as soon as practicable but within 24 hours of the initial observation correct filter or curtain coverage, shut down the unit or activity until it can be repaired, or report according to Section V.Q.5 Report of Problems not Corrected Within 24 hours. Failure to take action as described above is a deviation of this permit and must be reported under Section V.M Compliance certifications or V.Q Reporting of this permit.

- Where required by an order of approval permit condition, a pressure drop transmitter or gauge shall be installed to measure the pressure drop across the booth's exhaust filters. The acceptable pressure drop range shall be marked on or nearby the gauge or on a pressure drop log. A record that the pressure drop was in the acceptable range shall be made according to the frequency specified in the order of approval condition or at least once monthly if not specified in the order of approval. If the pressure drop is not within the acceptable range, Boeing shall, as soon as practicable but within 24 hours of the initial observation correct the pressure drop, shut down the unit or activity until it can be repaired, or report according to Section V.Q.5 Report of Problems not Corrected Within 24 hours. Failure to take action as described above is a deviation of this permit and must be reported under Section V.M Compliance certifications or V.Q Reporting of this permit.

- Where an order of approval or underlying requirement requires installation of specific type of filters, at least annually, check to see if the correct filters are installed.

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[3] On booths with no other applicable requirements, the primary filter is the visible filter. On booths with applicable requirements the primary filter is the filter that meets the efficiencies specified in the requirement. If a multi-stage filtration system is used to meet the required efficiencies, the primary filter is the visible filter that is part of the multistage system used to meet the required efficiency.

[WAC 173-401-615(1)(b), 10/17/02]

(iii) ***Above Ground Fuel Storage Tank Maintenance***

Boeing shall visually check for leakage of material at least semiannually. [WAC 173-401-615(1)(b), 10/17/02]

(iv) ***Boiler Maintenance***

- Boeing shall check for visible emissions (exclusive of uncombined water vapor) quarterly when burning gas.

- When natural gas is not available or is not being used due to economic reasons, Boeing shall check for visible emissions within 24 hours each time that it burns fuel oil during daylight hours and at least once per week when burning oil for more than seven consecutive days. If during the above monitoring visible emissions other than uncombined water are observed from a single unit or activity, Boeing shall, as soon as practicable but within 24 hours of the initial observation:

  (1) Take corrective action, which may include shutting down the unit or activity until it can be repaired, until there are no visible emissions (or until the unit or activity is demonstrated to be in compliance with all applicable opacity limitations in the permit using the reference test method) or,

  (2) Determine the opacity using the reference test, or

  (3) Observe for a minimum of 15 minutes, or until visible emissions have been observed for a total of 45 seconds, whichever is a shorter period. If visible emissions other than uncombined water are observed from a single unit or activity lasting longer than 45 seconds during a 15 minute interval, Boeing may continue to observe visible emissions for an additional 45 minutes or until visible emissions have been observed for a total of 3 minutes in the hour, whichever is a shorter period. If visible emissions are observed for a total of 3 minutes during the 60 minute observation, or if visible emissions have been observed for a total of 45 seconds during the 15 minute observation, and Boeing did not elect to continue the visible emission inspection as described above, Boeing shall, as soon as practicable but within 24 hours of the initial observation either;

  (1) Take corrective action, which may include shutting down the unit or activity until it can be repaired, until there are no visible emissions (or until the unit or activity is demonstrated to be in compliance with all applicable opacity limitations in the permit using the reference test method); or

(2) Alternatively, determine the opacity using the reference test method.

- Failure to take action as described above must be reported under Section V.M Compliance certifications or V.Q Reporting of this permit.
- All observations using the opacity reference test method shall be reported according to V.Q.4 Method 9A Reports.

[WAC 173-401-615(1)(b), 10/17/02]

(v) *Cyclone, Baghouse and Dust Filter Maintenance*

Boeing shall inspect the cyclones, baghouses, vacuum pumps, and abrasive blast booths, which exhaust to the outside atmosphere, as described below. If the inspection is required by an NOC order of approval permit condition, the inspection shall be conducted according to the frequency specified in the Order of Approval. Otherwise, Boeing shall inspect each unit at least monthly, except as provided under Section V.P Data recovery of this permit. However Boeing may reduce the inspection frequency to at least once per calendar quarter if the unit is rated at 2000 cfm or less.

- Boeing shall conduct visible emission inspections of the control equipment. Inspections are to be performed while the equipment is in operation during daylight hours. If during such inspections visible emissions other than uncombined water are observed from equipment, Boeing shall, as soon as practicable but within 24 hours of the initial observation:
  - Take corrective action, which may include shutting down the unit or activity until it can be repaired, until there are no visible emissions (or until the unit or activity is demonstrated to be in compliance with all applicable opacity limitations in the permit using the reference test method); or
  - Determine the opacity using the reference test method, or
  - Observe for a minimum of 15 minutes, or until visible emissions have been observed for a total of 45 seconds, whichever is a shorter period. Observations for visible emissions shall be at 15-second intervals. If visible emissions other than uncombined water are observed from a single unit or activity lasting longer than 45 seconds during a 15 minute interval, Boeing may continue to observe visible emissions for an additional 45 minutes or until visible emissions have been observed for a total of 3 minutes in the hour, whichever is a shorter period. If visible emissions are observed for a total of 3 minutes during the 60 minute observation, or if visible emissions have been observed for a total of 45 seconds during the 15 minute observation, and Boeing did not elect to continue the visible emission

inspection as described above, Boeing shall, as soon as practicable but within 24 hours of the initial observation either:

  - Take corrective action, which may include shutting down the unit or activity until it can be repaired, until there are no visible emissions (or until the unit or activity is demonstrated to be in compliance with all applicable opacity limitations in the permit using the reference test method); or,

  - Alternatively, determine the opacity using the reference test method

- Failure to take action as described above, observing opacity above the standard, or not shutting down the unit or activity within 24 hours is a deviation of this permit and must be reported under Section V.M Compliance certifications or V.Q Reporting of this permit.

- All observations using the opacity reference test method shall be reported according to V.Q.4 Method 9A Reports.

- Boeing shall check for evidence of fugitive dust or fallout from the equipment or the exhaust stack. If the fugitive dust or fallout from the equipment or the exhaust stack is observed, Boeing shall, as soon as practicable but no later than within 24 hours of observation, correct the problem, shut down the operation until it is repaired or corrected, or report according to Section V.Q.5 Report of Problems not Corrected Within 24 hours. Failure to take action as described above is a deviation of this permit and must be reported under Section V.M Compliance certifications or V.Q Reporting of this permit. Where required by an Order of Approval condition, a pressure drop transmitter or gauge shall be installed to measure the pressure drop across the booth's exhaust filters. The acceptable pressure drop range shall be marked on, nearby the gauge, or on a pressure drop log. A record that the pressure drop was in the acceptable range shall be made according to the frequency specified in the Order of Approval condition or at least once per month if not specified in the Order of Approval.

- If the pressure drop is not within the acceptable range, Boeing shall, as soon as practicable but within 24 hours of the initial observation correct the pressure drop, shut down the unit or activity until it can be repaired, or report according to Section V.Q.5 Report of Problems not Corrected Within 24 hours. Failure to take action as described above is a deviation of this permit and must be reported under Section V.M Compliance certifications or V.Q Reporting of this permit.

- If a pressure differential gauge is required by an Order of Approval condition, then the range shall be established using the manufacturer's recommendations or the low end of the range will be no less than 50 percent of the pressure differential when operating with a clean filter or cyclone and the high end shall be a value based on the operational experience and will be a value below that at which the filters or bags would reasonably be expected to fail.

[WAC 173-401-615(1)(b), 10/17/02]

(vi) ***Laboratory Tankline Scrubber Maintenance***

Boeing shall inspect the packed bed wet scrubbers used to control emissions from laboratory tankline operations as follows:

- At least once each month, except as provided under Section V.P Data recovery of this permit, inspect the pump for proper operation. If during inspection or any other time, Boeing discovers that the pump is not operating properly, resulting in a potential compliance problem with respect to an applicable requirement for which this section II.A.2(d)(vi) is an applicable monitoring method, Boeing shall, within 24 hours after identification, correct the problem, shutdown the operation, or report according to Section V.Q.5 Report of Problems not Corrected Within 24 hours. If Boeing corrects pump problems within 24 hours of initial observation or shuts down the unit or activity within 24 hours until it is repaired or corrected, Boeing docs not need to report the deviation under Section V.M Compliance certifications or V.Q Reporting of this permit.

- At least once each month, except as provided under Section V.P Data recovery of this permit, inspect for visible emissions exclusive of uncombined water vapor while the scrubber is in operation. Inspections are to be performed while the scrubber is in operation during daylight hours. If during such inspections visible emissions other than uncombined water are observed from a single unit or activity, Boeing shall, as soon as practicable but within 24 hours of the initial observation:

  i) Take corrective action, which may include shutting down the unit or activity until there are no visible emissions; (or until the unit or activity is demonstrated to be in compliance with all applicable opacity limitations in the permit using the reference test method); or

  ii) Determine the opacity using the reference test method, or

  iii) Observe for a minimum of 15 minutes, or until visible emissions have been observed for a total of 45 seconds, whichever is a shorter period. Observations for visible emissions shall be at 15-second intervals. If visible emissions other than uncombined water are observed from a single unit or activity lasting longer than 45 seconds during a 15 minute interval, Boeing may continue to observe visible emissions for an additional 45 minutes or until visible emissions have been observed for a total of 3 minutes in the hour, whichever is a shorter period. If visible emissions are observed for a total of 3 minutes during the 60 minute observation, or if visible emissions have been observed for a total of 45 seconds during the 15 minute observation, and Boeing did not elect to continue the visible emission inspection as described above, Boeing shall, as soon as practicable but within 24 hours of the initial observation either;

- Take corrective action, which may include shutting down the unit or activity until it can be repaired, until there are no visible emissions (or until the unit or activity is demonstrated to be in compliance with all applicable opacity limitations in the permit using the reference test method); or,.
- Alternatively, determine the opacity using the reference test method.

For scrubbers which recirculate fluid, at least once each calendar quarter check that the pH of the scrubber recirculation fluid is between 4 and 10. If the pH is not within the acceptable range, Boeing shall, as soon as practicable but within 24 hours of the initial observation take corrective action to bring the pH to between 4 and 10, shut down the unit or activity until it can be repaired, or report according to Section V.Q.5 Report of Problems not Corrected Within 24 hours.

Once each calendar quarter, inspect the nozzles for pluggage and even flow patterns. If sufficient plugged nozzles or uneven flow patterns that could cause violation of applicable emission standards are observed, Boeing shall, as soon as practicable but within 24 hours of the initial observation correct the problem, shut down the unit or activity until it can be repaired, or report according to Section V.Q.5 Report of Problems not Corrected Within 24 hours.

All observations using the opacity reference test method shall be reported according to V.Q.4 Method 9A Reports.

Where required by an Order of Approval condition, a pressure drop transmitter or gauge shall be installed to measure the pressure drop across the scrubber. The acceptable pressure drop range shall be marked on, nearby the gauge, or on a pressure drop log. A record that the pressure drop was in the acceptable range shall be made according to the frequency specified in the Order of Approval condition or at least once per month if not specified in the Order of Approval. If the pressure drop is not within the acceptable range, Boeing shall, as soon as practicable but within 24 hours of the initial observation; correct the pressure drop, shut down the unit or activity until it can be repaired or corrected, or report according to Section V.Q.5 Report of Problems not Corrected within 24 hours.Failure to take corrective action as described above must be reported under Section V.M Compliance certifications or V.Q Reporting of this permit.

[WAC 173-401-615(1)(b), 10/17/02]

(vii) ***Vapor Degreasers Maintenance***

Note that additional vapor degreaser inspection requirements are identified in II.A.2(l) "Vapor Degreaser Closed Cover", II.A.2(m) "Vapor Degreaser Hoist Speed" and II.A.2(n) "Air Blanket Center Temperature", as applicable.

Boeing shall inspect the vapor degreasers for the following:

1) Leaks: Once each month, except as provided under Section V.P Data recovery of this permit, inspect the vapor degreaser for leaks. Maintain records of the date of inspection, condition of the degreaser, and any deficiencies noted, and any corrective actions taken to correct deficiencies. Once eight consecutive month's worth of records indicating no deficiencies have been collected, inspections and recordkeeping may switch to quarterly. If leaks are observed, Boeing shall, as soon as practicable but within 24 hours of the initial observation correct the problem, shut down the unit or activity until it can be repaired, or report according to Section V.Q.5 Report of Problems not Corrected Within 24 hours. [Puget Sound Clean Air Agency Regulation III Section 3.05 (8/9/90)]

2) Thermostat and Liquid level Controls: Once each year check for proper operation of the high vapor thermostat control, and the low liquid level control. If the high vapor thermostat control or the low liquid level control switches are not operating properly, Boeing shall, as soon as practicable but within 24 hours of the initial observation correct the problem, shut down the unit or activity until it can be repaired, or report according to Section V.Q.5 Report of Problems not Corrected Within 24 hours. [Puget Sound Clean Air Agency Regulation III Section 3.05 (8/9/90)]

3) Room Windspeed: Once each year monitor the windspeed above the degreaser, by the following method. Measure the windspeed within 6 inches above the top of the freeboard area of the solvent cleaning machine using the following procedure. Determine the direction of the wind current by slowly rotating a velometer or similar device until the maximum speed is located. Orient a velometer in the direction of the wind current at each of the four corners of the machine. Record the reading for each corner. Average the values obtained at each corner and record the average wind speed. [Puget Sound Clean Air Agency Regulation III Section 3.05 (8/9/90)]

   If the average wind speed is more than 14.2 meters per minute (50 fpm), Boeing shall, as soon as practicable but within 24 hours of the initial observation correct the problem, shut down the unit or activity until it can be repaired, or report according to Section V.Q.5 Report of Problems not Corrected Within 24 hours.

[WAC 173-460-050 (c)(1-94); Puget Sound Clean Air Agency Regulation III Section 3.05 (8/9/90)]

4) If Boeing corrects such problems as described above as soon as practicable but within 24 hours, Boeing does not need to report the deviation under Section V.M Complinace certifications or V.Q Reporting.

Failure to take corrective action as described above must be reported under Section V.M Compliance certifications or V.Q Reporting of this permit.

[WAC 173-401-615(1)(b), 10/17/02]

(viii) ***Gasoline Delivery Certification and Inspection***

Boeing shall visually inspect the Stage 1 system after each product delivery. Any equipment found to be defective (e.g., loose caps or adapters, stuck poppet valves, damaged gaskets) shall be repaired or replaced as soon as possible, but no later than seven days after the inspection. [Puget Sound Clean Air Agency Regulation II, Section 2.07(b)(2), 12/9/99]Gasoline Stage II Pump

Stage 2 vapor recovery equipment shall be visually inspected for equipment defects (e.g. torn bellows, mini-booths, or hoses, leaking spouts, swivels or hoses, missing latch coils, stiff swivels) once per month. Any defective equipment shall be taken out of service until repaired. [Order of Approval No. 6061 (08/95)].

(ix) ***Emergency Generators subject to RICE***

Boeing shall use good industrial practices to maintain emergency generators subject to the requirements of 40 CFR 63 Subpart ZZZZ. For such equipment, Boeing shall also promptly repair defective equipment or alternatively shutdown the unit until the defective equipment can be repaired. Failure to take corrective action as described above must be reported under Section V.M Compliance certifications or V.Q Reporting of this permit.

[WAC 173-401-615(1)(b), 10/17/02]

(e) Purchase Specification

Boeing's fuel oil contract for the delivery of oil burned in fuel burning equipment shall specify that the fuel must meet the specifications listed in Puget Sound Clean Air Agency Regulation I, Section 9.08(a), and the specifications discussed in Orders of Approval. [WAC 173-401-615(1)(b), 10/17/02; Order of Approval 6190 (9/20/95)]

(f) Fuel Oil Sulfur Content Monitoring Procedure

For fuel oil used at BOIL05, the supplier shall provide a certification that the sulfur content of the fuel is no more than 0.5% by weight. [Order of Approval No. 6190 (9/20/95)]

For all other fuel oil deliveries, Boeing's fuel oil contract shall specify that only fuel oil with a sulfur content not greater than 2% be delivered to the site. [WAC 173-401-615(1)(b), 10/17/02]

(g) Aerospace NESHAP Solvent Cleaner Monitoring and Recordkeeping Procedure

Boeing shall record the name, vapor pressure, and documentation showing the organic HAP constituents of each affected cleaning solvent used for affected cleaning operations. [40 CFR 63.752(b)(1) , 9/1/98]

For each cleaning solvent used in the hand-wipe cleaning operation at the facility that complies with the composition requirements specified in 63.744(b)(1) or for semi-aqueous cleaning solvents used for flush cleaning, Boeing shall record the name, data and calculations demonstrating the solvent complies with the compositions requirements, and annual records of the volume of each solvent used. Boeing shall demonstrate compliance with solvent composition using manufacturer's data per 63.750(a). The hand-wipe cleaning operation means collectively all hand-wipe cleaning operations. Flush cleaning operations means collectively all flush cleaning operations. [40 CFR 63.752(b)(2) , 9/1/98]

For each cleaning solvent used in the hand-wipe cleaning operation at the facility that does not comply with the composition requirements in 63.744(b)(1) but does comply with the vapor pressure requirement of 63.744(b)(2), Boeing shall record the name, composite vapor pressure, the vapor pressure test results, data, or calculations used to determine the composite vapor pressure, and the amount in gallons of each cleaning solvent used each month at the Boeing facility. [40 CFR 63.752(b)(3) , 9/1/98]

For cleaning solvents that do not meet the composition or vapor pressure requirements and are used for the exempt hand-wipe cleaning operation, Boeing shall record the name and the amount of each cleaning solvent used each month for the collective exempt cleaning operation. Boeing shall maintain a list of the exempt processes to which the exempt hand-wipe cleaning operation applies. [40 CFR 63.752(b)(4), 9/1/98]

The test methods and procedures included in 40 CFR 63.750(a) and (b) shall be used for composition and vapor pressure determinations, as applicable. [40 CFR 63.750(a) and (b), 10/17/00]

(h) Aerospace NESHAP Coating Monitoring and Recordkeeping Procedure

Boeing shall maintain the following records on the Aerospace NESHAP regulated primers and topcoats (such as primers like BMS 10-11 type I, some 10-72 primers, some uses of 10-103; topcoats like BMS 10-11 type II, 10-60 types I and II, and 10-72) used at the site. These procedures do not apply to specialty, touch-up, repair, and other specialty coatings exempt per 40 CFR 63.741(f) or to low volume coatings exempt per 40 CFR 63.741(g).

(i) For uncontrolled primers and topcoats that meet the HAP and VOC content limits without averaging, the name of each primer and topcoat; the VOC content as received and as applied; the mass of organic HAP emitted per unit volume as applied (less water) as calculated using the procedures specified in 63.750(c); the mass of VOC emitted per unit volume as applied (less water and exempt solvents) as calculated using the procedures specified in 63.750(e), and all data, calculations, and test results used in determining the HAP and VOC contents; and the volume of each coating category of formulation used each month. [40CFR 63.752(c)(2), 9/1/98]

(ii) For "low HAP content" uncontrolled primers with organic HAP content less than or equal to 250 g/l and VOC content less than or equal to 250 g/l, the name of each primer and topcoat, the VOC content as received and as applied, annual purchase records of the total volume of each primer purchased, and all data, calculations, and test results used in determining the organic HAP and VOC contents. [40CFR 63.752(c)(3), 9/1/98]

(iii) For primers and topcoats complying with the organic HAP or VOC content level by averaging, the name of each primer and topcoat, the VOC content as received and as applied, the monthly volume-weighted average masses of organic HAP and VOC emitted per unit volume of coating as applied as determined by the procedures specified in 63.750(d) and (f), and all data, calculations, and test results used in determining the values. [40CFR 63.752(c)(4), 9/1/98]

Boeing shall comply using methods defined in 40 CFR 63.745(e) if applicable. [40CFR 63.745(e), 12/8/00]

(i) Aerospace NESHAP Pressure Drop/Water Flow Rate Monitoring and Recordkeeping Procedure

(i) For affected spray coating operations when inorganic HAPs are sprayed, unless the primers or topcoats have inorganic HAP concentration less than 0.1 % for carcinogens and 1.0 % for non-carcinogens, Boeing shall install a pressure gauge or water flow meter to continuously monitor:

- The pressure drop across dry particulate filter systems while aerospace primer or topcoat application operations are occurring, or

- The water flow rate of water wash systems while aerospace primer or topcoat application operations are occurring,

[40 CFR 63.751(c), 12/8/00]

(ii) Boeing shall read and record the pressure drop or water flow rate once each shift of operation on a log in accordance with 40 CFR 63.751(c) and 63.752(d) when spraying primer or topcoat with inorganic HAP regulated under 40 CFR 63.745(g), unless the primers or topcoats have inorganic HAP concentration less than 0.1 % for carcinogens and 1.0 % for non-carcinogens. [40 CFR 63.752(d), 9/1/98]

If the recorded pressure drop exceeds or falls below the acceptable limits established by Boeing or the filter manufacturer, as applicable, Boeing shall shut down the operation and take corrective action. If the recorded water flow rate is less than or falls below the acceptable limits established by Boeing or the booth manufacturer, as applicable, Boeing shall shut down the operation and take corrective action.

The operation can be resumed when pressure drop or water flow rate is returned within the specified limits. The corrective actions shall include investigating if the activity occurring at the time of the reading included activities regulated under 40 CFR 63.745(g). Boeing shall assume that the activity was regulated under 40 CFR 63.745(g) unless Boeing can demonstrate by a preponderance of the evidence otherwise. Acceptable limits shall be documented on the log. [40 CFR 63.745(g), 12/8/00]

(iii) The acceptable range for water flow rate shall be established using manufacturer's recommendations or the range will be based on the volume of water that has been shown through operational experience to obtain a continuous water curtain.

(iv) When the Aerospace NESHAP requires that the pressure drop across the exhaust filters be monitored and recorded once per shift, the pressure drop range shall be established using either the manufacturer's recommendations or shall be based on providing adequate air flow while maintaining filter integrity based on the specific design of the system. If the manufacturer's recommendations are not utilized, the pressure drop shall be established as follows:

- The low end of the range, with the exception of filter banks which have a clean filter pressure drop less than or equal to 0.03 inches of water, will be established at no less than 50 percent of the clean filter value. For filter banks which have a clean filter pressure drop less than or equal to 0.03 inches of water, the low end of the range may be set at zero.

- The high end will be established based on operational experience to allow for adequate air flow in the specific paint booth or hangar, but no higher than the point at which the filter will fail.
- If the manufacturer's recommendations are not utilized, all equipment malfunctions shall be immediately reported to supervisory personnel, or the malfunctioning dry filter booth shall be shut down.

[40 CFR 63.745(g), 12/8/00; 40 CFR 63.743(b), 3/27/98]

(v) For dry filter spray booths where Aerospace NESHAP primers and topcoats containing inorganic HAPs are sprayed, unless the primers or topcoats have inorganic HAP concentrations less than 0.1 % for carcinogens and 1.0 % for non-carcinogens:

- Install NESHAP-compliant filters in booths where inorganic HAPs are applied to aerospace parts.
- Check to see that the pressure gauge functions properly and the pressure drop range is labeled on the log sheets at least quarterly.

[40 CFR 63.745(g), 12/8/00]

(vi) For water wash booths where Aerospace NESHAP primers and topcoats containing inorganic HAPs are sprayed, unless the primers or topcoats have inorganic HAP concentrations less than 0.1% for carcinogens and 1.0% for non-carcinogens:

- If a water flowmeter is required, check to see that the meter functions properly and the flow range is labeled on the log sheet. This inspection shall be done monthly and,
- Malfunctions as defined by 40 CFR 63.2 causing the flow to be .outside of the range on the log sheet, or causing noncontinuous water curtain coverage shall be reported immediately to supervisory personnel, or the malfunctioning water wash booth shall be shut down.

[40 CFR 63.745(g), 12/8/00]

(j) Averaging Scheme for Exterior Commercial Primer and Topcoat

(i) Boeing may use any combination of uncontrolled primers, including waterborne primers, at one or more emission units, within that same facility, where aerospace exterior commercial priming operations occur that are subject to 40 CFR 63.745(c), provided that:

(a) The monthly volume-weighted average organic HAP content of the combination of exterior commercial primers does not exceed 650 g/liter (less water); and

(b) The monthly volume-weighted average VOC content of the combination of exterior commercial primers does not exceed 650 g/liter (less water and exempt solvents).

[40 CFR 63.752(c)(4), 9/1/98]

(ii) (a) Boeing shall maintain records of the monthly volume-weighted average mass of organic HAP emitted per unit volume of primer as applied (less water) (Ha) for all exterior commercial primers for which averaging is used to meet the HAP content limit (as determined by the procedures specified in 40 CFR 63.750(d)); and all data and calculations used to determine Ha for each emission unit for which Boeing wishes to use this averaging scheme to demonstrate compliance with the HAP content limit. [40CFR 63.752(c)(4), 9/1/98]

(b) Boeing shall maintain records of the monthly volume-weighted average mass of VOC emitted per unit volume of primer as applied (less water and exempt solvents) (Ga) for all exterior commercial primers for which averaging is used to meet the VOC content limit (as determined by the procedures specified in 40 CFR 63.750(f)); and all data and calculations used to determine Ga for each emission unit for which Boeing wishes to use this averaging scheme to demonstrate compliance with the VOC content limit. [40CFR 63.752 (c)(4), 9/1/98]

(c) If before the beginning of any calendar month Boeing enters into a log that a specific emission unit or units will only use exterior commercial primers with organic HAP content that does not exceed 650 g/liter (less water) and makes that log available to Puget Sound Clean Air Agency personnel upon request, then Boeing does not need to follow Condition No. 2(a) for that month or months. [WAC 173-401-650(1), 11/4/93]

(d) If before the beginning of any calendar month Boeing enters into a log that a specific emission unit or units will only use exterior commercial primers with VOC content that does not exceed 650 g/liter (less water and exempt solvents) and makes that log available to Puget Sound Clean Air Agency personnel upon request, Boeing does not need to follow Condition No. 2(b) for that month or months. [WAC 173-401-650(1), 11/4/93]

(k) Aerospace NESHAP Depainting Monitoring and Recordkeeping Procedure

The following monitoring and recordkeeping requirements apply if Boeing depaints more than six completed aircraft in a calendar year. An aircraft is counted as depainted if it has all the fuselage, wings, vertical stabilizers and horizontal stabilizers connected as one assembled unit and has had paint chemically removed from substantially all of the outer surface of either the fuselage, or wings, or horizontal stabilizers, or vertical stabilizers.

(i) For sources complying with 40 CFR 63.746(b)(3), must determine volume of organic HAP-containing chemical strippers or alternatively the weight of organic HAP used per aircraft using the procedures specified in 40 CFR 63.750(j)(1) through (3). [40 CFR 63.750(j), 10/17/00]

(ii) For all chemical strippers used in depainting operations subject to 40 CFR 63.746, record the name of each chemical stripper and the monthly volumes of each organic HAP containing stripper used or monthly weight of organic HAP-material used for spot stripping and decal removal. [40 CFR 63.752(e)(4), 9/1/98]

(iii) For each type of aircraft depainted, record a listing of the parts, subassemblies, and assemblies normally removed from the aircraft before depainting. Prototype, test model or aircraft that exist in low numbers are exempt from this requirement. [40 CFR 63.752(e)(4), 9/1/98]

(iv) For spot stripping and decal removal, record the volume of organic HAP-containing chemical stripper or weight of organic HAP used, the annual average volume or organic HAP-containing chemical stripper or weight of organic HAP used per aircraft, the annual number of aircraft stripped, and all data and calculations used. [40 CFR 63.752(e)(6), 9/1/98]

(l) Vapor Degreaser Closed Cover

Boeing shall conduct a visual inspection monthly to determine if the cover is opening and closing properly, completely covers the cleaning machine openings when closed, an is free of cracks, holes, and other defects. An exceedance of the Closed Cover occurs when the cover is found not to completely cover the cleaning machine opening when closed or has a crack, hole or other defect and is not corrected within 15 days of detection. If Boeing corrects the problem within 15 days of detection or shuts down the degreaser within 15 days of detection until it is repaired, Boeing does not need to report the problem under Section V.M Compliance certifications or V.Q Reporting. [40 CFR 63.466(b)(1), 12/3/99]

(m) Vapor Degreaser Hoist Speed

Boeing shall determine the hoist speed monthly by measuring the time it takes for the hoist to travel a measured distance. The speed is equal to the distance in meters divided by the time in minutes (meters per minute). If after a year of monitoring, no exceedances of the hoist speed are measured, Boeing may begin monitoring the hoist speed quarterly. If an exceedance of the hoist speed occurs during quarterly monitoring, the monitoring frequency returns to monthly until another year of compliance without an exceedance is demonstrated. [40 CFR 63.466(c), 12/3/99; Puget Sound Clean Air Agency Regulation III Section 3.05 (b)(5)(D) 8/9/90]

(n) Vapor Degreaser Air Blanket Center Temperature

Boeing shall use a thermometer or thermocouple measure and shall record the temperature at the center of the air blanket during idling mode weekly. In accordance with 40 CFR 63.463(e) (12/3/99), an exceedance has occurred if the air blanket temperature exceeds 30% of the solvent's boiling point (except when one of the chillers is in defrost mode) and is not corrected within 15 days of detection. Thirty percent of the boiling point for trichloroethane is 49.5 degrees Fahrenheit. If Boeing corrects the problem within 15 days of detection or shuts down the degreaser within 15 days of detection until it is repaired, Boeing does not need to report the problem under Section V.M Compliance certifications or V.Q Reporting. [40 CFR 63.466(a)(1), 12/3/99; Puget Sound Clean Air Agency Regulation III Section 3.05 (b)(5)(E) 8/9/90]

(o) Annual Emission Estimates Required by PSD or Order of Approval Permit Condition

Boeing shall document the annual VOC emissions from the source using information on the quantities and VOC content of cleaning solutions, paints, and other material used at the source during the reporting period. Boeing shall report this information to the Puget Sound Clean Air Agency annually as required by the NOC Order of Approval or PSD permit condition.

(i) **PSD 97-02**

Emission of VOC form the 4-86 building shall not exceed 3.0 tons per day. Compliance with the daily VOC emission limit shall be assured by limiting daily production rate of the 4-86 Building to no more than 12 aircraft wings per day. Identification of wing production rates shall be based on records for wings completing the final painting process in the 4-86 building. [PSD 97-02, Condition 1 (1/14/98)]

Emission of VOC from the 4-86 building shall not exceed 242 tons per year. VOC emission rates from the 4-86 Building shall be calculated using a mass balance approach, taking into account production parameters such as material purchase and usage, waste disposal and appropriate application of control efficiency assumptions; or other equivalent method as approved by PSAPCA. [PSD 97-02, Condition 2 (1/14/98)]

(ii) **PSD 88-4**

Emissions of VOC from the 4-41 building shall not exceed 124 tons per year. [PSD-88-4 Amendment 1, Condition 1 (5/17/95)]

Boeing Commercial Airplanes shall report the total amount of solvents contained in the cleaning solutions and paints used in the 4-41 building and the VOC emissions from the 4-41 building annually to the Puget Sound Air Pollution Control Agency. [PSD-88-4 Amendment 1, Condition 2 (5/17/95)]

(p) Excess oxygen monitoring

When burning residual oil at BOIL01, BOIL02, BOIL03 in the 4-89 building, Boeing shall operate and maintain a monitoring system for measuring excess oxygen, as an alternate mean of demonstrating compliance with Regulation I, Section 12.02(a)(4). This system shall be comprised of a circular chart or other equivalent mechanism which records the excess oxygen concentration while burning residual oil. [Order of Approval No. 5521 (8/29/94)]

(q) Wood furniture manufacture

Renton shall keep purchase or usage records to document that the facility is an incidental wood furniture manufacturer, as defined by 40 CFR 63.801. These records shall show the monthly use of finishing materials or adhesives used for the manufacture of wood furniture or wood furniture components at the Renton facility.

[40 CFR 63.800, 6/12/97]

(r) Order of Approval No. 5521, Condition No. 6

For the boilers in the 4-89 building Boeing shall keep records of the amount of residual oil used for maintenance or inventory turnover activities during the calendar year. Boeing shall install a Continuous Opacity Monitor if the annual usage of residual oil for maintenance or inventory activities exceeds 350,000 gallons.

Boeing may keep records clarifying when residual oil is used during equipment/component failure, or when residual oil is used during a period of natural gas curtailment.

If this clarifying information regarding equipment/component failure, or natural gas curtailment is available, Boeing may subtract out the residual oil used during equipment/component failure, or natural gas curtailment from the calculation of residual oil used for maintenance or inventory turnover activities. If clarifying information regarding equipment/component failure, or natural gas curtailment is not available, Boeing shall assume that the residual oil usage counts towards the 350,000 gallon threshold in Condition 6 of Order of Approval No. 5521.

[Order of Approval No. 5521, Condition 6 (8/29/94), WAC 173-401-615(b), 10/17/02]

(s) Fuel Monitoring for BOIL04

Records of fuel usage shall be maintained on a monthly basis and may be in the form of fuel bills or meter readings or any other records that adequately document fuel use. [40 CFR 60.48c(g) and (i) (10/17/00); Order of Approval No. 9068 Condition 4 (12/10/04)]

(t) Testing requirements for BOIL04

(i) *Opacity*

Boeing shall conduct quarterly inspections of the boiler stack for visible emissions. Inspections are to be performed during daylight hours while the boiler is in operation. If, during the scheduled inspection or at any other time, visible emissions other than uncombined water are observed, Boeing shall, as soon as possible, but no later than within 24 hours of the initial observation, take corrective action until there are no visible emissions or, alternatively, record the opacity using Ecology Method 9A, or shut down the boiler until it can be repaired. All observations using Ecology Method 9A shall be reported according to V.Q.4 Method 9A Reports. [Order of Approval No. 9068 Condition 8 (12/10/04)]

(ii) *CO*

Boeing shall conduct annual stack tests each calendar year to determine compliance with Order of Approval No. 9068 Condition 7 and 40 CFR 63 Subpart DDDDD Table 1(8) using 40 CFR 60, Appendix A Reference Method 10 (oxygen corrected to 3% CO). These tests shall be conducted in accordance with Puget Sound Clean Air Agency Regulation I, Section 3.07. [Order of Approval No. 9068 Condition 10 (12/10/04); 40 CFR 63 Subpart DDDDD Table 1 (9/13/04); Puget Sound Clean Air Agency Regulation I Section 3.07 (3/23/06)]

Boeing must conduct performance tests according to 40 CFR 63.7520 on an annual basis. Annual performance tests must be completed between 10 and 12 months after the previous performance test. [40 CFR 63.7515(a) and (e) (9/13/04)]

Boeing shall conduct performance tests according to 40 CFR 63.7(c), (d), (f), and (h) and according to Table 5 of 40 CFR 63 Subpart DDDDD. Testing shall be done while the boiler or process heater is running at the maximum normal operating load. Boeing must conduct 3 separate test runs for each performance test. Each test run must last at least 1 hour. Tests shall not be done during periods of start-up, shut-down, or malfunction. [40 CFR 63.7520 (9/13/04)]

Boeing shall use:

- 40 CFR 60 Appendix A Method 1, for selecting sampling point locations and traverse points

- 40 CFR 60 Appendix A Method 3a, for determining O_2 and CO_2 in the stack
- 40 CFR 60 Appendix A Method 4, for determining moisture content
- 40 CFR 60 Appendix A Method 10, for determining CO emissions

[40 CFR 63 Subpart DDDDD Table 5, (9/13/04)]

Boeing must report the results of performance test within 60 days after the completion of the test. The reports for all subsequent performance tests should include all applicable information required in 40 CFR 63.7550. [40 CFR 63.7515(g) (9/13/04)]

(iii) *NOx*

Boeing shall conduct annual stack tests each calendar year to determine compliance with Condition 6 using 40 CFR 60, Appendix A Reference Method 7E. These tests shall be conducted in accordance with Puget Sound Clean Air Agency Regulation I, Section 3.07. [Order of Approval No. 9068 Condition 11 (12/10/04)]

(u) Emergency Stationary RICE

Boeing shall track the total number of hours the generator operated each calendar year and note any hours during which the engine was operated in non-emergency situations. [WAC 173-401-615(1)(b), 10/17/02; Order of Approval 9084, Condition 4 (12/10/04); Order of Approval 9487, Condition 3 (8/11/06)]

(v) RICE fuel sulfur content

Boeing shall keep a record of the sulfur content of the fuel burned by generators where required by a Notice of Construction Order of Approval. [Order of Approval 9084, Condition 6 (12/10/04); Order of Approval 9487, Condition 6 (8/11/06)]

B. Operation and Maintenance (O&M) Plan Requirements

Boeing's O&M Plan shall include equipment operation and maintenance procedures specifying how Boeing will assure continuous compliance with Puget Sound Clean Air Agency Regulations I, II and III. For insignificant emission units, refer to the requirements stated in Section II.A.1(e) Maintenance and Repair of Insignificant Emission Units of this permit. The plan shall reflect good industrial practice. In most instances, following the manufacturer's operations manual or equipment operational schedule, minimizing emissions until the repairs can be completed and taking measures to prevent recurrence of the problem may be considered good industrial practice. Determination of whether good industrial practice is being used will be based on available information such as monitoring results, opacity observations, review of operations and maintenance procedures, and checks of the emission unit or equipment. The specific provisions of the O&M Plan, other than those required by Condition Section II.A.1 and II.A.2(d), shall not be deemed part of this permit.

[Puget Sound Clean Air Agency Regulation I, Section 7.09(b), 9/10/98]

III. PROHIBITED ACTIVITIES

Boeing is prohibited from conducting, causing, or allowing the following activities:

A. *Adjustment for Atmospheric Conditions*

Varying the rate of emissions of a pollutant according to atmospheric conditions or ambient concentrations of that pollutant is prohibited, except as directed according to air pollution episode regulations. [WAC 173-400-205, 3/22/91]

B. *Open Burning*

Boeing shall not conduct open burning during any stage of an air pollution episode or period of impaired air quality and shall not conduct any open burning other than the following types:

1. Fires consisting solely of charcoal, propane, natural gas, or wood used solely for the preparation of food that comply with WAC 173-425-020(1) and WAC 173-425-030(21) and

2. Fires for instruction in the methods of fighting fires, provided that the person conducting the training fire complies with Puget Sound Clean Air Agency Regulation I, Section 8.07.

[Puget Sound Clean Air Agency Regulation I, Sections 8.04(a), 11/09/2000 and 8.07, 9/09/1999] [WAC 173-425-020(1), 3/13/2000; WAC 173-425-030(21), 3/13/2000; RCW 70.94.743, 1998 c68 p1 and RCW 70.94.775(2), 1995 c362 p2 State/Puget Sound Clean Air Agency only]

C. *Refuse Burning*

Boeing shall not cause or allow the burning of combustible refuse except in a multiple chamber incinerator provided with control equipment. Boeing shall not operate refuse burning equipment any time other than daylight hours. [Puget Sound Clean Air Agency Regulation I, Section 9.05, 12/9/93]

D. *Concealment & Circumvention*

1. General

Boeing shall not cause or allow the installation or use of any device or use of any means which, without resulting in a reduction in the total amount of air contaminant emitted, conceals an emission of an air contaminant which would otherwise violate Puget Sound Clean Air Agency Regulation I, Article 9 or Chapter 173-400 WAC. [Puget Sound Clean Air Agency Regulation I, Section 9.13(a), 6/9/88 and WAC 173-400-040(7), 8/20/93] [WAC 173-400-040(7), 9/15/01state only]

2. NSPS

Boeing shall not build, erect, install, or use any article, machine, equipment or process, the use of which conceals an emission which would otherwise constitute a violation of an applicable (40 CFR Part 60) standard. Such concealment includes, but is not limited to, the use of gaseous diluents to achieve compliance with an opacity standard or with a standard which is based on the concentration of a pollutant in the gases discharged to the atmosphere. [40 CFR 60.12, 3/8/74]

3. NESHAP

Boeing shall not build, erect, install, or use any article, machine, equipment, or process to conceal an emission that would otherwise constitute noncompliance with a relevant standard adopted under 40 CFR Part 63. Such concealment includes, but is not limited to--

(a) The use of diluents to achieve compliance with a relevant standard based on the concentration of a pollutant in the effluent discharged to the atmosphere;

(b) The use of gaseous diluents to achieve compliance with a relevant standard for visible emissions; and

(c) Fragmentation. Fragmentation after November 15, 1990 which divides ownership of an operation, within the same facility among various owners where there is no real change in control, will not affect applicability. The owner and operator must not use fragmentation or phasing of reconstruction activities (i.e., intentionally dividing reconstruction into multiple parts for purposes of avoiding new source requirements) to avoid becoming subject to new source requirements.

[40 CFR 63.4(b) (4/5/02)]

E. Masking

Boeing shall not cause or allow the installation or use of any device or use of any means designed to mask the emission of an air contaminant that causes detriment to health, safety or welfare of any person or conceals or masks an emission of an air contaminant that would otherwise violate Regulation I, Article 9 or Chapter 173-400 WAC. [Puget Sound Clean Air Agency Regulation I, Section 9.13(b), 6/9/88 and WAC 173-400-040(7), 8/20/93] [WAC 173-400-040(7), 9/15/01state only]

F. Ambient Standards

Boeing shall not cause or allow the emission of air contaminants in sufficient quantity as to exceed any ambient air quality standard in Puget Sound Clean Air Agency Regulation I, Section 11.01. [Puget Sound Clean Air Agency Regulation I, Section 11.01(b), 4/14/94]

IV. ACTIVITIES REQUIRING ADDITIONAL APPROVAL

Boeing shall file notification and obtain the necessary approval from the Puget Sound Clean Air Agency before conducting any of the following:

A. New Source Review

Boeing shall not construct, install, establish, or modify an air contaminant source, except those sources that are excluded by Puget Sound Clean Air Agency Regulation I, Section 6.03, unless a "Notice of Construction and Application for Approval" has been filed with and approved by the Puget Sound Clean Air Agency. [Puget Sound Clean Air Agency Regulation I, Section 6.03, 9/12/96; WAC 173-400-110, 9/20/93; 40 CFR 60.7, 2/12/99; 40 CFR 60.14, 12/17/00; 40 CFR 60.15, 12/16/75; 40 CFR 63.5, 4/5/02] [Puget Sound Clean Air Agency Regulation I, Section 6.03, 7/12/01; WAC 173-400-110, 9/15/01; WAC 173-460-040, 2/14/94; RCW 70.94.152, 1996 c 67p1, 1996 c 29p1 State/Puget Sound Clean Air Agency only]

B. Replacement or Substantial Alteration of Emission Control Technology

Boeing shall file a Notice of Construction and Application for Approval according to WAC 173-400-114 with the Puget Sound Clean Air Agency before replacing or substantially altering any emission control technology installed at the facility, except as provided in Puget Sound Clean Air Agency Regulation I Section 6.03. [Puget Sound Clean Air Agency Regulation I, Section 6.03, 9/12/96; WAC 173-400-110, 9/20/93] [Puget Sound Clean Air Agency Regulation I Section 6.03, 7/12/01; WAC 173-400-114, 9/15/01; WAC 173-400-114, 9/20/93; RCW 70.94.152 1996 c 67p1, 1996 c29p1; RCW 70.94.153, 1991 c 199p303 State/Puget Sound Clean Air Agency only]

C. Asbestos

1. Boeing shall comply with 40 CFR 61.145 and 61.150 when conducting renovation or demolition activities at the facility. [40 CFR 61.145 and 61.150]

2. Boeing shall comply with Puget Sound Clean Air Agency Regulation III, Article 4 when conducting any asbestos project, renovation or demolition activities at the facility. [Puget Sound Clean Air Agency: Section 4.01, 2/27/03; Regulation III Section 4.02, 6/8/95; Regulation III Section 4.03, 5/22/03; Regulation III Section 4.04, 7/13/00; Regulation III Section 4.05, 2/27/03; Regulation III Section 4.07, 6/8/95; Regulation III Section 4.09, 7/13/00 State/Puget Sound Clean Air Agency only]

D. *Spray Coating*

1. Boeing shall get prior approval under Puget Sound Clean Air Agency Regulation I, Section 9.16(a) for causing or allowing the use of spray equipment to apply any VOC-containing material except for:
   a. The use of hand-held aerosol cans,
   b. Touch-up operations,
   c. The coating of marine vessels in dry docks,
   d. The coating of bridges, water towers, buildings or similar structures,
   e. Insecticide, pesticide, or fertilizer spray equipment, and
   f. The coating of items that cannot be reasonably handled in an enclosed spray area, provided that the operation has received the prior written approval of the Control Officer.

[Puget Sound Clean Air Agency Regulation I, Section 9.16, 6/13/91 This requirement will be superseded upon adoption of the 7/12/01 version of Reg I: 9.16 into the SIP]

2. a. Exemptions. The following activities are exempt from the provisions of Sections 9.16(c) and (d) of this regulation. Persons claiming any of the following spray-coating exemptions shall have the burden of demonstrating compliance with the claimed exemption.
   (1) Application of architectural or maintenance coatings to stationary structures (e.g., bridges, water towers, buildings, stationary machinery, or similar structures);
   (2) Aerospace coating operations subject to 40 CFR Part 63, Subpart GG. This includes all activities and materials listed in 40 CFR 63.741(f);
   (3) Use of high-volume, low-pressure (HVLP) spray guns when:
      (A) spray-coating operations do not involve motor vehicles or motor vehicle components;
      (B) the gun cup capacity is 8 fluid ounces or less;
      (C) the spray gun is used to spray-coat less than 9 square feet per day per facility;
      (D) coatings are purchased in containers of 1 quart or less; and

(E) spray-coating is allowed by fire department, fire marshal, or other government agency requirements.

(4) Use of air-brush spray equipment with 0.5 to 2.0 CFM airflow and a maximum cup capacity of 2 fluid ounces;

(5) Use of hand-held aerosol spray cans with a capacity of 1 quart or less; or

(6) Indoor application of automotive undercoating materials using organic solvents having a flash point in excess of 100°F.

b. General Requirements for Indoor Spray-Coating Operations. It shall be unlawful for any person subject to the provisions of this section to cause or allow spray-coating inside a structure, or spray-coating of any motor vehicles or motor vehicle components, unless the spray-coating is conducted inside an enclosed spray area. The enclosed spray area shall employ either properly seated paint arresters, or water-wash curtains with a continuous water curtain to control the overspray. All emissions from the spray-coating operation shall be vented to the atmosphere through an unobstructed vertical exhaust vent.

c. General Requirements for Outdoor Spray-Coating Operations. After January 1, 2000, it shall be unlawful for any person subject to the provisions of this section to cause or allow spray-coating ext. an enclosed structure unless such spray-coating operations are approved in a notice of construction permit issued in accordance with Article 6 of this regulation. The following minimum requirements for outdoor spray-coating operations will be included in all such notice of construction permits:

(1) Reasonable methods to confine overspray to the property where the spray-coating is being conducted shall be used (e.g., tarps, shrink wrap, mobile enclosure, or similar methods for control of overspray); and

(2) High-transfer efficiency spray equipment that minimizes overspray shall be used (e.g., HVLP, low-volume, low-pressure (LVLP), electrostatic, or air-assisted airless). Airless spray equipment may be used where low viscosity and high solid coatings preclude the use of higher-transfer efficiency spray equipment.

[Puget Sound Clean Air Agency Regulation I, Section 9.16, 7/12/01 State/Puget Sound Clean Air Agency only. This requirement will become federally enforceable upon adoption into the SIP and will replace the 6/13/91 version of Reg I: 9.16]

V. STANDARD TERMS AND CONDITIONS

A. Duty to comply

Boeing shall comply with all conditions of this permit. Any permit noncompliance constitutes a violation of Chapter 70.94 RCW and, for federally enforceable provisions, a violation of the Federal Clean Air Act (FCAA). Such violations are grounds for enforcement action; for permit termination, revocation and reissuance, or modification; or for denial of a permit renewal application. [Puget Sound Clean Air Agency Regulation I, Section 7.05, 10/28/93; WAC 173-401-620(2)(a), 11/4/93]

B. Permit actions

This permit may be modified, revoked, reopened and reissued, or terminated for cause. The filing of a request by Boeing for a permit modification, revocation and reissuance, or termination, or of a notification of planned changes or anticipated noncompliance does not stay any permit condition. [WAC 173-401-620(2)(c), 11/4/93]

C. Property rights

This permit does not convey any property rights of any sort, or any exclusive privilege. [WAC 173-401-620(2)(d), 11/4/93]

D. Duty to provide information

Boeing shall furnish to the Puget Sound Clean Air Agency, within a reasonable time, any information that the Puget Sound Clean Air Agency may request in writing to determine whether cause exists for modifying, revoking and reissuing, or terminating the permit or to determine compliance with the permit. Upon request, Boeing shall also furnish to the Puget Sound Clean Air Agency copies of records required to be kept by the permit or, for information claimed to be confidential, Boeing may furnish such records directly to EPA Region 10 along with a claim of confidentiality. The Puget Sound Clean Air Agency shall maintain the confidentiality of such information in accordance with RCW 70.94.205. [WAC 173-401-620(2)(e), 11/4/93]

E. Permit fees

Boeing shall pay fees as a condition of this permit in accordance with Puget Sound Clean Air Agency Regulation I, Article 7. Failure to pay fees in a timely fashion shall subject Boeing to civil and criminal penalties as prescribed in Chapter 70.94 RCW. [WAC 173-401-620(2)(f), 11/4/93; RCW 70.94.162, 1998 c 245p129]

F. Emissions trading

No permit revision shall be required, under any approved economic incentives, marketable permits, emissions trading, and other similar programs or processes for changes that are provided for in this permit. [WAC 173-401-620(2)(g), 11/4/93]

G. Severability

If any provision of this permit is held to be invalid, all unaffected provisions of the permit shall remain in effect and be enforceable. [WAC 173-401-620(2)(h), 11/4/93; RCW 70.94.905, 1991 c 199p719 State and Puget Sound Clean Air Agency only]

H. Permit appeals

This permit or any condition in it may be appealed only by filing an appeal with the Pollution Control Hearings Board and serving it on the Puget Sound Clean Air Agency within thirty days of receipt, pursuant to RCW 43.21B.310 and WAC 173-401-735. The provision for appeal in this section is separate from and additional to any federal rights to petition and review found under 40 CFR 505(b) of the FCAA. [WAC 173-401-620(2)(i), 11/4/93 and WAC 173-401-735, 5/3/97; RCW 70.94.221, 1970 ex.s.c 62p58]

I. Permit continuation

This permit and all terms and conditions contained therein, including any permit shield provided under WAC 173-401-640, shall not expire until the renewal permit has been issued or denied if a timely and complete application has been submitted. An application shield granted under WAC 173-401-705(2) shall remain in effect until the renewal permit has been issued or denied if a timely and complete permit application has been submitted. [WAC 173-401-620(2)(j), 11/4/93]

J. Federal enforceability

All terms and conditions of this permit are enforceable by the EPA administrator and by citizens under the FCAA, except for those terms and conditions designated in the permit as not federally enforceable (i.e. "state only" or "State/Puget Sound Clean Air Agency only." [WAC 173-401-625, 11/4/93]

K. Inspection and entry

Upon presentation of credentials and other documents as may be required by law, Boeing shall allow the Puget Sound Clean Air Agency or an authorized representative to:

1. Enter Boeing's premises or where records must be kept under the conditions of this permit;

2. Have access to and copy, at reasonable times, any records that must be kept under the conditions of the permit;

3. Inspect at reasonable times any facilities, equipment (including monitoring and air pollution control equipment), practices or operations regulated or required under the permit; and

As authorized by WAC 173-400-105 and the FCAA, sample or monitor at reasonable times substances or parameters for the purpose of assuring compliance with the permit or applicable requirements.

[WAC 173-401-630(2), 11/4/93; RCW 70.94.200, 1987 c 109 § 38 - State/Puget Sound Clean Air Agency only]

L. Compliance requirements

Boeing shall continue to comply with all applicable requirements with which the source is currently in compliance. Boeing shall meet on a timely basis any applicable requirements that become effective during the permit term. [WAC 173-401-630(3), 11/4/93; WAC 173-401-510(2)(h)(iii), 6/17/94]

M. Compliance certifications

Boeing shall submit a certification of compliance with permit terms and conditions once per year. The first such certification shall cover the period from the date of issuance of this permit to December 31, 2004. Each certification shall include:

1) The identification of each term or condition of the permit that is the basis of the certification;

2) The compliance status;

3) Whether compliance was continuous or intermittent; and

4) The method(s) used for determining the compliance status of the source, currently and over the reporting period. These methods must be consistent with the permit Monitoring, Maintenance and Recordkeeping Methods.

All annual compliance certifications shall be submitted to EPA Region 10 and to the Puget Sound Clean Air Agency, at the following addresses, by February 28 for the previous calendar year. [WAC 173-401-630(5), 11/4/93]:

Puget Sound Clean Air Agency
Attn.: Operating Permit Certification
1904 Third Ave, Suite 105
Seattle, Washington 98101

EPA Region 10, Mail Stop OAQ-107
Attn.: Air Operating Permits
1200 Sixth Avenue
Seattle, Washington 98101

N. Compliance determination

1. Emission Testing - General

i) For the purpose of determining compliance with an emission standard, the Puget Sound Clean Air Agency or Ecology may conduct testing of an emission unit or require Boeing to have it tested. In the event the Puget Sound Clean Air Agency or Ecology conduct the test, Boeing shall be given an opportunity to observe the sampling and to obtain a sample at the same time.

ii) Testing of sources for compliance with emissions standards shall be performed in accordance with the Reference Test Methods identified in Section I of this permit, except where this permit indicates that a specific Reference Test Method is not needed or appropriate.

iii) Boeing shall notify the Puget Sound Clean Air Agency in writing at least 2 weeks (14 days) prior to any compliance test and provide the Puget Sound Clean Air Agency an opportunity to review the test plan and to observe the test.

iv) Boeing, if required by the Puget Sound Clean Air Agency to perform a compliance test, shall submit a report to the Puget Sound Clean Air Agency no later than 60 days after the test. The report shall include:

(a) A description of the source and the sampling location;

(b) The time and date of the test;

(c) A summary of results, reported in units and for averaging periods consistent with the applicable emission standard;

(d) A description of the test methods and quality assurance procedures employed;

(e) The amount of fuel burned or raw material processed by the source during the test;

(f) The operating parameters of the source and control equipment during the test;

(g) Field data and example calculations; and

(h) A statement signed by the senior management official of the testing firm certifying the validity of the source test report.

[Puget Sound Clean Air Agency Regulation I, Section 3.05(b), 2/10/94; and Puget Sound Clean Air Agency. Regulation I, Section 3.07, 2/9/95] [WAC 173-400-105(4), 9/15/01 State/Puget Sound Clean Air Agency Only]

2. Credible Evidence

For the purpose of submitting compliance certifications or establishing whether or not a person has violated or is in violation of this permit, nothing shall preclude the use, including the exclusive use, of any credible evidence or information relevant to whether a source would have been in compliance with applicable requirements if the appropriate performance or compliance test or procedure had been performed. [40 CFR 60.11(g), 10/17/02] [Puget Sound Clean Air Agency Regulation I, Section 3.06, 10/8/98 State/Puget Sound Clean Air Agency Only]

O. Recordkeeping

1. General

Boeing shall maintain the following, where applicable:

1. Records of required monitoring information that include the following:
   - i) The date, place as defined in the permit, and time of sampling or measurements;
   - ii) The date(s) analyses were performed;
   - iii) The company or entity that performed the analyses;
   - iv) The analytical techniques or methods used;
   - v) The results of such analyses; and
   - iv) The operating conditions existing at the time of sampling or measurement. [WAC 173-401-615(2), 10/17/02]
2. Records describing changes made at the source that result in emissions of a regulated air pollutant subject to an applicable requirement, but not otherwise regulated under the permit, and the emissions resulting from those changes. [WAC 173-401-615(2), 10/17/02]
3. Records of all monitoring data and support information required by this permit shall be retained by Boeing for a period of five years from the date of the monitoring, sample, measurement, record or application. Support information includes all calibration and maintenance records and all original strip-chart recordings for continuous monitoring instrumentation, and copies of all reports required by the permit. [WAC 173-401-615(2), 10/17/02]
4. Boeing shall keep records of all inspections, tests and other actions required by Section II.A.1. of this permit, including who conducted the inspection, tests or other actions; and the date and the results of the inspection, tests or other actions including corrective

actions. Boeing shall also maintain records of all inspections, tests, and other actions required by the O&M Plan and Section II.A.2. of this permit. All records required under this item will be available for Puget Sound Clean Air Agency review. [Puget Sound Clean Air Agency Regulation I, Section 7.09(b), 9/10/98]

5. Boeing shall keep records for all complaints received concerning odor, fugitive emissions or nuisance relating to Section II of this permit. These records must also contain the following information:

    i) The date and time of the complaint,

    ii) The name of the person complaining, if known,

    iii) The nature of the complaint, and

    iv) The date, time and nature of any corrective action taken.

[WAC 173-401-615(2)(b), 10/17/02]

2. Specific

(a) NESHAP

For the requirements of the 40 CFR 63 Subparts T and GG, Boeing shall retain at least two years of records on site. The remaining three years of data may be retained off site. [40 CFR 63.10(b)(1), 4/5/02]

40 CFR 63 Subpart DDDDD: Boeing shall keep all applicable records discussed in 40 CFR 63.7555. Records shall be retained for at least two years on site. The remaining three years of records may be retained off site. Boeing shall kept records in a form suitable and readily available for expeditious inspection and review. Such files may be maintained on microfilm, on a computer, on computer floppy disk, on magnetic tape disks, or on microfiche. [40 CFR 63.7555 9/13/04; 40 CFR 63.7560, 9/13/04; 40 CFR 63.10(b)(1), 5/20/06]

(b) Boiler NSPS

All records required under 40 CFR 60.49b, as applicable, shall be maintained for a period of 2 years following the date of such record. [40 CFR 60.49b(o), 3/13/00]

Boeing shall maintain records of the occurrence and duration of any startup, shutdown, or malfunction, any malfunction of the air pollution control equipment, or any periods during which a monitoring device is inoperative. [40 CFR 60.7(b), 2/12/99]

Boeing shall maintain a file of all measurements and all other information required by 40 CFR 60 recorded in a permanent form suitable for inspection. The file shall be retained for at least two years following the date of such measurements, maintenance, reports, and records. [40 CFR 60.7(f), 2/12/99]

P. Data recovery

1. General Data Recovery

If the specific monitoring and recordkeeping requirements in Section II of this permit are silent on data recovery provisions then data recovery is assumed to be 100%. However, no data need be collected during any period that the monitored process does not operate.

2. Data Recovery Exceptions

This section applies to the following monitoring and recordkeeping requirements in Section II of this permit.

- II.A.2(d)(ii) Spray Booth Maintenance
- II.A.2(d)(v) Cyclone, Baghouse and Dust Filter Maintenance
- II.A.2(d)(vi) Laboratory Tankline Scrubber Maintenance
- II.A.2(d)(vii) Vapor Degreasers Maintenance

For the above listed, the following applies:

(1) Boeing shall collect at least the following amount of valid data:

  (a) For records or monitoring data that are required daily or more frequently, Boeing shall collect at least 90% of all records or data required in a month.

  (b) For records or monitoring data that are required monthly or more frequently (yet less frequently than daily), Boeing shall collect at least nine of the most recent ten required records.

(2) The Deviation Reports required by Section V.Q.1(b) shall include an explanation for any instance in which Boeing failed to meet the data recovery requirements of this condition for any monitored process or parameter and any instances of reconstructing lost data. The explanation shall include the reason that the data was not collected and any actions that Boeing will take to insure collection of such data in the future.

(3) Failure to recover the required amount of monitoring may be excused from penalty during any period during periods of monitoring system breakdown, malfunction, repairs, calibration checks, and acts of God deemed to be unavoidable. In determining whether a monitoring failure was unavoidable, the following factors shall be considered:

  (a) Whether the event was caused by poor or inadequate design, operation, maintenance, or any other reasonably preventable condition;

  (b) Whether the event was of a recurring pattern indicative of inadequate design, operation, or maintenance; and

  (c) Whether Boeing took immediate and appropriate corrective action in a manner consistent with good air pollution control practice.

(4) The occasional and unintentional loss or omission of required records shall not constitute a reportable permit deviation, provided Boeing, upon discovery of the missing records, is able to reconstruct the required information from other available information or knowledge or the missing record is otherwise allowed by this permit.

[WAC 173-401-615(1)(b), 10/17/02]

Q. Reporting

1. General Reports

(a) Semiannual Operating Permit Reports

Any monitoring reports required by this permit to be submitted to the Puget Sound Clean Air Agency shall be submitted at least once every six months, or more frequently where required by an applicable requirement. All instances of deviations from permit requirements must be clearly identified in such reports. If there were no deviation Boeing must submit a report stating that, there were no deviations. [WAC 173-401-615(3)(a), 10/17/02,]

(b) Deviation Reports

Boeing shall report in writing to Puget Sound Clean Air Agency Operating Permit Certification all instances of deviations from the permit requirements, including those attributable to upset conditions as defined in this permit, the probable cause of the deviations, and any corrective actions or preventive measures taken. For any excess emission that Boeing wants the Puget Sound Clean Air Agency to consider unavoidable, Boeing shall follow the procedures discussed in Section V.S Unavoidable excess emissions. Boeing shall maintain a contemporaneous record of all deviations. Boeing shall report any deviations to the Puget Sound Clean Air Agency that represent a potential threat to human health or safety by FAX (206-343-7522) as soon as possible but no later than 12 hours after such a deviation is discovered. Boeing shall report other deviations in writing to Puget Sound Clean Air Agency Operating Permit Certification within 30 days after the end of the month in which the deviation is discovered. Boeing is not required to submit a monthly report for months during which there were no deviations, except that if there are no deviations for the semiannual period, Boeing must report that there were no deviations by August 30 for the reporting period January 1 through June 30, and by February 28 for the reporting period between July 1 through December 31. [WAC 173-401-615(3)(b), 10/17/02; WAC 173-400-107, 9/20/93]

(c) Boeing shall report to the Puget Sound Clean Air Agency any instances where it failed to promptly repair any defective equipment. For any excess emission that Boeing wants the Puget Sound Clean Air Agency to consider unavoidable, Boeing shall follow the procedures discussed in Section V.S Unavoidable excess emissions. [WAC 173-401-615(3)(b), 10/17/02; WAC 173-400-107, 9/20/93]Reporting Certification

Any application form, report, or compliance certification that is required to be certified by any applicable requirement or is submitted pursuant to this permit shall contain certification by a responsible official of truth, accuracy, and completeness. This certification and any other certification required under this permit shall state that, based on information and belief formed after reasonable inquiry, the statements and information in the document are true, accurate, and complete. [WAC 173-401-520, 9/15/01]

The following application forms, reports, and compliance certifications must be certified upon submittal:

- Annual Air Operating Permit Compliance Certification (V.M Compliance certifications) (WAC 173-401-630(5))

- Semi-annual Air Operating Permit Report (V.Q.1(a) Semiannual Operating Permit Reports) (WAC 173-401-615(3)(a))

- Administrative Permit Amendment Requests (VI.B Administrative Permit Amendments) (WAC 173-401-720)

- Minor Permit Modification Application (VI.E Permit Modification) (WAC 173-401-725)

- Significant Permit Modification Application (VI.E Permit Modification) (WAC 173-401-725)

- Aerospace NESHAP semiannual report(V.Q.3(b) Semiannual Compliance Certification Reports) (40 CFR 63.753(b)(1), 40 CFR 63.753(c)(1), 40 CFR 63.9(i))

- Aerospace NESHAP annual report (V.Q.3(c)

Annual Compliance Certification Reports) (40 CFR 63.753(c)(2), 40 CFR 63.9(i))

For all other application forms, reports, and compliance certifications the responsible official's certification needs only to be submitted once every six months, covering all required reporting since the date of the last certification, provided that the certification specifically identifies all documents subject to the certification. [WAC 173-401-615(3)(a), 10/17/02]

(d) Reporting Submittal

All reports required under this section shall be submitted the Puget Sound Clean Air Agency, at the following address:

Puget Sound Clean Air Agency
Attn.: Operating Permit Certification
1904 Third Ave, Suite 105
Seattle, Washington 98101

2. Annual Emission Inventory

Boeing shall report annually to the Puget Sound Clean Air Agency for those air contaminants that are emitted in amounts equal to or exceeding the following (tons per year) during the previous calendar year:

Carbon monoxide (CO) emissions	25
Facility combined total of all toxic air contaminants (TAC) emissions	6
Any single toxic air contaminant (TAC) emissions	2
Nitrogen oxide (NO_X) emissions	25
Particulate matter (PM_{10}) emissions	25
Particulate matter ($PM_{2.5}$) emissions	25
Sulfur oxide (SO_X) emissions	25
Volatile organic compounds (VOC) emissions	25

Annual emissions rates shall be reported to the nearest whole ton per year for only those contaminants that equal or exceed the thresholds above. Boeing shall submit to the Puget Sound Clean Air Agency any additional information required by WAC 173-400-105(1) or Puget Sound Clean Air Agency Regulation III, Section 1.11. [Puget Sound Clean Air Agency Regulation I, Section 7.09(a), 9/12/96, 9/10/1998 State and Puget Sound Clean Air Agency only]

3. Aerospace Manufacturing and Rework Facilities NESHAP -- Reporting/Notification

(a) Notification of Compliance Status Report

<u>For new or reconstructed affected sources:</u>

No later than 240 days after the startup date of a new or reconstructed affected source, or 60 days after the performance test (if one is performed), whichever is earlier, the facility shall submit a Notification of Compliance Status to Puget Sound Clean Air Agency Operating Permit Certification in accordance with 40 CFR Section 63.753(a)(1) and the applicable 40 CFR Section 63.9(h). [40 CFR Section 63.753(a)(1), 9/1/98 and 40 CFR Section 63.9(h), 4/5/02]

(b) Semiannual Compliance Certification Reports

Boeing shall submit a semiannual compliance certification report to Puget Sound Clean Air Agency Operating Permit Certification in accordance with 40 CFR 63.753(b)(1) and (c)(1) and V.Q.1 General Reports. [40 CFR 63.753(b)(1) and (c)(1), 9/1/98]

This semiannual report shall include the following:

1) Any instance where a noncompliant cleaning solvent is used for a nonexempt hand-wipe cleaning operation;

2) A list of any new cleaning solvents used for hand-wipe cleaning in the previous 6 months and, as appropriate, their composite vapor pressure or notification that they comply with the composition requirements specified in 40 CFR 63.744(b)(1);

3) Any instances where a noncompliant spray gun cleaning method is used;

4) Any instance where a leaking enclosed spray gun cleaner remains un-repaired and in use for more than 15 days;

5) If the cleaning operations have been in compliance for the semiannual period, a statement that the cleaning operations have been in compliance with the applicable standards;

6) For cleaning operations, a statement of compliance signed by a responsible company official certifying that the facility is in compliance with all applicable requirements;

7) For primers and topcoats where there is no averaging or a control device, each value of H_i and G_i that exceeds the applicable organic HAP or VOC content limit;

8) For primers and topcoats that are averaged, each value of H_a and G_a that exceeds the organic HAP or VOC content limit;

9) All times when a primer or topcoat application operation was not immediately shut down when the pressure drop or water flow rate was ext. the limits;

10) If the primer and topcoat operations have been in compliance for the semiannual period, a statement that the operations have been in compliance with the applicable standards;

11) For depainting operations where the facility depaints more than 6 completed aircraft in a calendar year:

- Any 24-hour period where organic HAP were emitted from depainting aerospace vehicles, other than from exempt operations in 40 CFR 63.746(a), (b)(3), and (b)(5).

- Any new chemical strippers used at the facility during the reporting period and any stripper that undergoes reformulation, as well as their organic HAP content.

- A list of new and discontinued aircraft models depainted at the facility over the last 6 months and a list of the parts normally removed from depainting for each new aircraft model being depainted.

- If the depainting operation has been in compliance for the semiannual period, a statement that operations have been in compliance with the applicable standards.

(c) Annual Compliance Certification Reports

Boeing shall submit an annual compliance certification report to Puget Sound Clean Air Agency Operating Permit Certification by February 28 of each year for the period covering the preceding calendar year in accordance with 40 CFR 63.753(c)(2). [40 CFR 63.753(c)(2), 9/1/98]

The annual report shall list the number of times the pressure drop or water flowrate for each dry filter or water wash system was outside of the limits and, if the facility depaints more than 6 completed aircraft in a calendar year, the average volume per aircraft of organic HAP-containing strippers or weight of organic HAP used for spot stripping and decal removal operations if it exceeds the limit specified in 40 CFR 63.746(b)(3) 9/1/98. [40 CFR 63.746(b)(3), 9/1/98]

(d) Change in Information

Boeing shall provide in writing any change in the information that was already provided within 15 calendar days after the change in accordance with 40 CFR Section 63.9(j). [40 CFR Section 63.9(j), 4/5/02]

(e) Startup, Shutdown, and Malfunction Reports

For spray booths conducting a topcoat or primer operation regulated under 40 CFR 63.745(g), except for dry particulate filter systems operated per the manufacturer's instructions, Boeing shall submit to Puget Sound Clean Air Agency Operating Permit Certification the startup, shutdown, and malfunction report semiannually if a startup, shutdown or malfunction occurred in the semiannual period in accordance with 40 CFR Section 63.10(d)(5)(i) and Section V.Q.(1) of this permit. The report shall be delivered or postmarked by the 30th day following the end of each calendar half (or other calendar reporting period, as appropriate). [40 CFR Section 63.10(d), 4/5/02]

Boeing shall submit Immediate Startup, Shutdown and Malfunction Reports, as required by 40 CFR 63.10(d)(5)(ii), to the Puget Sound Clean Air Agency if an action taken during a startup, shutdown or malfunction is not consistent with the procedures specified in the Startup, Shutdown and Malfunction Plan. These reports shall be submitted within 30 days of the end of the month in which the action occurred. [40 CFR 63.10(d)(5), 4/5/02]

4. Method 9A Reports

Boeing shall report to the Puget Sound Clean Air Agency results of all opacity monitoring using Ecology Method 9A within 30 days after the end of the month that the measurement occurred. These reports will be certified in accordance with Q.1.(c) at least semi-annually. [WAC 173-401-615(3)(a), 10/17/02]

5. Report of Problems not Corrected Within 24 hours

If Boeing is reporting a problem (such as leak, out of range pressure drop, out of range pH, or other problem, as applicable) in lieu of correcting it or shutting down the associated equipment or activity in accordance with Sections II.A.1(b), II.A.1(c), II.A.1(d), II.A.1(f), II.A.2(d)(ii), II.A.2(d)(v), II.A.2(d)(vi), and II.A.2(d)(viii) then Boeing shall report to the Agency in writing by facsimile (206-343-7522) to Puget Sound Clean Air Agency Attn.: Operating Permit Certification, the nature of the problem and Boeing's intent to continue operating while seeking to address the problem.

In addition, within 30 days after the end of the month in which the problem was reported under this section (V.Q.5), Boeing shall also submit either:

(a) A deviation report pursuant to V.Q.1(b) Deviation Reports; or

(b) A report indicating that after reasonable inquiry Boeing has determined that no deviation occurred and the basis for that determination.

All reports submitted pursuant to this Section V.Q.5 shall be certified in accordance with Section V.Q.1(c) Reporting Certification at least semi-annually.

Nothing in this Section V.Q.5 shall be construed to extend the deadlines for submitting deviation reports under Section V.Q.1(b) Deviation Reports, notifications of emergencies under Section V.R, or reports of unavoidable excess emissions under Section V.S.

[WAC 173-401-615(3), 10/17/02]

6. Halogenated Solvent Cleaning NESHAP -- Reporting/Notification

(a) Annual Report

Boeing shall submit an annual report to the Puget Sound Clean Air Agency and EPA Region 10 by February 28 of each year for the period covering the preceding calendar year. This report shall include the following:

Boeing shall include a signed statement from the responsible official that, "All operators of solvent cleaning machines have received training on the proper operation of solvent cleaning machines and their control devices sufficient to pass the test required in 40 CFR 63.463(d)(10)," and

Boeing shall include an estimate of solvent consumption for each solvent cleaning machine during the reporting period in the annual report.

[40 CFR 63.468(f), 12/14/99]

(b) Semi-Annual Exceedance Report

Boeing shall report all exceedances and all corrections and adjustments made to avoid an exceedance as specified in 40 CFR 63.468(h) except that when an exceedance occurs, Boeing must report the exceedance according to V.Q.1(b) Deviation Reports. Semiannual Exceedance Reports shall be submitted according to V.Q.1(a) Semiannual Operating Permit Reports. The Exceedance Report shall include the following information:

- Boeing shall include information on the actions taken to comply with Chilled Air Blanket Center Temperature, Closed Cover and Hoist Speed in the Exceedance Report. This information shall include records of written or verbal orders for replacement parts, a description of the repairs made, and additional monitoring conducted to demonstrate that monitored parameters have returned to accepted levels.
- Boeing shall report the reason for the exceedance and a description of the actions taken in the Exceedance Report.
- If no exceedances of a parameter have occurred, or a piece of equipment has not been inoperative, out of control, repaired, or adjusted, such information shall be stated in the report.

[40 CFR 63.468(h), 12/14/1999]

7. Boiler and Process Heater -- NESHAP Reporting/Notification

For boilers and process heaters subject to the requirements of 40 CFR 63 Subpart DDDDD, Boeing shall submit all applicable reports and notifications in 40 CFR 63.7(b) and (c), and 63.9(b) through (h). [40 CFR 63.7545(a), 9/13/04]

Such reports and notifications shall include the following, as applicable:

(a) Initial Notification

Initial notification for boiler or process heaters that started-up before November 12, 2004 is due not later than 120 days after November 12, 2004, and must include the information required by 40 CFR 63.9(b)(2). Initial notification for new or reconstructed affected sources that start up on or after November 12, 2004 is due no later than 15 days after the actual date of startup. [40 CFR 63.7545(b) and (c), 9/13/04]

(b) CO Performance Test Reports

(i) Before the test

Boeing must notify the Puget Sound Clean Air Agency of the test at least 60 days before conducting the test, and must submit a Notification of Intent to conduct a performace test at least 30 days before the test is scheduled to begin. If requested by the Puget Sound Clean Air Agency, Boeing shall submit a test plan according to 40 CFR 63.7(c). If rescheduling a performance test, Boeing must notify the Puget Sound Clean Air Agency 5 days before the scheduled date. [40 CFR 63.7545(a) and (d), 9/13/04; 40 CFR 63.7(b) and (c), 4/5/02, 40 CFR 63.9(e), 5/30/03]

(ii) After the initial compliance test

After completing the initial compliance test, Boeing must submit a Notification of Compliance Status according to 40 CFR 63.9(h)(2)(ii). This report shall include all performance test results as well as the information in 40 CFR 63.7545(e)(1) through (e)(9). The report shall be submitted before the close of business on the 60th day following the completion of the performance test. [40 CFR 63.7545 (a) and (e), 9/13/04; 40 CFR 63.9(h), 5/30/03]

(c) Semiannual Compliance Report

For boilers or process heaters meeting the definition of new large gaseous fuel fired boilers in 40 CFR 63.7575, Boeing shall submit semiannual compliance reports to the Puget Sound Clean Air Agency. Such reports shall cover the semiannual period from January 1 through June 30 and the semiannual period from July 1 through December 31. The reports shall be postmarked or delivered no later than August 30th for the January 1 through June 30 reporting period, and no later than February 28th for the July 1 through December 31 reporting period. Semiannual Compliance Reports shall be submitted according to V.Q.1(a) Semiannual Operating Permit Reports. The reports shall include the following:

- Company name and address
- Statement by a responsible official with the official's name, title, and signature, certifying the truth, accuracy, and completeness of the content of the report
- Date of report and beginning and ending dates of the reporting period
- Total fuel use by each boiler or process heater, for each month within the semiannual reporting period, including but not limited to, a description of the fuel and the total fuel usage amounts with units of measure.
- Summary of the results of the annual performance test
- Signed statement indicating that the boiler or process heater burned no new fuel types, or if a new fuel was burned, the information required by 40 CFR 63.7550(c)(6) and (7).

- If a startup, shutdown, or malfunction occurred during the reporting period and Boeing took actions consistent with the SSMP, include the information in 40 CFR 63.10(d)(5)(i).
- If there were no deviations from the CO emission limit, a statement that there were no deviations during the reporting period.

[40 CFR 63.7550(b) & (c), 4/13/04; 40 CFR 63 Subpart DDDDD Table 9(1), 9/13/04]

If deviations from CO emission limit occurred, Boeing shall report each instance in which the boiler or process heater did not meet the CO emission limit in Table 1 in the semiannual report. (Boeing shall also report each instance during a startup, shutdown, or malfunction when the boiler or process heater did not meet the CO emission limit in accordance with V.Q.7(d) Start-up, Shut-down, and Malfunction Report.) These instances are deviations from the emission limits in this subpart and shall be reported according to 40 CFR 63.7550. [40 CFR 63.7540(b), 4/20/06]

For each deviation from the CO emission limit, the report must contain the information required by 40 CFR 63.7550(c) (see V.Q.7(c) above). In addition, the report must include the following information:

- Total operating time of the boiler or process heater during the reporting period
- A description of the deviation and the emission limit from which the boiler or process heater deviated
- Information on the number, duration, and cause of deviations, and the corrective actions taken

[40 CFR 63.7550(d), 9/13/04; 40 CFR 63 Subpart DDDDD Table 9(1)(c), 9/13/04]

(d) Start-up, Shut-down, and Malfunction Report

(i) Periodic SSM Report

If actions taken during a startup or shutdown caused the boiler or process heater to exceed the CO emission limit, or a malfunction occurred, and Boeing followed the SSMP, Boeing shall submit a report that includes the information in 40 CFR 63.10(d)(5)(i). For each deviation from the CO emission limit during periods of startup, shutdown, or malfunction, the report must contain the information required by 40 CFR 63.7550(c) and (d) (see V.Q.7(c)). [40 CFR 63.10(d)(5)(i), 4/20/06; 40 CFR 63.7550(d), 9/13/04; 40 CFR 63 Subpart DDDDD Table 9(1)(c) and (d), 9/13/04; 40 CFR 63.6(e)(3)(iii), 4/20/06]

This report shall be delivered or postmarked by August 30th for the reporting period of January through June and by February 28th for the reporting period of July through December. Reports are only required if a startup or shutdown cause the boiler or process heater to exceed the CO emission limit or a malfunction occurred during the reporting period. [40 CFR 63 Subpart DDDDD Table 9(1)(d), 9/13/04; 40 CFR 63.10(d)(5)(i), 4/20/06; 40 CFR 63.6(e)(3)(iii), 4/20/06]

Consistent with 40 CFR 63.6(e) and 63.7(e)(1), deviations that occur during a period of startup, shutdown, or malfunction are not violations if Boeing demonstrates to the Puget Sound Clean Air Agency's satisfaction that the boiler or process heater was operating in accordance with 40 CFR 63.6(e)(1). The Puget Sound Clean Air Agency will determine whether deviations that occur during a period of startup, shutdown, or malfunction are violations, according to the provisions in 40 CFR 63.6(e). [40 CFR 63.7540(d), 4/20/06]

(ii) Immediate SSM Report

If an action taken by Boeing during a startup or shutdown (that caused the boiler or process heater to exceed the CO emissions limit), or a malfunction, is not consistent with the SSMP, Boeing shall submit a report of the actions taken for the event. This report shall be submitted within 30 days of the end of the month in which the action occurred, and shall include the information in 40 CFR 63.10(d)(5)(ii). [40 CFR 63 Subpart DDDDD Table 9(2), 9/13/04; 40 CFR 63.10(d)(5)(ii), 4/20/06; 40 CFR 63.6(e)(3)(iv), 4/20/06]

Consistent with 40 CFR 63.6(e) and 63.7(e)(1), deviations that occur during a period of startup, shutdown, or malfunction are not violations if Boeing demonstrates to the Puget Sound Clean Air Agency's satisfaction that the boiler or process heater was operating in accordance with 40 CFR 63.6(e)(1). The Puget Sound Clean Air Agency will determine whether deviations that occur during a period of startup, shutdown, or malfunction are violations, according to the provisions in 40 CFR 63.6(e). [40 CFR 63.7540(d), 4/20/06]

(e) Change in Information

Boeing shall provide in writing any change in the information that was already provided under 40 CFR Section 63.9 within 15 calendar days after the change in accordance with 40 CFR Section 63.9(j). [40 CFR Section 63.9(j), 5/30/03]

8. RICE NESHAP -- Reporting/Notification

(a) Initial Notification

For new and reconstructed stationary RICE subject to 40 CFR Part 63 Subpart ZZZZ, Boeing shall submit initial notification that includes the information in 40 CFR 63.9(b)(2)(i) through (v), and a statement that the stationary RICE has no additional requirements and explain the basis of the exclusion (for example, that it operates exclusively as an emergency stationary RICE). [40 CFR 63.6645(d), 6/15/04]

(b) Change in Information

Boeing shall provide in writing any change in the information that was already provided under 40 CFR Section 63.9 within 15 calendar days after the change in accordance with 40 CFR Section 63.9(j). [40 CFR Section 63.9(j), 5/30/03]

9. REQUIRED APPLICATIONS, REPORTS, AND COMPLIANCE CERTIFICATIONS

The following table summarizes the reporting requirements included in this permit. In the event of a conflict between the reporting requirements listed below and the reporting requirements listed in other sections of this permit, the reporting requirements listed in other sections of the permit shall govern.

Name of Application, Report, or Compliance Certification	Required by	Paraphrased Frequency
Halogenated Solvent NESHAP Annual Report (V.Q.6(a))	40 CFR 63.468(f)	By February 28 of each year for the preceding year.
Halogenated Solvent NESHAP Exceedance Report (V.Q.6(b) Semi-Annual Exceedance Report)	40 CFR 63.468(h)	Semiannually, by August 30th for the reporting period of January through June and by February 28th for the reporting period of July through December. All deviations must also be reported consistent with V.Q.1(b) Deviation Reports.
Aerospace NESHAP semiannual report (V.Q.3(b) Semiannual Compliance Certification Reports)	40 CFR 63.753(b)(1) 40 CFR 63.753(c)(1)	Semiannually, by August 30th for the reporting period of January through June and by February 28th for the reporting period of July through December. All deviations must also be reported consistent with V.Q.1(b) Deviation Reports.
Aerospace NESHAP annual report (V.Q.3(c) Annual Compliance Certification Reports)	40 CFR 63.753(c)(2)	Annually, by February 28 for the reporting period of January through December of the previous year.
Periodic startup, shutdown, malfunction report (applicable to Aerospace NESHAP only) (V.Q.3(e) Startup, Shutdown, and Malfunction Reports)	40 CFR 63.10(d)(5)(i)	Semiannually, by August 30th for the reporting period of January through June and by February 28th for the reporting period of July through December. All deviations must also be reported consistent with V.Q.1(b) Deviation Reports.

Name of Application, Report, or Compliance Certification	Required by	Paraphrased Frequency
Immediate SSM report (applicable to Aerospace NESHAP only) (V.Q.3(e) Startup, Shutdown, and Malfunction Reports)	40 CFR 63.10(d)(5)(ii)	Consistent with V.Q.1(b) Deviation Reports.
Initial CO performance test report (V.Q.7(b))	40 CFR 63.7545(e)	Before the close of business on the 60th day following the completion of the test.
Subsequent annual CO performance test report (V.Q.7(b))	40 CFR 63.7515(g)	Within 60 days after the completion of the test.
Boiler and Process Heater NESHAP semiannual compliance report (V.Q.7(c))	40 CFR 63.7550(a)-(c) 40 CFR 63 Subpart DDDDD Table 9(1) 40 CFR 63.7540(b)	Semiannually postmarked or delivered by August 30 for the reporting period of January 1 through June 30, and by February 28 for the reporting period of July 1 through December 31.
Boiler and Process Heater NESHAP - Immediate SSM report (V.Q.7(d)(ii))	40 CFR 63 Subpart DDDDD Table 9(2) 40 CFR 63.10(d)(5)(ii)	Consistent with V.Q.1(b) Deviation Reports.
Boiler and Process Heater NESHAP - Periodic SSM report (V.Q.7(d)(i))	40 CFR 63.10(d)(5)(i)	Semiannually, by August 30th for the reporting period of January through June and by February 28th for the reporting period of July through December. All deviations must also be reported consistent with V.Q.1(b) Deviation Reports.
Compliance certification V.M Compliance certifications	WAC 173-401-630(5)	Annually – February 28 for the previous calendar year. *Note: (This report must be submitted to both EPA & Puget Sound Clean Air Agency.)*
Semiannual deviation report (V.Q.1(a) Semiannual Operating Permit Reports)	WAC 173-401-615(3)(a)	August 30 for period January 1-June 30 and February 28 for period July 1-December 31.
Permit deviations which represent a potential threat to human health or safety (V.Q.1(b) Deviation Reports)	WAC 173-401-615(3)(b)	As soon as possible but no later than 12 hours of discovery of the deviation.

Name of Application, Report, or Compliance Certification	Required by	Paraphrased Frequency
Other permit deviations including failure to repair any defective equipment (V.Q.1(b) Deviation Reports)	WAC 173-401-615(3)(b)	Monthly - within 30 days after the end of the month in which the deviation is discovered Note: If Boeing is claiming the emergency defense of WAC 173-401-645 the report must be submitted within two working days.
Emission inventory statement (V.Q.2 Annual Emission Inventory)	Reg. I, 7.09(a)	Annually, by April 15th for the previous reporting period, or by a different date if specified by the Puget Sound Clean Air Agency.
VOC Emission Cap Report for PSD No.88-4 Amendment 1 (05/23/95) (II.A.2(o) Annual Emission Estimates Required by PSD or Order of Approval Permit Condition 4-41 bldg.	PSD 88-4 Amendment 1, Condition No. 2 (5/23/95)	Annually, by July 1st for the previous reporting period.
VOC Emission Cap Compliance Report for PSD No.97-02 (II.A.2(o) Annual Emission Estimates Required by PSD or Order of Approval Permit Condition4-86 bldg.	PSD No.97-02, Conditions No.1 and 2, Order of Approval No. 7155 (1/6/1998)	Annually, by July 1st for the previous reporting period.
Unavoidable Excess Emissions (V.S Unavoidable excess emissions)	WAC 173-400-107	As needed.
Administrative permit amendment request (VI.B Administrative Permit Amendments)	WAC 173-401-720	Can make change immediately on submission.
Notice of off permit changes (VI.D Off Permit Changes)	WAC 173-401-724	Contemporaneous with the change.
Minor permit modification application (VI.E Permit Modification)	WAC 173-401-725	Can make change immediately after filing application.
Significant permit modification application (VI.E Permit Modification)	WAC 173-401-725	As needed.

Name of Application, Report, or Compliance Certification	Required by	Paraphrased Frequency
Notice of Construction and Application for Approval (IV.A New Source Review)	Puget Sound Clean Air Agency Reg. I, Article 6	Before construction begins.
Asbestos project quarterly reports	Puget Sound Clean Air Agency Reg. III, Section 4.03(a)(8)(C)	Submitted quarterly
PSD permit applications (IV.A New Source Review)	WAC 173-400-141	Before construction begins.
NESHAP Application for Approval of Construction or Reconstruction	40 CFR 63.5(d)(1)	As soon as possible prior to construction if NESHAP in effect. No later than 60 days after effective date of standard if not in effect.
When using averaging scheme, report value of Ha and Ga that exceeds the 650 g/L HAP and VOC content limits.	General Order No. 8073 Condition No. 3	Semiannual (submitted along with the facility's semiannual compliance status report)

10. NOTIFICATION REQUIREMENTS

The following table summarizes the notification requirements included in this permit. In the event of a conflict between the notification requirements listed below and the notification requirements listed in other sections of this permit, the notification requirements listed in other sections of the permit shall govern.

Reqmt. No.	Citation	Adoption or Effective Date	Paraphrased Notification Requirement	Date Notification Due
N. 1	Puget Sound Clean Air Agency Regulation I, Section 3.07(b)	2/9/1995	As specified in Section V. N. of this permit, Boeing shall notify the Puget Sound Clean Air Agency in writing at least 2 weeks (14 days) prior to any compliance test and provide the Puget Sound Clean Air Agency an opportunity to review the test plan and to observe the test.	At least 14 days prior to compliance test.
N. 2	40 CFR 60.7(a)(1)	9/15/1994	Boeing shall furnish written notification to the Puget Sound Clean Air Agency and EPA Region 10 of the date of construction or reconstruction of an affected NSPS facility as specified in 40 CFR Part 60	Postmarked no later than 30 days after date of construction or reconstruction
N. 3	40 CFR 60.7(a)(2)	9/15/1994	Boeing shall furnish written notification to the Puget Sound Clean Air Agency and EPA Region 10 of the anticipated date of initial start-up of an affected NSPS facility as specified in 40 CFR Part 60	No more than 60 nor less than 30 days prior to anticipated date of initial start-up
N. 4	40 CFR 60.7(a)(3)	9/15/1994	Boeing shall furnish written notification to the Puget Sound Clean Air Agency and EPA Region 10 of the actual date of initial start-up of an affected NSPS facility as specified in 40 CFR Part 60	Postmarked within 15 days after date of initial start-up
N. 5	40 CFR 60.7(a)(4) 40 CFR 60.48c(a)	9/15/1994 10/17/2000	Boeing shall furnish written notification to the Puget Sound Clean Air Agency and EPA Region 10 of any physical or operational change which may increase emission rate of any air pollutant to which an NSPS standard applies unless change is exempted under 40 CFR 60.14(3)	Postmarked 60 days or as soon as practicable before change is commenced
N. 6	40 CFR 60.8	5/17/1989	Provide notice to the Puget Sound Clean Air Agency and EPA Region 10 of performance test conducted to demonstrate compliance with standards in 40 CFR Part 60 (NSPS)	30 days prior to test

Reqmt. No.	Citation	Adoption or Effective Date	Paraphrased Notification Requirement	Date Notification Due
N. 7	40 CFR 63.5(b)(4) 40 CFR 63.743(a)(10)	4/5/02 3/27/1998	For a new affected source or reconstructed affected source subject to a NESHAP, notify the Puget Sound Clean Air Agency of the intended construction or reconstruction. Submit in accordance with 63.9(b), Initial Notifications, and include information required for application for approval or construction or reconstruction as specified in 40 CFR 63.5(d). For major sources, application for approval may be used to fulfill notification requirements. For construction or reconstruction of a spray booth or hangar subject to the aerospace NESHAP (40 CFR Part 63, Subpart GG) that does not have the potential to emit 10 tons/year or more of an individual inorganic HAP or 25 tons/year or more of all inorganic HAP combined, Boeing shall comply with 40 CFR 63.5(b)(4) by notifying the Puget Sound Clean Air Agency on an annual basis on or before March 1 or each year. Notification shall include information required in 40 CFR 63.5(b)(4) for each spray booth or hangar.	For major sources, see timeline in 63.5(d).
N. 8	40 CFR 63.6645(d)	6/15/2004	For a new affected source, notification should include the information in 40 CFR 63.9(b)(2)(i) through (v), and a statement that your stationary RICE has no additional requirements and explain the basis of the exclusion (for example, that it operates exclusively as an emergency stationary RICE).	No later than 120 days after initial startup.
N. 9	40 CFR 63.7545(b)	9/13/2004	Submit Initial Notification for boilers and process heaters that start up before November 12, 2004 with the information in 63.9(b)(2).	Not later than 120 days after Nov. 12, 2004
N. 10	40 CFR 63.7545(c)	9/13/2004	Submit Initial Notification for boiler or process heaters that start up on or after November 12, 2004	Not later than 15 days after startup
N. 11	40 CFR 7545(d); 40 CFR 63.7(c)	9/13/2004 4/5/2002	Submit Notification of Intent to conduct a CO performance test.	60 days before performance test
N. 12	40 CFR 63.9(b)(3)	4/5/02	For a new or reconstructed affected source subject to a NESHAP with an initial startup after the effective date of a relevant standard and for which an application for approval of construction or reconstruction is not required under 40 CFR 63.5(d), submit an initial notification to the Puget Sound Clean Air Agency in accordance with 40 CFR 63.9(b)(3).	No later than 120 days after initial startup.

Reqmt. No.	Citation	Adoption or Effective Date	Paraphrased Notification Requirement	Date Notification Due
N. 13	40 CFR 63.9(e), 40 CFR 63.9(i), Puget Sound Clean Air Agency Reg I: 3.07	4/5/02 2/9/959	Boeing shall notify the Control Officer in writing of its intention to conduct a NESHAP performance test at least 60 calendar days before the performance test is scheduled to begin to allow the Control Officer to review and approve the site-specific test plan required under 40 CFR 63.7(c), if requested by the Control Officer, and to have an observer present during the test.	At least two weeks before the performance test is scheduled to begin.
N. 14	40 CFR 63.9(j) Puget Sound Clean Air Agency Regulation III, 2.02	5/30/03 09/09/1999	For vapor degreasing operations, aerospace coating operations, boilers and process heaters, and RICE subject to NESHAPs, Boeing shall send changes in information already submitted under 40 CFR 63.9 to the Puget Sound Clean Air Agency within 15 days	Within 15 days of determining changes in information needed
N. 15	WAC 173-401-724	11/4/93	Notice of off permit changes (VI.D Off Permit Changes)	Contemporaneous with the change
N. 16	Puget Sound Clean Air Agency Reg. III, Section 4.03	7/13/00	Asbestos project notification (Note: Includes all notification required under Reg. III, Section 4.03) (IV.C Asbestos)	Up to 10 days prior
N. 17	WAC 173-401-645(d)	11/4/93	Notice of Emeergency (V.R Emergencies)	Within 2 days of exceeding emission limits.

Reqmt. No.	Citation	Adoption or Effective Date	Paraphrased Notification Requirement	Date Notification Due
N. 18	Notice of changes not requiring permit revisions, including 502(b)(10) changes and SIP authorized emission trading (VI.C Changes not Requiring Permit Revisions)	WAC 173-401-722	7 days prior to making a change.	Notice of changes not requiring permit revisions, including 502(b)(10) changes and SIP authorized emission trading (VI.C Changes not Requiring Permit Revisions)

R. Emergencies

An emergency, as defined in WAC 173-401-645(1), constitutes an affirmative defense to an action brought for noncompliance with a technology-based emission limitation if the conditions of WAC 173-401-645(3) are met.

The affirmative defense of emergency shall be demonstrated through properly signed, contemporaneous operating logs, or other relevant evidence that:

1. An emergency occurred and that Boeing can identify the cause(s) of the emergency;
2. The permitted facility was at the time being properly operated;
3. During the period of the emergency Boeing took all reasonable steps to minimize levels of emissions that exceeded the emission standards or other requirements in the permit; and
4. Boeing submitted notice of the emergency to the Puget Sound Clean Air Agency within two (2) working days of the time when the emissions limitations were exceeded due to the emergency or shorter periods of time specified in an applicable requirement. This notice fulfills the requirement of WAC 173-401-615(3)(b) unless the excess emissions represent a potential threat to human health or safety. This notice must contain a description of the emergency, any steps taken to mitigate emissions, and corrective actions taken.

In any enforcement proceeding, Boeing has the burden of proof to establish the occurrence of an emergency. This provision is in addition to any emergency or upset provision contained in any applicable requirement. [WAC 173-401-645, 11/4/93]

S. Unavoidable excess emissions

Excess emissions due to startup or shutdown conditions, scheduled maintenance or upsets that are determined to be unavoidable under the procedures and criteria in WAC 173-400-107 shall be excused and not subject to penalty. For any excess emission that Boeing wants the Puget Sound Clean Air Agency to consider unavoidable and excusable under WAC 173-400-107, Boeing shall submit the information required under WAC 173-400-107. [WAC 173-400-107(2), 8/20/93 State/Puget Sound Clean Air Agency only]

T. Need to halt or reduce activity not a defense

It shall not be a defense for Boeing in an enforcement action that it would have been necessary to halt or reduce the permitted activity in order to maintain compliance with the conditions of this permit. [WAC 173-401-620(2)(b), 11/4/93]

U. Stratospheric ozone and climate protection

1. Boeing shall comply with the following standards for recycling and emissions reduction pursuant to 40 CFR Part 82, Subpart F, except as provided for motor vehicle air conditioners (MVACs) in Subpart B:

   i) Persons opening appliances for maintenance, service, repair, or disposal must comply with the required practices pursuant to 40 CFR 82.156;

   ii) Equipment used during the maintenance, service, repair, or disposal of appliances must comply with the standards for recycling and recovery equipment pursuant to 40 CFR 82.158; and

   iii) Persons performing maintenance, service, repair, or disposal of appliances must be certified by an approved technician certification program pursuant to 40 CFR 82.161.

2. Boeing may switch from any ozone-depleting substance to any alternative approved pursuant to the Significant New Alternatives Program (SNAP), 40 CFR Part 82, Subpart G, without a permit revision but shall not switch to a substitute listed as unacceptable pursuant to such program. [40 CFR 82.174, 1/13/95]

3. Any certified technician employed by Boeing shall keep a copy of their certification at their place of employment. [40 CFR 82.166(1), 1/13/95]

4. Boeing shall not willfully release any regulated refrigerant and shall use refrigerant extraction equipment to recover regulated refrigerant when servicing, repairing or disposing of commercial air conditioning, heating, or refrigeration systems. [40 CFR 81.154, 12/27/96] [RCW 70.94.970(2) and (4), 1991 State/Puget Sound Clean Air Agency only]

V. RACT satisfied

Emission standards and other requirements contained in rules or regulatory orders in effect at the time of this permit issuance shall be considered RACT for the purposes of issuing this permit. [WAC 173-401-605(3), 11/4/93] [Puget Sound Clean Air Agency Regulation I, Section 3.04(g), 3/11/99, State/Puget Sound Clean Air Agency only]

W. Risk management programs

In accordance with 40 CFR Part 68, if Boeing has or receives more than a threshold quantity of a regulated substance in a process, as determined under 40 CFR 68.115, Boeing shall comply with the requirements of the Chemical Accident Prevention Provisions of 40 CFR Part 68 no later than the following dates:

1. Three years after the date on which a regulated substance is first listed under 40 CFR 68.130; or

2. The date on which a regulated substance is first present above a threshold quantity in a process.

[40 CFR 68.10, 1/6/1999]

X. Definitions

Unless otherwise defined in this permit, the terms used in this permit shall have the same meaning ascribed to them in the referenced regulation. [WAC 173-401-200, 10/17/02]

Y. Duty to supplement or correct application

Upon becoming aware that it has failed to submit any relevant facts in a permit application or that it has submitted incorrect information in a permit application, Boeing shall promptly submit such supplementary facts or corrected information to the Puget Sound Clean Air Agency. [WAC 173-401-500(6), 10/17/02]

Z. Insignificant emission units and activities

1. Insignificant emission units and activities at Boeing are subject to all applicable requirements set forth in Sections I.A, III and IV. This permit does not require testing, monitoring, reporting or recordkeeping for insignificant emission units or activities, except as required by sections II.A.1(a) through II.A.1(c), II.A.1(e), and II.A.1(f) of this permit. For insignificant emission units, the testing, monitoring, reporting, or recordkeeping requirements identified are applicable once a potential air operating permit deviation issue is initially observed and continue to be applicable until the potential deviation issue is resolved. Compliance with sections II.A.1(a) through II.A.1(c), II.A.1(e), and II.A.1(f) of this permit shall be deemed to satisfy the requirements of WAC 173-401-615 and 173-401-630(1). [WAC 173-401-530(2)(c), 10/17/02]

2. Where this permit does not require testing, monitoring, recordkeeping and reporting for insignificant emissions units or activities, Boeing may certify continuous compliance if there were no observed, documented, or known instances of noncompliance during the reporting period. Where this permit requires testing, monitoring, recordkeeping and reporting for insignificant emission units or activities, Boeing may certify continuous compliance when the testing, monitoring, and recordkeeping required by the permit revealed no violations during the period, and there were no observed, documented, or known instances of noncompliance during the reporting period. [WAC 173-401-530(2)(d), 10/17/02]

3. An emission unit or activity that qualifies as insignificant solely on the basis of WAC 173-401-530(1)(a) shall not exceed the emission thresholds specified in WAC 173-401-530(4) until this permit is modified pursuant to Section VI.E of this permit and WAC 173-401-725. [WAC 173-401-530(6), 10/17/02]

VI. PERMIT ACTIONS

A. Permit Renewal, Revocation And Expiration

(1) **Renewal application**. Boeing shall submit a complete permit renewal application to the Puget Sound Clean Air Agency no later than 12 months prior to the expiration of this permit. The Puget Sound Clean Air Agency will send Boeing a renewal application no later than 18 months prior to the expiration of this permit. Failure of the Puget Sound Clean Air Agency to send Boeing a renewal application shall not relieve Boeing from the obligation to file a timely and complete renewal application. [WAC 173-401-710(1), 10/17/02; WAC 173-401-500(2), 10/17/02]

(2) **Expired permits.** Permit expiration terminates Boeing's right to operate unless a timely and complete renewal application has been submitted consistent with WAC 173-401-710(1) and WAC 173-401-500. All terms and conditions of the permit shall remain in effect after this permit expires if a timely and complete permit application has been submitted. [WAC 173-401-710(3), 10/17/02]

(3) **Revocation of permits**. The Puget Sound Clean Air Agency may revoke a permit only upon the request of Boeing or for cause. The Puget Sound Clean Air Agency shall provide at least thirty days written notice to Boeing prior to revocation of the permit or denial of a permit renewal application. Such notice shall include an explanation of the basis for the proposed action and afford Boeing an opportunity to meet with the Puget Sound Clean Air Agency prior to Puget Sound Clean Air Agency's final decision. A revocation issued under this condition may be issued conditionally with a future effective date and may specify that the revocation will not take effect if Boeing satisfies the specified conditions before the effective date. Nothing in this subsection shall limit Puget Sound Clean Air Agency's authority to issue emergency orders. [WAC 173-401-710(4), 10/17/02]

B. Administrative Permit Amendments

(1) **Definition.** An "administrative permit amendment" is a permit revision that:

a) Corrects typographical errors;

b) Identifies a change in the name, address, or phone number of any person identified in the permit, or provides a similar minor administrative change at Boeing;

c) Requires more frequent monitoring or reporting by Boeing;

d) Allows for a change in ownership or operational control of a source where the Puget Sound Clean Air Agency determines that no other change in the permit is necessary, provided that a written agreement containing a specific date for transfer of permit responsibility, coverage, and liability between the current and new permittee has been submitted to the Puget Sound Clean Air Agency;

e) Incorporates into the permit the terms, conditions, and provisions from orders approving notice of construction applications processed under an EPA-approved program, provided that such a program meets procedural requirements substantially equivalent to the requirements of WAC 173-401-700, 173-401-725, and 173-401-800 that would be applicable to the change if it were subject to review as a permit modification, and compliance requirements substantially equivalent to those contained in WAC 173-401-600 through 173-401-650. [WAC 173-401-720(1), 11/4/93]

(2) **Administrative permit amendment procedures**. An administrative permit amendment may be made by the Puget Sound Clean Air Agency consistent with the following:

a) The Puget Sound Clean Air Agency shall take no more than sixty days from receipt of a request for an administrative permit amendment to take final action on such request, and may incorporate such changes without providing notice to the public or affected states provided that it designates any such permit revisions as having been made pursuant to this paragraph.

b) The Puget Sound Clean Air Agency shall submit a copy of the revised permit to EPA.

c) Boeing may implement the changes addressed in the request for an administrative amendment immediately upon submittal of the request. [WAC 173-401-720(3), 11/4/93]

(3) **Permit shield**. The Puget Sound Clean Air Agency shall, upon taking final action granting a request for an administrative permit amendment, allow coverage by the permit shield in WAC 173-401-640 for administrative permit amendments made pursuant to part (1)(e) of this condition. [WAC 173-401-720(4), 11/4/93]

C. *Changes not Requiring Permit Revisions*

(1) **General**.

a) Boeing is authorized to make the changes described in this section without a permit revision, providing the following conditions are met:

i) The proposed changes are not Title I modifications as defined in WAC 174-401-200;

ii) The proposed changes do not result in emissions that exceed those allowable under the permit, whether expressed as a rate of emissions, or in total emissions;

iii) The proposed changes do not alter permit terms that are necessary to enforce limitations on emissions from units covered by the permit; and

iv) Boeing provides EPA and the Puget Sound Clean Air Agency with written notification at least seven days prior to making the proposed changes except that written notification of a change made in response to an emergency shall be provided as soon as possible after the event.

b) Permit attachments. Boeing and the Puget Sound Clean Air Agency shall attach each notice to their copy of the relevant permit.

(2) **Section 502(b)(10) changes**. Pursuant to the conditions in subsection (1) of this section, Boeing is authorized to make section 502(b)(10) changes (as defined in WAC 173-401-200) without a permit revision.

a) For each such change, the written notification required under subsection (1)(a)(iv) of this condition shall include a brief description of the change within the permitted facility, the date on which the change will occur, any change in emissions, and any permit term or condition that is no longer applicable as a result of the change.

b) The permit shield authorized under WAC 173-401-640 shall not apply to any change made pursuant to this paragraph.

(3) **SIP authorized emissions trading.** Pursuant to the conditions in Subsection (1) of this condition, Boeing is authorized to trade increases and decreases in emissions in the permitted facility, where the Washington state implementation plan provides for such emissions trades without requiring a permit revision. This provision is available in those cases where the permit does not already provide for such emissions trading.

a) Under this Subsection (3), the written notification required under subsection (1)(a)(iv) of this condition shall include such information as may be required by the provision in the Washington state implementation plan authorizing the emissions trade, including at a minimum, when the proposed change will occur, a description of each such change, any change in emissions, the permit requirements with which Boeing will comply using the emissions trading provisions of the Washington state implementation plan, and the pollutants emitted subject to the emissions trade. The notice shall also refer to the provisions with which Boeing will comply in the applicable implementation plan and that provide for the emissions trade.

b) The permit shield described in WAC 173-401-640 shall not extend to any change made under this paragraph. Compliance with the permit requirements that Boeing will meet using the emissions trade shall be determined according to requirements of the applicable implementation plan authorizing the emissions trade. [WAC 173-401-722, 10/17/02]

D. Off Permit Changes

(1) Boeing shall be allowed to make changes not specifically addressed or prohibited by the permit terms and conditions without requiring a permit revision, provided that the proposed changes do not weaken the enforceability of existing permit conditions. Any change that is a Title I modification or is a change subject to the acid rain requirements under Title IV of the FCAA must be submitted as a permit revision.

(2) Each such change shall meet all applicable requirements and shall not violate any existing permit term or condition.

(3) Boeing must provide contemporaneous written notice to the Puget Sound Clean Air Agency and EPA of each such change, except for changes that qualify as insignificant under WAC 173-401-530. Such written notice shall describe each such change, including the date, any change in emissions, pollutants emitted, and any applicable requirement that would apply as a result of the change.

(4) The change shall not qualify for the permit shield under WAC 173-401-640.

(5) Boeing shall keep a record describing changes made at Boeing that result in emissions of a regulated air pollutant subject to an applicable requirement, but not otherwise regulated under the permit, and the emissions resulting from those changes.

(6) When making a change under this section, Boeing shall comply with applicable preconstruction review requirements established pursuant to RCW 70.94.152 and Puget Sound Clean Air Agency Regulation I, Article 6. [WAC 173-401-724, 11/4/93]

E. Permit Modification

(1) Definition. A permit modification is any revision to this permit that cannot be accomplished under provisions for administrative permit amendments under WAC 173-401-720.

(2) Procedures. Minor permit modification procedures.

a) Criteria.

i) Minor permit modification procedures shall be used for those permit modifications that:

a) Do not violate any applicable requirement;

b) Do not involve significant changes to existing monitoring, reporting, or recordkeeping requirements in the permit;

c) Do not require or change a case-by-case determination of an emission limitation or other standard, or a source-specific determination for temporary sources of ambient impacts, or a visibility or increment analysis;

d) Do not seek to establish or change a permit term or condition for which there is no corresponding underlying applicable requirement and that Boeing has assumed to avoid an applicable requirement to which Boeing would otherwise be subject. Such terms and conditions include:

(1) A federally enforceable emissions cap assumed to avoid classification as a modification under any provision of Title I of the FCAA; and

(2) An alternative emissions limit approved pursuant to regulations promulgated under Section 112(i)(5) of the FCAA;

e) Are not modifications under any provision of Title I of the FCAA;

ii) Notwithstanding (a)(i) of this subsection, and subsection (3) of this section, the Puget Sound Clean Air Agency may allow the use of minor permit modification procedures for permit modifications involving the use of economic incentives, marketable permits, emissions trading, and other similar approaches, to the extent that the use of such minor permit modification procedures is explicitly provided for in the Washington state implementation plan or in applicable requirements promulgated by EPA and in effect on April 7, 1993.

b) Application. An application requesting the use of minor permit modification procedures shall meet the requirements of WAC 173-401-510 and shall include the following:

i) A description of the change, the emissions resulting from the change, and any new applicable requirements that will apply if the change occurs;

ii) Boeing's suggested draft permit;

iii) Certification by a responsible official, consistent with WAC 173-401-520, of the truth, accuracy, and completeness of the application and that the proposed modification meets the criteria for use of minor permit modification procedures and a request that such procedures be used; and

iv) Completed forms for the Puget Sound Clean Air Agency to use to notify EPA and affected states as required under WAC 173-401-810 and 173-401-820.

c) Boeing's ability to make change. Boeing may make the change proposed in its minor permit modification application immediately after it files such application provided that those changes requiring the submission of a notice of construction application have been reviewed and approved by the Puget Sound Clean Air Agency. After Boeing makes the change allowed by the preceding sentence, and until the Puget Sound Clean Air Agency takes any of the actions specified in WAC 173-401-725(d), Boeing must comply with both the applicable requirements governing the change and the proposed permit terms and conditions. During this time period, Boeing need not comply with the existing permit terms and conditions it seeks to modify. However, if Boeing fails to comply with its proposed permit terms and conditions during this time period, the existing permit terms and conditions it seeks to modify may be enforced against it.

d) Permit shield. The permit shield under WAC 173-401-640 shall not extend to minor permit modifications.

(3) **Group processing of minor permit modifications.** Consistent with WAC 173-401-725(3), the Puget Sound Clean Air Agency may process groups of a source's applications for certain modifications eligible for minor permit modification processing.

(4) **Significant modification procedures.**

a) Criteria. Significant modification procedures shall be used for applications requesting permit modifications that do not qualify as minor permit modifications or as administrative permit amendments. Every significant change in existing monitoring permit terms or conditions and every relaxation of reporting or recordkeeping permit terms or conditions shall be considered significant. Nothing herein shall be construed to preclude Boeing from making changes consistent with Chapter 173-401 WAC that would render existing permit compliance terms and conditions irrelevant.

b) Significant permit modifications shall meet all requirements of Chapter 173-401 WAC, including those for applications, public participation, review by affected states, and review by EPA, as they apply to permit issuance and permit renewal. The Puget Sound Clean Air Agency shall complete review on the majority of significant permit modifications within nine months after receipt of a complete application. [WAC 173-401-725, 11/4/93]

F. Reopening for Cause

(1) **Standard provisions.** This permit shall be reopened and revised under any of the following circumstances:

a) Additional applicable requirements become applicable to Boeing with a remaining permit term of three or more years. Such a reopening shall be completed not later than eighteen months after promulgation of the applicable requirement. No such reopening is required if the effective date of the requirement is later than the date on which the permit is due to expire, unless the original permit or any of its terms and conditions have been extended pursuant to WAC 173-401-620(2)(j);

b) Additional requirements (including excess emissions requirements) become applicable to an affected source under the acid rain program. Upon approval by

EPA, excess emissions offset plans shall be deemed to be incorporated into the permit;

c) The Puget Sound Clean Air Agency or EPA determine that the permit contains a material mistake or that inaccurate statements were made in establishing the emissions standards or other terms or conditions of the permit; or

d) The Puget Sound Clean Air Agency or EPA determine that the permit must be revised or revoked to assure compliance with the applicable requirements.

(2) **Procedures.** Proceedings to reopen and issue a permit shall follow the same procedures as apply to initial permit issuance and shall affect only those parts of the permit for which cause to reopen exists. Such reopening shall be made as expeditiously as practicable.

(3) **Notice.** Reopenings under this section shall not be initiated before a notice of such intent is provided to Boeing by the Puget Sound Clean Air Agency at least thirty days in advance of the date that the permit is to be reopened, except that the Puget Sound Clean Air Agency may provide a shorter time period in the case of an emergency. [WAC 173-401-730, 11/4/93]

VII. PERMIT SHIELD

Compliance with the conditions of the permit shall be deemed compliance with any applicable requirements contained in Sections I through VI of this permit that are specifically identified in this permit as of the date of permit issuance. [WAC 173-401-640(1), 11/4/93]

Nothing in this permit shall alter or affect the following:

(1) The provisions of Section 303 of the FCAA (emergency orders), including the authority of the administrator under that section;

(2) The liability of an owner or operator of Boeing for any violation of applicable requirements prior to or at the time of permit issuance;

(3) The applicable requirements of the acid rain program, consistent with Section 408(a) of the FCAA;

(4) The ability of EPA to obtain information from a source pursuant to Section 114 of the FCAA; or

(5) The ability of the Puget Sound Clean Air Agency to establish or revise requirements for the use of reasonably available control technology (RACT) as provided in chapter 252, Laws of 1993.

[WAC 173-401-640(4), 11/4/93]

VIII. APPENDIXES

A. Reference Method Titles and Averaging Periods

EPA Reference Test Method	Date	Title	Averaging Period
Puget Sound Clean Air Agency Method 5 Puget Sound Clean Air Agency Board Resolution 540	August 11, 1983	Determination of Particulate Emissions from Stationary Sources	1-hour tests unless otherwise specified.
EPA Method 6 40 CFR Part 60, Appendix A	July 1, 2001	Determination of Sulfur Dioxide Emissions from Stationary Sources	1-hour tests.
EPA Method 7 40 CFR Part 60, Appendix A	July 1, 2001	Determination of Nitrogen Oxide Emissions from Stationary Sources	Four 15 seconds for Method 7, 7A grab samples taken at 15 minute intervals. 1 hour for Method 7C, 7D or 7E.
Ecology 9A, "Source Test Manual – Procedures for Compliance Testing"	July 12, 1990	Visual Determination of the Opacity of Emissions from Stationary Sources - for State and Puget Sound Clean Air Agency requirements	Any 13 opacity readings above standard in one hour, opacity readings taken in 15-second intervals.
EPA Method 9 40 CFR Part 60, Appendix A	July 1, 2001	Visual Determination of the Opacity of Emissions from Stationary Sources - for Federal Requirements	6-minute averaging period, opacity readings taken in 15-second intervals.
EPA Method 10 40 CFR 60, Appendix A	August 14, 2006	Determination of Carbon Monoxide Emissions from Stationary Sources	1-hour tests.

EPA Reference Test Method	Date	Title	Averaging Period
EPA Method 19, 40 CFR Part 60 Appendix A	July 1, 2001	Determination of Sulfur Dioxide Removal Efficiency and Particulate Matter, Sulfur Dioxide, and Nitrogen Oxides Emission Rates	30-day rolling average for nitrogen oxides.
EPA Method 24 40 CFR Part 60, Appendix A	July 1, 2001	Determination of Volatile Matter Content, Water Content, Density, Volume Solids, and Weight Solids of Surface Coatings	For water-based and water reducible coatings, vendor certification or data will be used for determining compliance. For other VOC containing materials, vendor certification or data will be the primary means for determining compliance. If Method 24 is used for coatings, grab samples will be taken and the average of all of a single type of coating (e.g., primer or topcoat), mixed and ready for application within the same coating operation, will be used for determining compliance.
EPA Method 26 A 40 CFR Part 60, Appendix A	July 1, 2001	Determinations of HCl	1-hour tests.
EPA Method 27 40 CFR Part 60, Appendix A	July 1, 2001	Determination of Vapor Tightness of Gasoline Delivery Tank Using Pressure-Vacuum Test	5-minute averaging period.
EPA Method 307 40 CFR Part 63, Appendix A	July 1, 2001	Determination of Emissions from Halogenated Solvent Vapor Cleaning Machines Using a Liquid Level Procedure	16 hour test runs

EPA Reference Test Method	Date	Title	Averaging Period
EPA Method 319 40 CFR Part 60, Appendix A	July 1, 2001	Determination of Filtration Efficiency for Paint Overspray	None required.

For Puget Sound Clean Air Agency Method 5, EPA Method 6, EPA Method 7, A, C and D, EPA Method 24, EPA Method 26A and EPA Method 306 A and B, each test shall consist of three separate runs and compliance shall be determined from the arithmetic average of the three runs. In the event that a sample is accidentally lost or conditions occur in which one of the runs must be discontinued because of circumstances beyond the operator's control, compliance may, upon EPA or Puget Sound Clean Air Agency approval, be determined from the arithmetic average of the two other runs.

Source Test Method 99 Fuel Oil Analyses

Ash	ASTM D482,
Sulfur	ASTM D3120,
Halogens	EPA SW846, 9076,
PCB	EPA SW846, 8080,
Lead	EPA 600/4-81-045, 200.7
Flash Point	EPA SW846,1020

B. Non-EPA Test Methods

1. **Puget Sound Clean Air Agency Method 5**
2. **Ecology Method 9A**

3. Attachments

No.	Subject
1	A. Lee Letter dated March 18, 1993 to M. Babich re PSCAA Approval of Non-Vertical Exhaust for 10-59 Building Spray Booths No. 14-16 as exempt from PSCAA I: 9.16(c).
2	Dave S. Kircher letter dated November 30, 1992 to B J Thompson re PSAPCA Approval for exemption to the Requirements of Regulation I, Section 9.16 "Spray Coating Operations"
3	Letter dated February 1, 1993, D. Kircher to L. Babich; Subject: PSAPCA Approval for Exemption to the Requirements of Regulation I, Section 9.16 "Spray Coating Operations
4	Abigail C Lee letter dated August 1, 1996 to Chris Morris re Airplane Cleaning Operations Boeing Renton Facility
5	Douglas E Hardesty, EPA, letter dated Oct 14, 1998 to Jay M Willenberg re Preval Spray Units Applicability to the Aerospace NESHAP
6	Jay M Willenberg letter dated February 19, 1999 to Robin Bennett re Aerospace NESHAP Paint Booth Requirements
7	Bonnie Thie, EPA, letter dated April 2, 1998 to Robin Bennett re Aerospace NESHAP Rule Interpretation
8	J M Willenberg letter dated January 9, 1998 to David Moore re Notice of Construction (NOC) Requirements for Paint Spray Booths
9	David S Kircher letter dated August 10, 1999 to Charles Austin re Small Container Used for Immersion Cleaning with Acetone
10	David S Kircher letter dated May 8, 1995 to Hannah Kimball re Rule Applicability for Cold Solvent Cleaners
11	Jay M Willenberg letter dated June 14, 2000 to Robin Bennett re Equivalency Determination for Safety Kleen Models 1107 and 1111 Gun Cleaning Systems with Gun Cleaning Techniques in 40 CFR 63.744(c)
12	Jay M Willenberg letter dated January 30, 2001 to Edward Cierebiej re Mobile Equipment
13	N Shulman letter dated January 15, 1998, to D. Moore re Clarifies that Manufacturer's Supplied Data is normally sufficient to be able to Certify Compliance for 63.750(a) and (c)(1). However, Puget Sound Clean Air Agency reserves the right to use other methods or require Boeing to use the reference method if needed.

14 Jay Willenberg letter dated June 22, 1995 to Janette Ramos, Boeing re Exemption from Registration Granted/NOC Not Required for Dust Collector in Building 4-82.

15 Jay M Willenberg letter dated May 20, 1999 to Frank Migaiolo re Acceptable Pressure Drop Limits for Dry Filter Banks Subject to the Aerospace NESHAP.

16 S Van Slyke letter dated October 10, 2001, to J. Hudson re Notice of Construction (NOC) Requirements for Scrubbers and Baghouses

17 N Shulman letter dated January 15, 1998, to D. Moore re Solvent Composition Requirements in Aerospace NESHAP

18 J Nolan letter dated August 27, 2001, to N. Welch re Applicability of PSCAA Regulation III, Section 3.05, Solvent Metal Cleaners

19 J Willenberg letter dated January 18, 2002, to R. Bennett re "New Source" Requirements for Spray Gun Cleaning Operations

20 S Van Slyke letter January 16, 2002, to N Welch re Solvent Metal Cleaners for Paint Removal

21 J Willenberg letter June 6, 1995, to L. Babich re Approval of Exemption Request from Spray Coating Regulation I, Section 9.16(b)(6) for Spray Operations at Flight Lines

22 A McIntyre email January 2, 2003 to J. Fosberg re Meaning of "month" and "week" requested December 18, 2002.

23 S Van Slyke email dated September 14, 2001 to B. Thompson re Rule Interpretaion on New NOC Interpretation

24 A. Lee letter February 26, 1993, to J. Johnston re record keeping requirements regarding the operations and maintenance of fume hoods or ovens

25 Steve Van Slyke letter, September 13, 2004, to Jeff KenKnight re recordkeeping requirements for BOIL04 in compliance with 40 CFR 60.48c(g).

APPENDIX J

CLIBRE Operations and Maintenance Plan for the
Renton Cleanup Action Soil Vapor Extraction Systems

OPERATIONS AND MAINTENANCE PLAN
FOR THE RENTON CLEANUP ACTION
SOIL VAPOR EXTRACTION SYSTEMS

Prepared for:

THE BOEING COMPANY
EHS REMEDIATION

Prepared by:
CALIBRE Systems, Inc.
16935 SE 39th St.
Bellevue WA 98008

June 19, 2014

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CALIBRE- CALIBRE Systems, Inc.	PPE – Personal Protective Equipment
CFM – cubic feet per minute	PSCAA -Puget Sound Clean Air Agency
DCE – cis 1,2-dichloroethene	RH – Relative Humidity
FM – Flow Meter	RTU – Remote Telemetry Unit
HASP – Health and Safety Plan	SOP – Standard Operating Procedure
MSDS – Material Safety Data Sheets	SP – Sampling Port
LPC – Liquid Phase Carbon	SVE – Soil Vapor Extraction
O&M – Operations and Maintenance	TCE – Trichloroethene
PCE - Tetrachloroethene	VC – Vinyl Chloride
PID – Photo Ionization Detector	VOC – Volatile Organic Compounds
PLC - Programmable Logic Controller	VPC – Vapor Phase Carbon

OPERATIONS AND MAINTENANCE PLAN FOR THE RENTON CLEANUP ACTION - SOIL VAPOR EXTRACTION SYSTEM

1.0 INTRODUCTION

This Draft Operations and Maintenance (O&M) plan has been prepared for the operation of Soil Vapor Extraction (SVE) Systems to be operated as part of the Renton cleanup action at the Boeing Renton Facility. The project location is shown in Figure 1-1. All O&M work on this project must be coordinated with Boeing. Boeing contacts are listed in the Key Project Contacts Table 1-1. These contacts are for assistance with the handling/ documentation associated with all process waste streams, ordering and receipt of bulk materials required, and any emergency response actions. All O&M work on this project must be conducted in compliance with the requirements of Boeing's Service Provider Manual (see Attachment A) and the project HASP

This O&M plan covers operation of two SVE systems and associated off-gas treatment equipment; hereafter referred to as the System. This O&M plan also describes procedures required for management of process-derived waste streams. The O&M plan for the System contains activities that are specific to operation and maintenance of the System. The plan for management of process-derived waste streams addresses requirements for waste management and coordination of disposal with Boeing. The primary wastes expected to be generated are:

- spent vapor phase carbon (VPC) used for off-gas treatment (if treatment is required)
- accumulated water generated from condensate knock-out drum during system operation
- sediment from condensate in the moisture separator
- used air filters from the blower (particulate filters)
- used lubricating oil from the blowers

The requirements for the waste management plan are described in detail in Section 5.

A training plan for site personnel is required under WISHA regulations (WAC 296-62-055415). The program to meet that requirement is covered in the project Health and Safety Plan (HASP).

This O&M plan includes a variety of planned procedures and requirements for System operation. Monitoring will be conducted as part of System startup and subsequent operation. Based on the operating data collected, the Draft O&M plan may be changed to modify specific procedures or requirements that can be optimized based on the monitoring data.

Each element of this plan must be understood and followed by all operations personnel. Washington State laws require that each element of the waste management plan be followed and documented as required. Any failure to follow the plan requirements, specifically including the required documentation, may violate State laws.

1.1 Organization

This O&M manual is divided into five sections as follows:

1) Section 1.0 presents the introduction, organization, and health and safety considerations
2) Section 2.0 provides a description of the systems and components
3) Section 3.0 details operating procedures for the SVE systems
4) Section 4.0 describes maintenance procedures and schedules

5) Section 5.0 describes the procedures for management of process derived waste streams

1.2 General Operations and Safety Considerations

All O&M and monitoring activities will be conducted in accordance with the procedures specified in the Boeing Service Provider Manual (Attachment A) and all requirements in the project HASP. The HASP will be maintained on-site along with this O&M Manual and project Work Plan (in the equipment trailer). This O&M manual documents the System operational settings and procedures, describes waste handling procedures, and also identifies various safety considerations associated with specific O&M procedures and activities. The warnings presented throughout this O&M Manual are intended to provide specific emphasis to potentially hazardous conditions. These added warnings/safety precautions are intended to augment all requirements/procedures in the HASP and other related Standard Operating Procedures (SOPs), not to replace the requirements described in other procedures.

Safety measures, safe equipment operation, and safety related to the handling of materials are the first and foremost consideration for all site work. This O&M Manual has been prepared to serve as a general guide in operating and maintaining the equipment systems. The manual is intended for use by qualified personnel with knowledge of the specific equipment used and their operation (primarily blowers, electric motors, belt/pulley drives, electrical systems, pumps, a vapor off-gas treatment system, and a control system). It does not, and is not intended to, cover all possible variations in equipment or to provide guidance for all operating problems that may arise. Should additional information be required, the project engineer should be contacted. No amount of written instructions can replace clear thinking and reasoning on the part of operations personnel. All operations personnel must be thoroughly familiar with the equipment before operating or maintaining the equipment. All operations personnel must be thoroughly familiar with the contingency plan and emergency response procedures (presented in attached SOPs, Attachment B).

Competent supervision of mechanical and electrical equipment operation and maintenance is necessary to maintain safe and reliable operation. Prior to operation of the System, all operations staff must certify they have read this O&M Manual, the project HASP, and the Contingency Plan to minimize the potential for injury to personnel, discharge of any environmentally regulated substance, and/or damage to equipment. The general operations and safety considerations described in this O&M Manual must be understood and followed by all personnel associated with system operation. The following procedures and safety considerations are repeated in this O&M manual in specific operating procedures and it is a requirement that operation personnel fully understand each element before on-site work begins.

GENERAL SAFETY CONSIDERATIONS

It is the operator's responsibility to follow company safety procedures, all Boeing safety procedures, all procedures and safety considerations presented in this O&M Manual, and the site-specific Health and Safety Plan. All operations personnel must be thoroughly familiar with all equipment including all emergency shutdown procedures, spill response, and notification procedures.

ELECTRICAL SAFETY

1) Before attempting any O&M procedures locate the main electrical source and understand how to safely control it. Always verify (via direct measurement) that the electric source is disconnected.
2) Always lockout and tagout the electrical source before beginning any repair or replacement tasks. Refer to equipment manual and the project HASP for specific instructions.
3) Repairs or modifications to major components of the electrical distribution system (electrical panels) must be made by a qualified electrician.
4) During periods of lightning activity, do not connect or disconnect any cables or perform installation, maintenance, or reconfiguration of any system components.
5) Notify appropriate supervisory personnel before and after conducting maintenance to any components of the system.

WARNING LOCKOUT/TAGOUT PROCEDURES

High voltage and equipment with rotating parts can cause serious or fatal injury. Installation, operation, and maintenance of all equipment should be performed by qualified personnel. Appropriate lockout/tagout procedures must be followed for any maintenance work on all equipment with electrical connections and/or rotating parts, as per the requirements of OSHA CFR 29 Section 1910.147. It is a critical safety concern that all equipment with electrical connections and/or rotating parts be positively disconnected and locked out before any maintenance work takes place.

ROTATING EQUIPMENT DANGER

Equipment with rotating parts can cause serious or fatal injury. Installation, operation, and maintenance of all equipment should be performed by qualified personnel. All equipment has belt and pulley guards in place. Only remove guards during maintenance activity and ensure proper lockout tagout procedures are followed to ensure power is not supplied to rotating equipment. After maintenance is completed reinstall all guards and maintain good housekeeping to prevent tooling and debris from inadvertently coming into contact with rotating equipment.

DO NOT WEAR LOOSE CLOTHING NEAR ROTATING EQUIPMENT

1.2.1 OSHA Regulations

System operators must meet all OSHA and WISHA requirements regarding hazardous waste operations. This is to include appropriate training (40-hour OSHA and 8-hour updates) and medical monitoring if deemed necessary.

1.2.2 Confined Space Entry Procedures

None expected for this project.

1.2.3 Chemical Dangers and Exposure Risks

Exposure to chemicals is a risk during operation of the remediation systems. Contaminants of concern at these sites include; tetrachloroethene (PCE), trichloroethene (TCE), cis-1,2-dichloroethene (DCE), vinyl chloride (VC), methylene chloride, benzene, and gasoline. These volatile chemicals pose a possible risk via potential exposure pathways including inhalation, dermal contact, and ingestion. Appropriate monitoring, personal protective equipment (PPE), and safe work practices will be implemented to eliminate and/or minimize any potential exposure pathways.

To prevent potential adverse health effects and reduce exposure, two procedural steps are to be followed:

1) The well-head vaults should not be entered (unless absolutely necessary and only with ventilation, monitoring and a respirator) until vapor concentrations have been reduced to a level where they do not pose as high a potential health risk to workers. The system has been constructed in a manner that vault access should not be necessary, well flow meters and control valves have been constructed outside of the individual well vaults.
2) Within the treatment trailer, the ventilation fan should run continuously. In the unplanned event that pressure relief valves were to leak or malfunction, the ventilation fan will reduce any fugitive vapor concentrations within the trailer.

Personnel should be knowledgeable in procedures to minimize exposure risks and proper handling protocols for all potential contaminants and chemicals present at the System.

1.2.4 Storm Water Management

All activities at the Renton Facility project will be conducted in a manner to limit the potential for any material to be transported to nearby storm water conveyance systems. This will include storing all materials under cover so that they are not contacted by precipitation. All liquid materials will be stored within secondary containment. When process maintenance requires changing media (e.g., VPC changes), the vessels will be transported to a location away from storm drains for the physical operations necessary to change the media.

The condensate collection drums will be located in storage sheds which have a 75-gallon capacity secondary containment system.

1.2.5 Spill Kit Location

A spill kit for condensate water is located in/near the equipment trailer. The condensate spill kit includes spill containment pillows, absorbent material, covers for nearby storm drain catch basins, a shovel, a shop-vac with extension cord, a broom, an empty drum for collection of spill cleanup residuals, a portable eye wash, and PPE consisting of nitrile gloves, rubber overboots, and Tyvek coveralls. All personnel operating the System, as well as additional on-site personnel, will be aware of the spill kit location and knowledgeable in its use. A plan view map of the Health and Safety features, including eye wash, spill kit, first aid kit, and fire extinguisher locations are shown in Figure 1-2.

1.2.6 Specific Contacts for Project Coordination/Support

Table 1-1 provides a list of key contacts for project coordination/support activities.

Table 1-1 Project Contact List

Responsibility/function	**Contact name/ Organization**	**Phone**
Renton Site EHS Contact	Ray Power/ Boeing	(425) 965-2297
Renton EHS hazardous waste management contact	Nancy Swenson/Boeing	(206) 544-6224
Security (non-emergency)		(206) 655-8800
Emergency Response to environmental spills/leaks		(206) 655-2222
Boeing Project Manager	Carl Bach	(206) 898-0438 cell
Boeing Dispatch (forklift)		(206) 544-6500
Boeing Site Contact	Jennifer Parsons Fred Wallace	(206) 715-7981 cell (206) 930-0461 cell
AMEC Project Manager	Larry McGaughey	(206) 342-1760
CALIBRE Project Manager	Tom McKeon	(425) 241-8449 cell
CALIBRE Field Ops Manager	Grant Dawson	(206) 801-7362 (509) 430-6752 cell
Alternate CALIBRE contacts	Justin Neste	(360) 981-5606
	Chris Gallagher	(253) 278-2841

2.0 SVE SYSTEM DESCRIPTION

The systems consist of two separate SVE equipment packages located at two locations, SWMU-172/174 and Building 4-78/79. Each SVE system is comprised of an SVE equipment package, off-gas treatment system, and a number of vapor extraction wells (3 wells at SWMU-172/174 and up to 15 wells at Building 4-78/79).

The SVE wells are connected to the SVE equipment packages with PVC piping (including both above and below grade). The transport piping is consolidated into a single inlet into each SVE equipment package. Off-gas treatment systems (if required) consist of two VPC vessels connected in series. The VPC vessels are used to remove the organic vapors (primarily PCE, TCE, and DCE) by adsorption (VPC use at these sites is to be determined). Systems are run with a vacuum blower to recover vapor from wells and pass through a moisture separator. The moisture separator/condensate knockout prevents moisture from accumulating in the VPC vessels which can reduce the adsorption efficiency of the carbon.

2.1 System Layout

The typical layout of the SVE equipment systems at each site is shown in Figure 2-1. Each equipment compound consists of the equipment trailer, off-gas treatment vessels, condensate collection shed, and spill kits. The equipment compounds are located near Building 5-09 (SWMU-172/174) and Building 4-78/4-79. Figures 2-2 and 2-3 show the general locations of equipment packages.

2.2 System Components and Equipment

System components consist of equipment for operating SVE, VPC for air treatment, and condensate transfer/storage. The equipment components include a blower, motor, belt/pulley drive system with guards, inlet filter, valves and flow meters, moisture separator, discharge pump, electrical systems (breaker panels, motor starters or variable speed drives) and Programmable Logic Controller (PLC) with associated process controls. The VPC vessels are adjacent to the SVE trailers and accumulated condensate water is stored in the storage sheds. The list of equipment components (when already known/specified) are shown in Tables 2-1 and 2-2.

2.2.1 SVE Equipment Operation

The equipment components for SVE operations are shown in Figure 2-4. The primary components of the systems are the wells; a well head vault that houses each SVE well; underground and overhead piping to convey air extracted from each SVE well; an equipment trailer with moisture separator and blower, and VPC units to treat the collected air stream.

The air extraction piping is connected to each of the SVE wells. Each extraction line is equipped with individual flow meters and gate valves to control flow from each SVE well. The extraction lines are consolidated into a single pipe before connecting to the vacuum side of the blower.

Table 2-1 SWMU-172 SVE Equipment List

FUNCTION/PURPOSE	EQUIPMENT USED
Building/Enclosure	
Enclosure	Enclosed trailer , side door, rear double doors
Cooling/ventilation	To Be Determined
Air Handling Equipment	
Pressure/vacuum blower	1 Kaeser Omega Model 21P
Blower motor	To Be Determined
Air flow meters	To Be Determined
Air filter	To Be Determined
Piping connections to trailer	To Be Determined
Off-gas treatment system	To Be Determined
Moisture Separator	To Be Determined
Discharge pump from moisture separator	To Be Determined
Pressure & vacuum gauges	To Be Determined
Automated Control Systems	
Programmable Logic Controller (PLC)	To Be Determined
Vacuum/pressure relief valves	To Be Determined
High temperature switch	To Be Determined
High press./vacuum switches	To Be Determined
High/low level switches	To Be Determined
Temperature measurement	To Be Determined
Return air stream humidity control	To Be Determined
Electrical System	
Motor starters	To Be Determined
Surge protector	To Be Determined
Service panel	To Be Determined
Circuit breakers	To Be Determined
Well Construction	
Well casing	PVC
Well head fittings	To Be Determined

Note: Listed equipment is typical SVE equipment; specific model numbers will be available after delivery of equipment system.

Table 2-2 Building 4-78/79 SVE Equipment List

FUNCTION/PURPOSE	EQUIPMENT USED
Building/Enclosure	
Enclosure	16 ft double axle trailer, side door, rear double doors
Cooling/ventilation	Thermostat controlled vent fan (100 cfm)
Air Handling Equipment	
Pressure/vacuum blower	1 Kaeser Omega 23 BB23
Blower motor	1 Baldor, 7.5 hp motor, 230v, 1-phase
Air flow meters	3 Ametek direct reading 2" flow meters; 2 model FM20A125Q; 1 model FM20A175Q
Air filter	1 Solberg In-line filters (part # 515255)
Piping connections to trailer	All connections on outside of trailer connected to flex hose fittings, connected to piping manifolds
Off-gas treatment system	Activated carbon adsorption (VPC) vessels with KMN (permanganate) vessels
Moisture Separator	Steel 55-gallon drum, with vacuum relief valve
Discharge pump from moisture separator	Teel, ½ hp pump to transfer accumulated water to storage drum including wiring, motor starter, check valve and piping
Pressure & vacuum gauges	1 pressure gauge (blower outlet), 1 vacuum gauge (blower inlet)
Automated Control Systems	
Programmable Logic Controller (PLC)	Industrial Control Links 4200
Vacuum/pressure relief valves	Mayer 2 inch adjustable pressure relief valve, Kunkle model 215V, 3 inch adjustable vacuum relief valve
High temperature switch	Programmed into PLC based on thermocouple reading
High press./vacuum switches	Programmed into PLC based on signals from Dwyer pressure transducer.
High/low level switches	2 Flo-Tec model L6 in moisture separator
Temperature measurement	Thermocouple connected to digital readout in PLC, one for blower outlet
Return air stream humidity control	Compression heating from blower and insulated vessels down stream
Electrical System	
Motor starters	Square D, 1 NEMA size 2 (7.5 hp blower)
Surge protector	Leviton, 51120 surge protector
Service panel	Square D
Circuit breakers	Square D
Well Construction	
Well casing	PVC
Well head fittings	To Be Determined

Note: Listed equipment is for expected SVE equipment system, specific model numbers may change at time of installation.

The air extracted from the SVE wells flows through a moisture separator to remove any entrained moisture. The air then flows through the blower and then through VPC units, which remove VOCs. The treated air is then discharged to the atmosphere through a stack. The expected emissions from the systems are low enough that both systems are exempt from requiring a permit from Puget Sound Clean Air Agency (PSCAA), as a result discharge system monitoring will be done solely for performance monitoring and to ensure that the carbon vessels do not experience break-through.

2.2.2 Off-gas Treatment Systems

The vapor treatment system uses two VPC vessels connected in series to adsorb volatile compounds in the vapor stream. The lead-lag setup is used to prevent volatile chemicals from being released due to carbon "breakthrough" of the lead vessel.

2.2.2.1 Vapor-Phase Carbon (VPC) System

Figure 2-4 shows the vapor-phase treatment system layout. In operation, the VOC vapors are piped to the lead VPC vessel[1] followed by a lag VPC vessel. Based on vapor concentrations and flow rates (to be measured), the expected life of the carbon will be determined. In addition, the off-gas vapors will be sampled before the lead vessel, between the lead and lag vessel, and after the lag vessel. This sampling will be conducted with a field instrument (photo-ionization detector [PID]) to verify VOC vapor removal by the carbon and to detect breakthrough from the lead carbon adsorption vessel. Samples for laboratory analysis will also be obtained from sample ports during system monitoring events as needed for remedial optimization.

2.2.2.2 Vapor Stream Relative Humidity Control

The air stream from the wells will have a high relative humidity (RH), approximately 100% RH, and a temperature of approximately 50-55 °F. This air stream needs to be conditioned to lower the RH to a level of less than 40% in order to have efficient VPC removal of VOCs. The heat of compression of the blower is used to heat the air stream and thereby lower the RH. The VPC vessels have a large surface area and vessels located outside of a climate controlled area are therefore insulated to minimize heat loss. The outlet temperature of the lag VPC vessel needs to be measured and the blower performance adjusted to ensure sufficient heating of the air stream.

2.3 Process Control Systems

The process control system monitors operating parameters and integrates those operating conditions with the control logic programmed in the PLC. The equipment system PLC is located within the electrical panel inside the trailer.

The trailer control system consists of the following equipment:

- Programmable logic controller (PLC)
- Pressure and vacuum relief valves
- Ventilation fan with thermostat
- Switches, relays, and fuses
- High/low level switches

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[1] off-gas treatment units will include a lead unit with both carbon and zeolite with permanganate (KMN) in series as a unit/combo, then a lag unit (including both)

The equipment systems are controlled by PLCs. The PLC interface has a limited number of menu screens for the operator to interrogate operating control parameters (temperature, pressure, vacuum) and adjust the set points for process control of those parameters. In hand mode, all PLC control systems are bypassed (limits for temperature, pressure, and vacuum), relief valves remain operational.

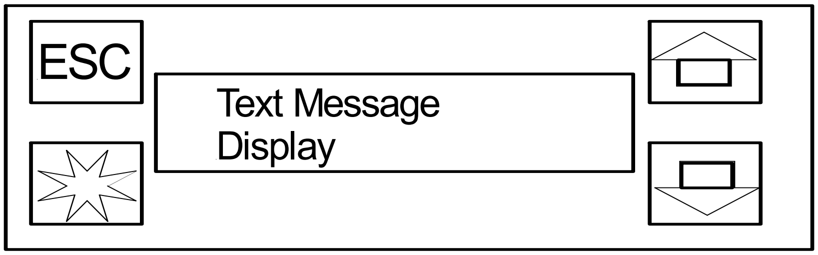
2.3.1 System Process Control

The PLC monitors operating conditions and automatically shuts the system down if conditions are outside of preset normal ranges. Conditions monitored by the PLC include pressure/vacuum into and out of the blower, the outlet temperature of the blower and the water level in the moisture separator.

2.3.2 PLC Operations/Interface

Each trailer has its own unique PLC controller and display screens the following section describes one example. Each PLC has a direct reading display that displays operating information (with brief descriptions and standard engineering units). Some PLC units automatically cycle through different monitored parameters such as vacuum, pressure, etc. Other PLC units require manual interaction to scroll through parameters. The following example is for the SVE system requiring manual interaction. If the PLC automatically cycles through parameters, operators performing routine monitoring should avoid pressing input buttons to prevent changing set points or inadvertently locking or freezing the PLC.

The display information on the PLC is depicted below and described in the following paragraphs.



The star button (lower left) allows the PLC display screen to scroll through several screens with different display information. The display information is presented in three levels or categories:

1) Startup/shutdown times & any current/last fault conditions
2) Current operating parameters
3) Set points for process control parameters

Each time the star button is pressed, the display information toggles to the subsequent screen (for the display screens listed above; 1→2, 2→3, 3→1**).** *It is critical that the PLC display screen always be returned to screen level 1) Startup/shutdown times after other screens are viewed*. If this procedure is not followed the PLC occasionally gets locked up and the system must be shutdown, power disconnected, and restarted.

Within any given display level (one of the 3 listed above), pressing another button, either the ESC button or the arrows, toggles the display through sub-level displays.

Within the 1st display level, 1) Startup/shutdown times & any current/last fault conditions; pressing the up/down arrow buttons (on the right side) toggles the display through several recent start/stop time conditions and faults.

Within the 2nd display level, 2) Current operating parameters; pressing the ESC button (upper left), toggles the display through several current operating parameters listed below.

a) Operating vacuum at blower inlet (inches water)
b) Operating pressure at blower discharge (inches water)
c) Operating temperature of blower (°F)
d) Return air temperature (not currently used, °F)
e) Pressure transducer reading (not currently used, % of full scale)

Each time the ESC button is pressed the display information toggles to the subsequent sub-level screen (for the display screens listed above; a→b, b→c, c→d, d→e, e→a).

Within the 3rd display level, 3) Set points for process control parameters; pressing the ESC button (upper left), toggles the display through the current set-point/control conditions listed below.

a) Set point limit for operating vacuum at blower inlet
b) Set point limit operating pressure at blower discharge
c) Set point limit operating temperature of blower (°F)
d) Set point for return air temperature (not currently used, °F)
e) Set point limit for pressure transducer reading (not currently used)

Within each of the set point screens listed above, pressing the up/down arrow buttons (on the right side) allows the process control set-points to be changed. Table 2-3 describes the PLC interface and screens, Table 2-4 describes process control set-points and related operational parameters.

Table 2-3 Description of PLC Display Screens

Primary display levels (toggled through with star button, lower left)	**Secondary display sub-levels (toggled through with ESC button, upper left)**	**Up/down arrows (right side)**
1) Startup/shutdown times & any current/last fault conditions	No effect	Toggles through recent start/stop/ fault records
2) Current operating conditions	a) Operating vacuum at blower inlet	No effect
	b) Operating pressure at blower discharge	
	c) Operating temperature of blower	
	d) Return air temperature (not currently used)	
	e) Pressure transducer reading (not currently used)	
3) Set points for process control parameters	a) Set-point for vacuum limit	Change set-point
	b) Set-point for pressure limit	Change set-point
	c) Set-point for blower temperature limit	Change set-point
	d) Return air temperature setting (not currently used)	Change set-point
	e) Set-point for transducer reading (not currently used	Change set-point

Table 2-4 Operating Parameters and PLC Shut Down Points

Parameter	Measurement Location	Operating Range	PLC Shut Down Point
Operating Condition and PLC Shut Down Point			
Temperature	Blower Exhaust	< 180° F	> 180 °F for a 5 second duration
Pressure	Blower Exhaust	< 180 inches water	> 180 inches water for a 5 second duration
Vacuum	Blower Inlet	< 120 inches water	> 120 inches water for a 5 second duration
Water Level	Moisture Separator	Separator is below high float level	Separator is at high float level (& discharge pump is not working)
Water Level	Condensate Water Storage Tank	Not in use	Not in use

2.3.3 Temperature Set Point and Control

The blower has a high-temperature-limit shutdown. The temperature can be monitored on a screen in the PLC. A separate screen in the PLC can be used to set the desired temperature limits. This parameter has been preset in the PLC prior to startup. The preset maximum operating temperature for the blower exhaust is 180 °F. If the temperature exceeds the set point for a 5-second duration, the system will shut down. To restart the system, the operator must determine the cause of the excess temperature, remedy the problem, and restart after the temperature has been allowed to decrease.

2.3.4 Pressure/Vacuum Set Point and Control

The blower has high-pressure/high-vacuum-limit shutdowns. The pressure/vacuum can be monitored on a screen in the PLC. A separate screen in the PLC can be used to set the desired pressure/vacuum limits. These parameters have been preset in the PLC prior to startup. The preset maximum operating pressure for the blower exhaust is 180 inches water (6.5 psi). The preset maximum operating vacuum for the blower inlet is 100 inches water (7.4 inches Hg). If the pressure or vacuum exceed the set point for a 5 second duration, the system will shut down. To restart the system, the operator must determine the cause of the excess pressure (such as a closed valve), remedy the problem, and restart after the pressure/vacuum has been allowed to decrease.

2.3.5 Moisture Separator and Discharge Pump

The moisture separator is used to separate the liquids from the inlet air stream to the vacuum side of the blower. The separator has two methods from which collected condensate can be pumped out; automatic or manual (noted as hand on the switch). In the automatic mode, the condensate pump is activated by a high-level float switch in the moisture separator. The condensate is pumped out of the moisture separator drum, until the low-level float switch turns the pump off. In manual mode, the pump can be operated manually by the switch. If the switch is not activated (to hand or auto mode) the condensate pump will not operate.

2.4 Electrical Service and Distribution System

A short summary and diagrams of the electrical service/distribution system are presented in this section.

2.4.1 Electric Service from Main Panel

Electrical service is independent to each trailer system. The SVE equipment packages are serviced with either 240 Volt, single phase power, or 240 Volt, 3 phase power. Service connections must be installed by qualified personnel and maintained by Boeing personnel.

2.4.2 Electric System at Equipment Trailer

The fusible disconnect to the electric service for both equipment systems is located on the equipment trailers end (see Figure 2-1). A circuit breaker panel is located inside the equipment trailer. All breakers within the panel are labeled.

3.0 OPERATING PROCEDURES

Operating procedures consist of initial inspection, equipment startup, normal operation, and equipment shutdown.

3.1 Initial Inspection of System Operations

Upon arrival at site, the following tasks should be completed and recorded on the field log forms (checklist) as shown in Attachment C.

- Review project HASP before commencing work activities
- Unlock trailer doors and allow trailer to vent (in case any vapors have collected inside the trailer)
- Check the position of all valves and verify correct positions (open/closed) relative to the planned operation (SVE)
- Check the equipment electrical switches (blower motor and moisture separator discharge pump) to verify correct positions relative to the planned operations mode
- Visually inspect the condition of all equipment (look for any drips around blower, discharge pump, and piping systems)
- Record air flow rate from each SVE well
- Record air pressures and vacuums on inlet and outlet of blower
- Record operating temperature of blower
- Record discharge temperature from outlet of second VPC vessel
- Complete any off-gas vapor monitoring required (PID measurements of vapors into and out of VPC vessels and vapor grab samples for laboratory analysis). See field log forms for data recording in Attachment C.
- Record vapor monitoring data in log book.

3.2 Equipment Systems Startup

Prior to the startup of the equipment system, personnel should verify all electrical connections are completed and all equipment guards are in place.

If the equipment is to be either started or stopped, set the valves to the positions shown in Table 3-1. These valve positions are only for start up or shut down purposes. The system can then be operated.

Table 3-1 Equipment System Valve Changes for Either Startup or Shut down Operations

Valve ID	Position	Valve Function/other notes
Bleed	Open fully	Bleed valve for inlet vacuum
Recycle	Closed, may be partially open	Recycle loop on blower inlet/outlet to adjust air flow rate
Discharge	Open	Flow restriction valve for blower discharge (may be partially closed to increase discharge air temperature, may be used to preheat off-gas vessels)

3.2.1 Temperature/Humidity Considerations for VPC vessels

Prior to system startup, the temperature of the VPC vessels (and air stream discharge from the vessels) must be assessed to determine if condensate may be generated within the VPC vessels.

VPC vessels used for vapor treatment are to be insulated to minimize cooling of the air stream. However, if the ambient temperature during the shutdown period has been below 50 F, the vapor air stream may initially be cooled to a level where the relative humidity rises to 100% (the dew point) and it is possible to create condensate within the carbon vessels. Condensate in the vessels may substantially reduce the effectiveness of the VOC removal.

For the reasons noted above, the outlet discharge temperature from the lag carbon vessel should be measured on startup. If the outlet temperature is less than 60 ^{o}F, the system should be operated using only bleed air (no VOC vapors from the wells) until the VPC vessels are warmed up. In order to heat the discharge air it may be necessary to open the recycle valve and reduce the discharge flow rate with a restriction valve putting the blower under pressure (see Figure 2-4). The increased pressure will cause the blower to increase the discharge temperature. In cold weather, this warm-up period may require 24 to 48 hours.

3.2.2 SVE Startup Procedure

This section presents a summary of procedures that will be performed during routine O&M of the systems operating for SVE. Typical system startup will be with the valves configured to pull vapors from the extraction wells; at the initial start the recycle valve (the airflow is allowed to recycle around the blower) will be fully open (see Figure 2-4). Once the motor/blower have reached full RPMs (typically 1 or 2 seconds) the recycle valve is slowly closed until the desired flow rate is set. Flow rates from individual wells will be balanced at the target extraction rates. Flow balancing may change after operational data indicate if certain areas/wells have lower vapor concentrations.

The startup monitoring for systems include initial testing of operation and adjusting physical operating parameters to meet design specifications for operation. The system will be started and run according to engineering designs. The estimated initial parameters are for a total air flow of 30 cfm for the system at SWMU-172/174 (10 cfm per extraction well) and a flow of 25-60 cfm for the system at building 4-78 (1.5 to 10 cfm per well). Actual operating parameters will be adjusted at initial system startup and may change if monitoring events indicate operational changes are necessary to optimize remedial activities.

3.2.3 Normal Systems Operation

During SVE system operation (for SWMU-172/174 and the Building 4-78/79 SWMU/AOC Group) the baseline operating conditions will be established per the Engineering Design Report and the VOC mass removal will be measured and evaluated to verify that the systems are operating effectively. After the initial startup, periodic flow adjustments, inspection, monitoring, and maintenance will be required. Flows from selected wells will be adjusted to optimize vapor extraction rates without excessive water recovery. The SVE wells with the highest VOC concentrations will be targeted for operation at higher flow rates with the overall objective of increasing overall recovery of COCs for each of the targeted treatment areas.

The physical operating parameters of the systems should be checked, recorded and adjusted, as required, on a regular schedule. Initially, the systems will be checked weekly for the first month of operation, after that the systems will be monitored at least bi-monthly. Observed values should be recorded on field log forms. An example of this form is provided in Attachment C. These completed checklists should be maintained at the site. The initial expected range of values for the specific parameters contained on the checklist are shown on Table 3-2.

Table 3-2 Initial Expected Values of SVE Operating Parameters for Renton Remediation Systems

SWMU-172/174

Operating Parameter	Expected Range
Inlet vacuum gauge	To be determined, based on field conditions
Discharge pressure gauge	To be determined, based on off-gas treatment
Total air extraction flow rate	~30 scfm
Temperature of air out of SVE blower	>110 ºF

Building 4-78/79

Operating Parameter	Expected Range
Inlet vacuum gauge	To be determined, based on field conditions
Discharge pressure gauge	To be determined, based on off-gas treatment
Total air extraction flow rate	~25-60 scfm
Temperature of air out of SVE blower	>110 ºF

3.3 Equipment Shutdown Procedures

The equipment systems will need to be shut down in order to perform some of the required O&M activities (e.g., oil change, belt tensioning/replacement, filter replacement, other miscellaneous items). The key step in system shutdown is to first take the load off the blower (release pressure or vacuum) and allow the blower to cool down while operating. For system shutdown, the process valves should set to the positions in Table 3-1 and the blower operated for an additional 5 minutes. At that time, push the RED stop button in the control panel to shut down all equipment.

If an emergency shutdown is required, the simplest method when outside the trailer is to disconnect the electric service at the service connection. This will shut down all equipment and also disconnect the equipment system electric outlets, which may be undesirable if a shop vac is needed. The electric service may be switched back on within about 5 seconds after disconnect and the equipment system (blowers/pumps, etc.) will not restart until manually engaged.

3.4 Sampling for Operations

The discharge from the vapor treatment vessels will be sampled during initial operations to confirm soil gas composition and during operations to monitor emissions and to determine when it is necessary to change out the VPC. The soil-gas vapors will be sampled and evaluated as described in the SVE Emissions Monitoring Protocol included as Attachment E. All PID sampling will be done by filling a Tedlar bag and using a PID to test the collected vapors.

The personnel responsible for system operations will complete the field log forms (see Attachment C) on each monitoring event with test/check items completed as required. These results will be compiled to monitor total volatile organic compounds recovery and breakthrough conditions for each SVE system.

4.0 SYSTEM MAINTENANCE

Maintenance consists of preventive maintenance and repairs. By performing regularly scheduled preventive maintenance, repairs are minimized and the life of the equipment is maximized. Copies of MSDS for all maintenance supplies will be provided to the Boeing contact and also maintained at the equipment trailer.

GENERAL SAFETY CONSIDERATIONS

It is the operator's responsibility to follow company safety procedures, all Boeing safety procedures, all procedures and safety considerations presented in this O&M Manual, and the site-specific Health and Safety Plan. All operations personnel must be thoroughly familiar with all equipment including all emergency shutdown procedures, spill response, and notification procedures.

ELECTRICAL SAFETY

1) Before attempting any O&M procedures, locate the main electrical source and understand how to safely control it. Always verify (via direct measurement) that the electric source is disconnected.
2) Always lockout and tagout the electrical source before beginning any repair or replacement tasks. Refer to equipment manual and the project HASP for specific instructions.
3) Repairs or modifications to major components of the electrical distribution system (electrical panels) must be made by a qualified electrician.
4) During periods of lightning activity, do not connect or disconnect any cables or perform installation, maintenance, or reconfiguration of any system components.
5) Notify appropriate supervisory personnel before and after conducting maintenance to any components of the system.

LOCKOUT/TAGOUT PROCEDURES

WARNING -- High voltage and equipment with rotating parts can cause serious or fatal injury. Installation, operation, and maintenance of all equipment should only be performed by qualified personnel. Appropriate lockout/tagout procedures must be followed for all maintenance work on all equipment with electrical connections and/or rotating parts, as per the requirements of OSHA CFR 29 Section 1910.147.

ROTATING EQUIPMENT DANGER

Equipment with rotating parts can cause serious or fatal injury. Installation, operation, and maintenance of all equipment should be performed by qualified personnel. All equipment has belt and pulley guards in place. Only remove guards during maintenance activity and ensure proper lockout tagout procedures are followed to ensure power is not supplied to rotating equipment. After maintenance is completed reinstall all guards and maintain good housekeeping to prevent tooling and debris from inadvertently coming into contact with rotating equipment.

DO NOT WEAR LOOSE CLOTHING NEAR ROTATING EQUIPMENT

4.1 Operational Maintenance

Operational maintenance entails the routine servicing of system components/equipment required for continued operations. Some of the operational maintenance activities described below (e.g., changing off-gas treatment media and others) will generate a waste stream that must be managed in strict accordance with the requirements specified in this plan.

4.1.1 Equipment System

The blower package, both the blower and the motor, should be kept clean. Any accumulation of dirt, oil, grime, etc., on the surfaces will limit heat dissipation from the equipment, which may cause damage through overheating. The interior of the equipment trailer should be kept clean by sweeping the interior on every inspection/visit and the surfaces of motors and blowers should be wiped clean once every two months or more frequently if dirt/grime accumulation is apparent.

The inlet filter to the blower should be checked monthly and cleaned as necessary. If the vacuum gauge between the blower and filter indicates an increase in vacuum, then the filter may be becoming plugged. When the filter is cleaned it should be inspected for any signs of wear or failure and replaced as necessary. If the filter has failed it should be replaced and the recommended service of the blower (as described in the following section on maintenance procedures) should be performed.

If the pressure gauge between the blower and vapor treatment system indicates an increase in pressure, then the vapor treatment system is becoming plugged and will require service and/or replacement.

The cooling system should be set to 90 °F so that ventilation cooling only comes on when interior temperatures are above 90 °F.

The oil level in the blower should be checked monthly. Oil should be changed on the blower after 200 hours of initial operation and every 2,000 hours of operation (approximately every 3 months) thereafter. Use only the high-grade blower oil recommended by the manufacturer. The blower holds 2.4 oz of oil on the drive end and 2.8 oz on the gear end (~ 1/4 quart of oil is sufficient for oil change on both ends).

The electric motor driving the blower will also require periodic maintenance including lubricating the blower motor grease fittings every 3 months using grease as recommended by the manufacturer (Polyrex EM, or Texaco Polystar, or Rykon Premium #2, or Pennzoil Pen 2 lube, or Chevron SRI). Caution should be taken not to over grease the motor. Use the following procedure to grease the motor:

- Clean all grease fittings
- Remove grease outlet plug
- Add grease slowly until new grease appears at shaft hole in the endplate or purge outlet plug
- Reinstall grease outlet plug

Check the belts between the motor and the blower for proper tension every 500 hours (20 days). The tensioning device automatically adjusts the belt tension over a certain range with the aid of a compression spring. If the drive belts have stretched to the extent that the marking pin is located at the lower end of the indicating slot, the belt tension must be re-adjusted using the following procedure:

- Loosen lower hex nut
- Tighten the belt with the upper hex nut until the marking pin is located at the top end of the indicating slot
- Tighten the lower hex nut

See the manufacturer's manual for each specific piece of equipment for illustrations. Replace the belts when they become checked, cracked, or delaminated.

Check the pressure and vacuum relief safety valves every 6 months. The pressure relief valve is located near the blower outlet and the vacuum relief valves (2) are located on top of the moisture separator and near the inlet air filter.

4.1.2 Off-gas Treatment System

The maintenance tasks for the vapor-phase treatment units will be primarily sampling the inlet/ outlet vapor concentrations and changing the units when the media is spent. Waste management procedures associated with the VPC change-out process are discussed below and also in Section 5. The VPC is used to remove VOCs vapors from the off-gas vapor stream by physical adsorption. The VOCs are retained in the VPC and will accumulate over time, eventually reducing the effectiveness of the treatment process.

Procedures for sampling the input and discharge from the off-gas treatment system are defined in Section 3. When the off-gas treatment system vessels are to be changed, the following steps will be taken:

Preparation

1. Notify the Boeing contact (Fred Wallace) to assist with the change out procedures (see contact list in Table1-1).
2. Call the carbon change-out vendor to schedule media change-out/ replacement services. This should be as far in advance as possible; 3 days to 1 week as a minimum advance notice.

VPC Change-Out

1. Shut down the system following the steps outlined in Section 3.
2. Check the drain valve on the bottom of each carbon vessel to determine if any accumulated liquid is present. If liquid is present, remove the liquid and place it in the condensate storage tank.
3. Remove hose connections and corresponding fittings from the VPC vessels (no valves exist). Replace fittings with plug connections.
4. For any vessels that have to be moved from the area prior to carbon change, coordinate fork lift support with Boeing dispatch (206) 544-6500.
5. Direct the carbon vendor/ representative to take care to contain all dust generation and potential spillage. Oversee the change-out process. Eliminate the possibility of any fugitive dust potentially entering a catch basin. Vacuum the area clean following the change-out.
6. If only one carbon vessel is changed, direct the fork lift operator to place the lag VPC vessel in the lead position and the newly-changed VPC vessel in the lag position.
7. Re-connect the hoses to the vessels.

8. Restart the system following the applicable start up procedures outlined in section 3.
9. Inspect the off-gas treatment system for leaks or other problems.
10. Manage wastes per requirements of Sections 5..

4.1.3 Condensate Water

Condensate water may be generated in system operation. The condensate water will be in contact with the VOC vapor stream (before treatment) and will therefore contain COCs. The condensate water is untreated and may be stored in an accumulation shed in 55-gallons drums. The actual water generation rates will be determined after initial startup and operation. If storage drums are found to be filled at a high rate, larger accumulation containers may be required. Condensate water will be treated at the on-site wastewater treatment facility, which is permitted to manage this wastewater

When the condensate drum is nearing a ¾ full level, the following steps must be taken:

Removal of condensate water

1. Transfer condensate inlet line from ¾ full drum to second drum in storage shed.
2. Cap full drum with venting lid and remove from shed to be placed on a pallet for shipment to treatment area.
3. Manage wastes per the requirements of Section 5 (Table 5-1).
4. Obtain an empty drum to be placed in storage shed for the next drum change out.

4.1.4 Sediment/Solids in Moisture Separator

The moisture separator should be checked every time the site is inspected. If the unit contains water, it should be drained to the condensate storage container. The moisture separator may accumulate a small quantity of solids that is to be periodically removed. Drain the moisture separator and clean out any accumulated solids every 3 - 6 months. This material is in contact with VOC vapor flow stream (before treatment) and may contain COCs. Whenever sediment has to be removed from the moisture separator, the following steps will be taken:

Preparation

1. Obtained required materials (rags, drum, other).

Removal of sediment

1. Shut down the system following the steps outlined in Section 3.
2. Close valves before the moisture separator.
3. Wipe sediment from the moisture separator with rags and manage rags per the requirements of Section 5.
4. Open the valves previously closed in step 2.
5. Restart the system following the applicable start up procedures described in Section 3.

4.1.5 Other Miscellaneous Maintenance Items

All wastes derived from miscellaneous maintenance tasks will be managed per the requirements of Section 5.

Blower Particulate Filters

The blower particulate filter (air filter) is used to keep the blower operating properly. The filter will be changed with regularly scheduled maintenance for the blower. The blower air filter will be inspected monthly and replaced as necessary.

Blower Drive Belts

The motor uses a belt/pulley drive to operate the blower. The belts will be changed with regularly scheduled maintenance for the blower. The drive belts will be inspected monthly and replaced as necessary. The used belts are considered garbage.

Blower Oil

The blower requires an oil change on a regular basis. The oil will be changed after the initial 200 hours and every three months thereafter along with regularly scheduled maintenance for the blower.

Miscellaneous Solid Waste Debris

Miscellaneous solid waste debris will be generated during routine maintenance of the systems. Used gloves, paper towels, trash bags, etc. will be part of the solid waste debris that will be generated.

4.2 Preventive Maintenance

Preventive maintenance entails the regular servicing of each of the system components on a scheduled basis. Preventive maintenance on the trailer (i.e. tire pressure, turn signals, etc.) is performed only when the equipment trailer is moved.

Table 4-1 shows the SVE equipment requiring routine maintenance, the type of maintenance required, the required products for preventive maintenance to be performed, and the frequency for the maintenance. Following Table 4-1 are specific maintenance requirements for the systems.

Table 4-1 System Preventive Maintenance Schedule

Equipment	Procedure	Product	Frequency
Blowers	Check oil Change oil	Omega SB-220	Inspect for leaks every visit, check level monthly Change at 200 hours initially then every 2,000 hours (3 months)
Motors	Grease fittings	Polyrex EM, or Texaco Polystar, or Rykon Premium #2, or Pennzoil Pen 2 lube, or Chevron SR1	Every 3 months
Belts	Check tension Change	(note size and number required for the blowers)	Every 500 hours (20 days) As needed
Filters	Clean or replace	Solberg	Monthly, as necessary
Moisture separator	Drain and remove sediment	None	Every 3 months
Safety valves	Check operation	None	Annually

4.3 Trouble Shooting and Repairs

Table 4-2 presents trouble-shooting guidelines for some of the common problems that could be encountered during the operation of the remediation system. Problems that cannot be solved using the trouble-shooting guide should be referred to the project engineer and/or a manufacturer's representative or other trained individual for the type of equipment involved. Table 4-2 presents a trouble-shooting guide for the SVE equipment systems.

Any equipment components requiring repair/replacement will need to follow the procedures recommended by the original equipment manufacturer.

Table 4-2 Trouble-shooting Guide for SVE Equipment

ALARM/PROBLEM	PROBABLE CAUSE	SOLUTION
Motor(s) will not start	Kill switch is depressed	Reset switch (PLC panel)
	Alarm condition exists	Check alarm menu, reset any alarms, test motor in hand vs. auto
	Power outage	Notify Boeing
	Breaker tripped	Reset breaker, check wiring at breaker terminals (tighten if loose)
	Fuse burned out	Replace fuse
	Windings shorted out	Replace motor
Motor runs slow	One phase of power is out	Notify Boeing
Motor makes excessive noise	Bearings are worn	Replace bearings
	High voltage	Notify Boeing
	Eccentric air gap	Have motor serviced
Motor overheating	Overload	Remove excessive friction
	Improper ventilation	Check fans and clean motor
	Unbalanced voltage	Check voltage
	Rotor rubbing on stator	Check air gap, bearings, bolts
	Over or under voltage	Check voltage
	Grounded winding	Perform dielectric test & repair
Bearing overheating	Misalignment	Realign equipment
	Excessive belt tension	Reduce belt tension
	Excessive end thrust	Reduce end thrust
	Excessive grease in bearing	Remove excess grease
	Insufficient grease in bearing	Add grease
	Dirt in bearing	Clean bearing and cavity
Vibration	Misalignment	Realign equipment
	Rotor out of balance	Rebalance rotor
	Resonance	Tune system
Blower makes excessive noise	Gear backlash excessive	Replace timing gears
	Bearings worn	Replace bearings
	Rotors out of time	Retime rotors
Blower temperature excessive	Excessive pressure difference	Adjust pressure
	Plugged air filter	Clean or replace air filter
Oil leaking into air chamber	Oil level too high	Drain oil to correct level
System runs with no airflow	Valves closed	Open valves
	Moisture separator full	Drain separator and check float switches
	Check-ball stuck (in separator)	Dislodge check-ball
Blower system has low airflow and/or relief valves are open	Moisture separator full and/or high float check ball stuck	Relieve vacuum, tap on top of separator pipe or open moisture separator drum and clean floats
	Vents plugged	Redevelop wells

5.0 MANAGEMENT OF PROCESS WASTE STREAMS

This section describes the procedures that will be implemented to manage waste streams generated from the operation of the SVE systems. Boeing Airplane Programs Safety/ Health/ Environmental Affairs (APSHEA) Environmental Engineers are responsible for designating all wastes generated on Boeing property and will determine the packaging, labeling, marking, and treatment requirements. If there are any questions about how to manage a waste stream generated from this project contact the Boeing Environmental Field Representative Fred Wallace at (206) 930-0461or the Renton site EHS contact Nancy Swenson at (206) 544-6224.

Prior to generating waste, the contractor needs to contact the Boeing representative for the appropriate containers and labels. The correct label identified by the Profile number will be provided by the Renton EHS contact.

5.1 Handling of Waste Containers

There will be no 90-day accumulation of waste at the SVE location. All waste will be packaged and transferred to the Renton accumulation area on the same day it is generated.

Preparation of all containers of waste must include the following steps:

- Secure the label on the top 1/3 of the container immediately prior to placing the waste in the container.
- Make sure that the label is completely filled out. The name in box 4 is the name of the person who first puts waste into the container. The manifest number in box 6 is left intentionally blank.
- Keep the container closed except for the 15 minutes prior to and following the addition of waste.
- Secure all waste containers on pallets as per Boeing requirements.
- Attach a completed transportation tag
- Call dispatch at (206) 544-6500 for transfer of the pallet to the designated accumulation area.

5.2 Personnel Training

Personnel that perform operation, maintenance, and monitoring activities must have the following training and certification:

- Current HAZWAPOR certification
- Boeing Service Provider Manual orientation (Boeing document # F70115 03-03-2010).

Table 5-1 Waste Streams

Waste Stream	Origin	Contaminant	Estimated Quantity	Other Details
Spent vapor phase activated carbon (VPC) media (*see note 1*)	Absorbs VOC vapors from the off-gas vapor stream	PCE, TCE, DCE, VC. Methylene Chloride, and TPH-G.	To be determined (TBD)	
Condensate water	By-product of the SVE operation	PCE, TCE, DCE, VC. Methylene Chloride, and TPH-G.	TBD	
Sediment from condensate water (on cleaning rags)	By-product of the SVE operation	PCE, TCE, DCE, VC. Methylene Chloride, and TPH-G.	Small quantity, ~ 1-10 lbs every three months	
Used blower oil (drain onto sorbent pads)	Blower maintenance	None	< ½ quart every 3 months.	
Used air filters	Blower maintenance	None	4 to 12 per year	
Solid Waste debris that has contacted waste streams	Maintenance, cleaning and sampling activities	PCE, TCE, DCE, VC. Methylene Chloride, and TPH-G.	TBD	
Non-contaminated Debris and trash	Routine Maintenance and cleaning	none	As needed	

Notes

1. The carbon media exchange procedures need to be coordinated with Boeing. Boeing will provide specific direction regarding the location and management of the media exchange.

5.3 Emergency Preparedness and Response

The Contingency Plan and Emergency Response Procedures are defined in the attached Standard Operating Procedure. Personnel that perform operation, maintenance, and monitoring activities must have access to a cellular phone when on site. The emergency contact numbers are posted and readily visible at several locations.

The following emergency response equipment will be maintained at the site:

- Spill containment pillows
- Absorbent material
- Shovel
- Broom
- Shop vac
- Portable eye wash kits
- PPE consisting of goggles and face shield, rubber gloves or equivalent, rubber over boots, coated Tyvek coveralls or equivalent, and a rubber apron
- Two, five-pound type ABC dry chemical fire extinguishers

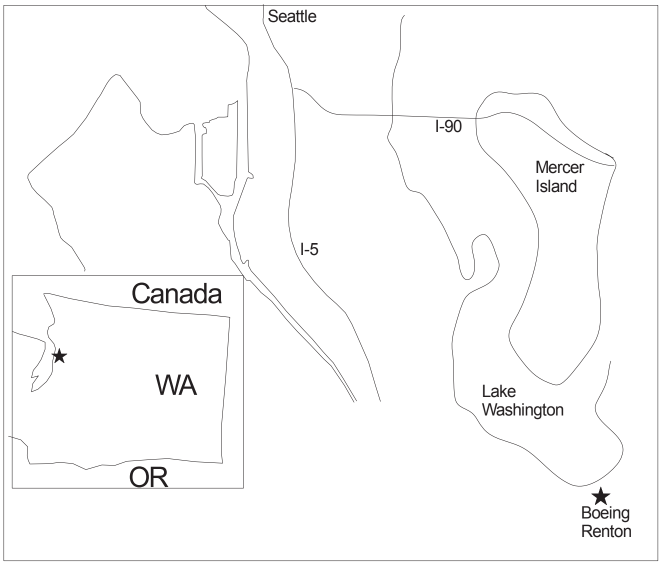
- MSDS for the on-site materials
- Emergency contact numbers posted and easily visible

<u>In the event of any emergency call:</u>

1) Boeing Emergency Dispatch (206) 655-2222
2) The Boeing Project representative Carl Bach (425) 898-0438

These contact numbers will be posted at the systems. The locations of the fire extinguishers, eye wash stations, first aid kits, and spill control materials are marked and noted on Figure 1-2.

Figures



APPROXIMATE SCALE IN FEET

0 250 500 1000

BOEING®

CALIBRE Systems

REVISION NO.: 0

DATE: 6/04/07

FILE: Renton location

Figure 1-1. Site Location Map

DES'D: GWD

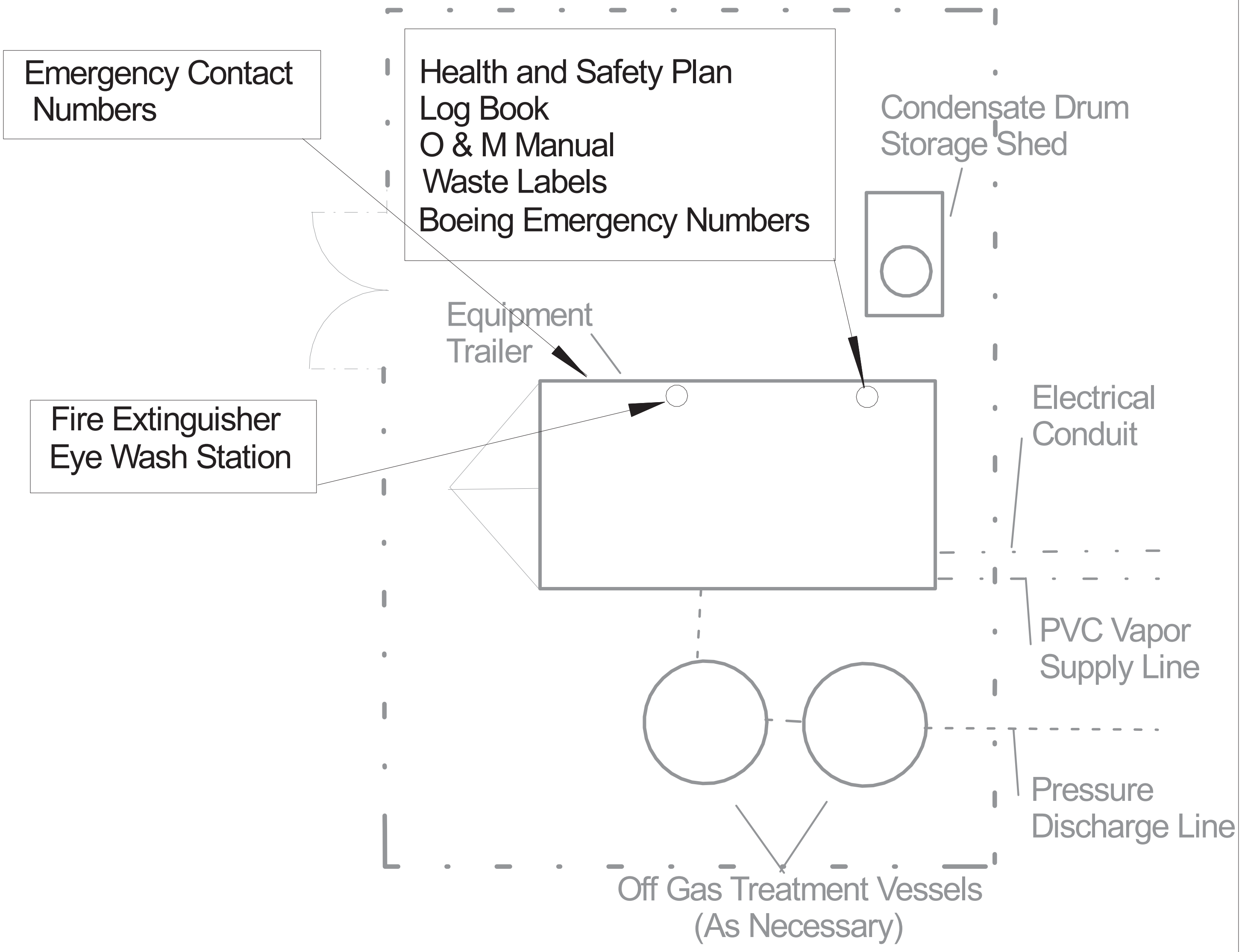
CLIENT: Boeing

PROJECT NO.:

CHK'D: TJM

LOCATION: Boeing Renton

FIGURE: 1-1



SCALE IN FEET

0 5 10 20

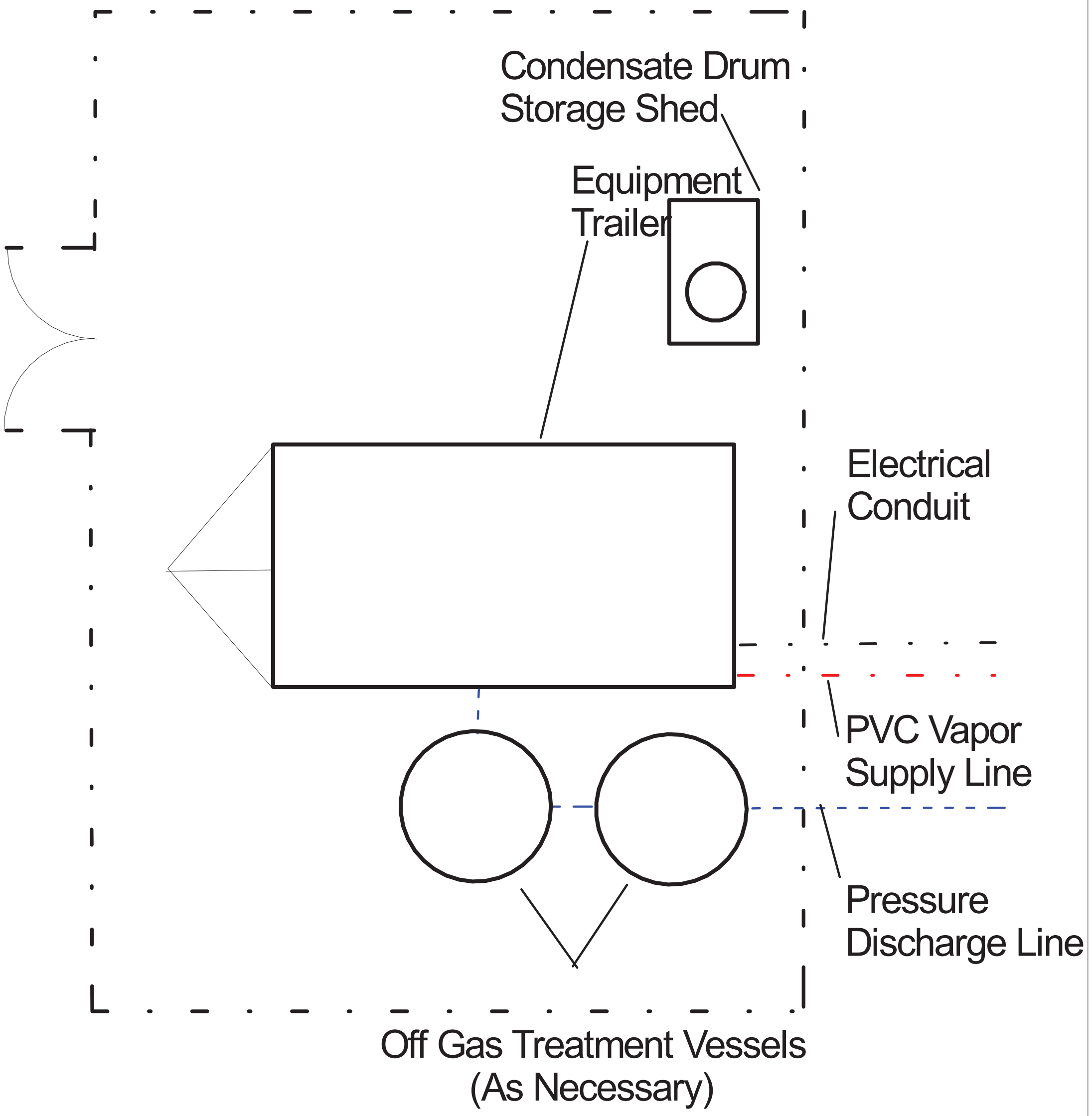
CALIBRE

BOEING®

REVISION NO.: 0
DATE: 3/10/2014
FILE: Site Layout.SKD

Figure 1-2. Typical SVE System Layout With Safety Equipment

DES'D: GWD
CLIENT: Boeing
PROJECT NO.:
CHK'D: TJM
LOCATION: Boeing Renton
FIGURE: 1-2



SCALE IN FEET

0 5 10 20

– · – · VACUUM RETURN LINES

- - - - - - PRESSURE DISCHARGE LINES

_ . . _ ELECTRICAL CONDUIT

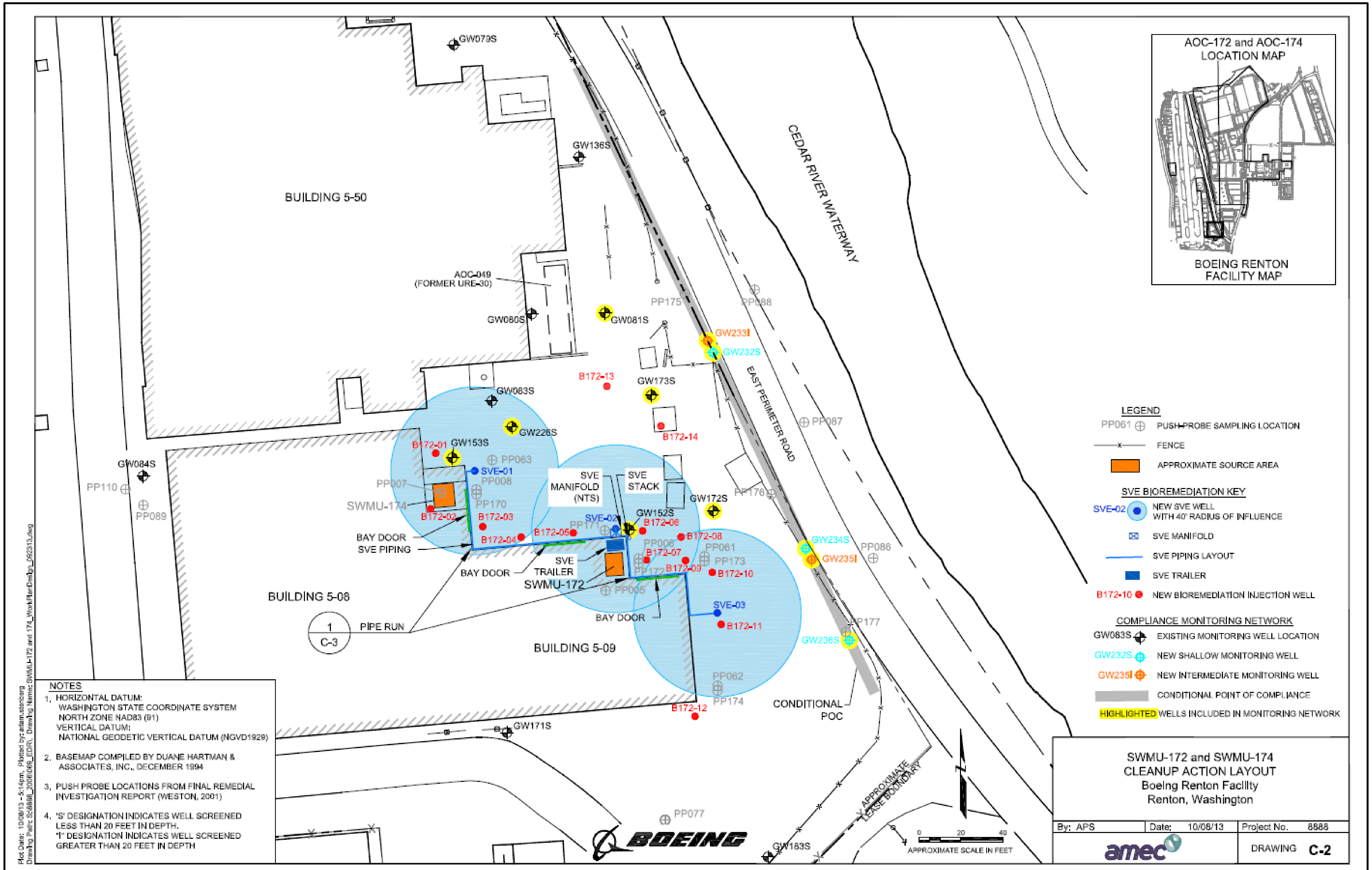
– · – SVE EQUIPMENT COMPOUND

CALIBRE

REVISION NO.: 0
DATE: 3/10/14
FILE: Figure 2-1.SKF

Figure 2-1. Typical SVE Equipment System Layout

DES'D: GWD
CLIENT: Boeing
PROJECT NO.:
CHK'D: TJM
LOCATION: Boeing Renton
FIGURE: 2-1



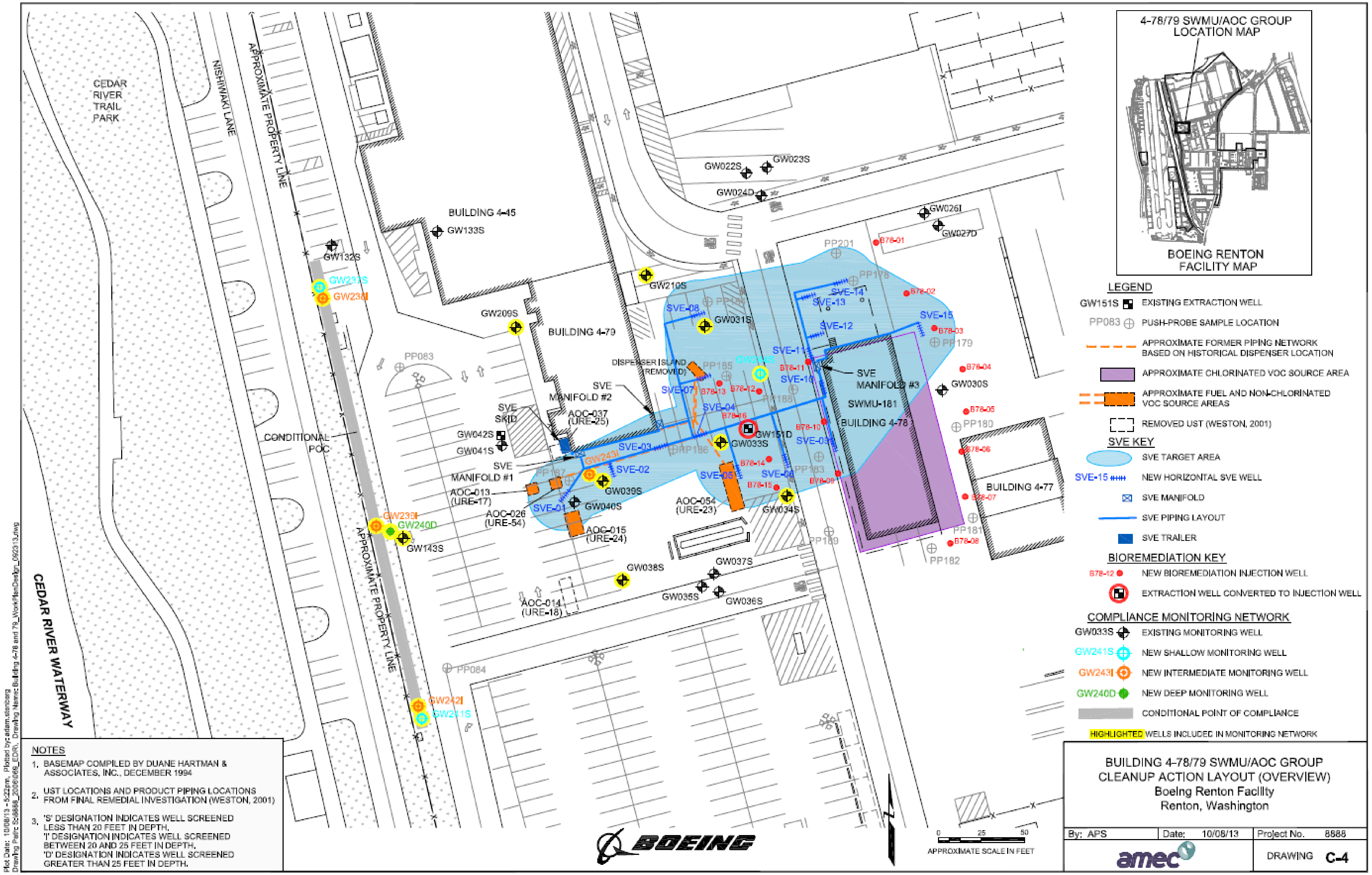
NOTES

1. HORIZONTAL DATUM:
   WASHINGTON STATE COORDINATE SYSTEM
   NORTH ZONE NAD83 (91)
   VERTICAL DATUM:
   NATIONAL GEODETIC VERTICAL DATUM (NGVD1929)
2. BASEMAP COMPILED BY DUANE HARTMAN & ASSOCIATES, INC., DECEMBER 1994
3. PUSH PROBE LOCATIONS FROM FINAL REMEDIAL INVESTIGATION REPORT (WESTON, 2001)
4. 'S' DESIGNATION INDICATES WELL SCREENED LESS THAN 20 FEET IN DEPTH.
   "I" DESIGNATION INDICATES WELL SCREENED GREATER THAN 20 FEET IN DEPTH

SWMU-172 and SWMU-174
CLEANUP ACTION LAYOUT
Boeing Renton Facility
Renton, Washington

By: APS	Date: 10/08/13	Project No. 8888
		DRAWING C-2

	CALIBRE Systems Inc. 16935 SE 39th St Bellevue, WA 98008	TITLE: Figure 2-2. SWMU-172/174 SVE Treatment Area	
DRAWN: GWD	CLIENT: BOEING	ACAD FILE: Figure 2-2.skf	LOCATION: Building 5-08/5-09 Boeing Renton Facility, Renton, WA	DATE: 3/19/14
CHECKED: TJM	REVISION NO: 0	PROJECT NO:		FIGURE: 2-2



NOTES

1. BASEMAP COMPILED BY DUANE HARTMAN & ASSOCIATES, INC., DECEMBER 1994
2. UST LOCATIONS AND PRODUCT PIPING LOCATIONS FROM FINAL REMEDIAL INVESTIGATION (WESTON, 2001)
3. 'S' DESIGNATION INDICATES WELL SCREENED LESS THAN 20 FEET IN DEPTH.
'I' DESIGNATION INDICATES WELL SCREENED BETWEEN 20 AND 25 FEET IN DEPTH.
'D' DESIGNATION INDICATES WELL SCREENED GREATER THAN 25 FEET IN DEPTH.

LEGEND

GW151S ◙	EXISTING EXTRACTION WELL
PP083 ⊕	PUSH-PROBE SAMPLE LOCATION
- - - -	APPROXIMATE FORMER PIPING NETWORK BASED ON HISTORICAL DISPENSER LOCATION
🟪	APPROXIMATE CHLORINATED VOC SOURCE AREA
🟧	APPROXIMATE FUEL AND NON-CHLORINATED VOC SOURCE AREAS
⬚	REMOVED UST (WESTON, 2001)

SVE KEY

⬭	SVE TARGET AREA
SVE-15 ####	NEW HORIZONTAL SVE WELL
☒	SVE MANIFOLD
—	SVE PIPING LAYOUT
🟦	SVE TRAILER

BIOREMEDIATION KEY

B78-12 ●	NEW BIOREMEDIATION INJECTION WELL
◙	EXTRACTION WELL CONVERTED TO INJECTION WELL

COMPLIANCE MONITORING NETWORK

GW033S ⊕	EXISTING MONITORING WELL
GW241S ⊕	NEW SHALLOW MONITORING WELL
GW243I ⊙	NEW INTERMEDIATE MONITORING WELL
GW240D ●	NEW DEEP MONITORING WELL
▬	CONDITIONAL POINT OF COMPLIANCE

HIGHLIGHTED WELLS INCLUDED IN MONITORING NETWORK

BUILDING 4-78/79 SWMU/AOC GROUP
CLEANUP ACTION LAYOUT (OVERVIEW)
Boeing Renton Facility
Renton, Washington

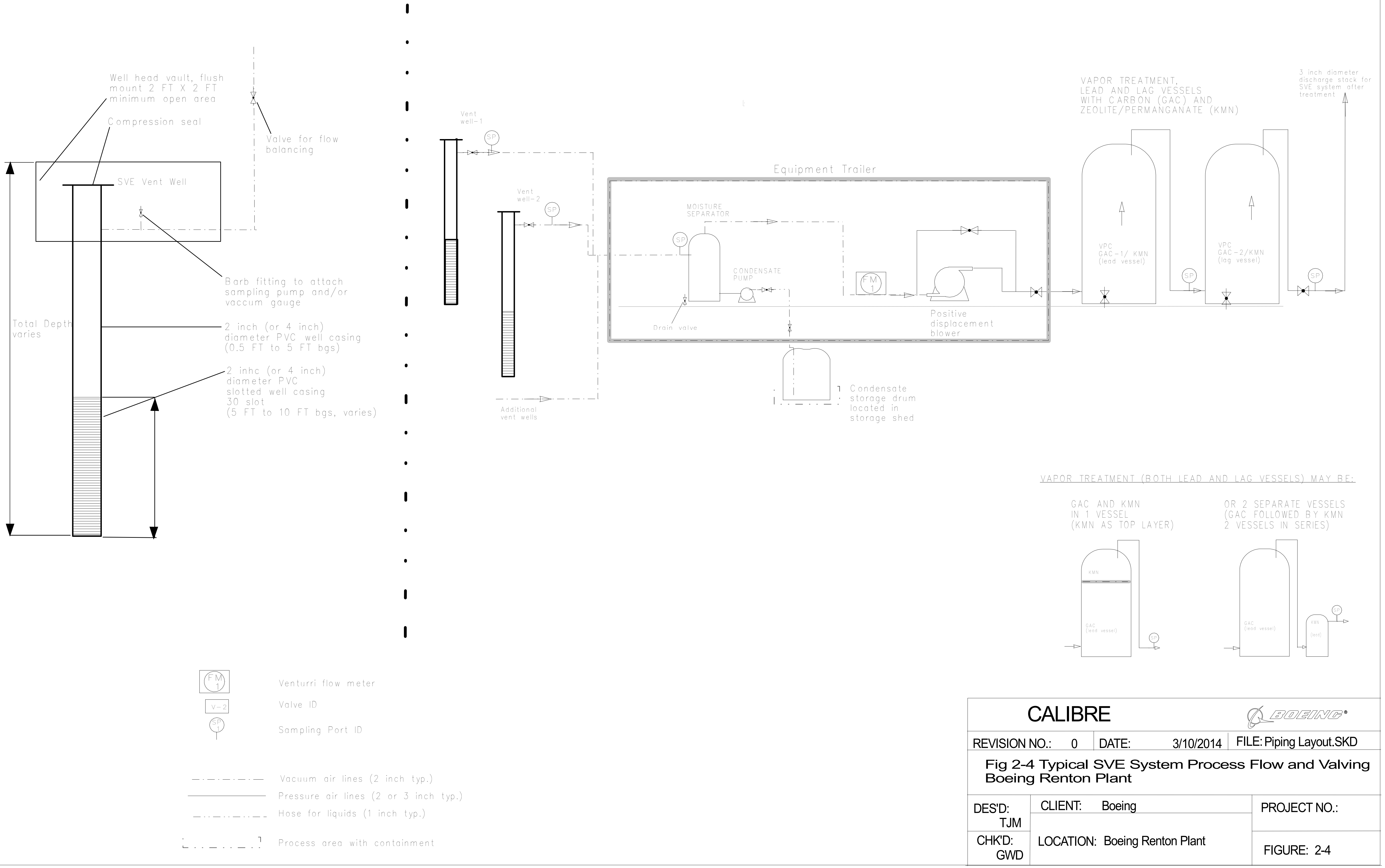
By: APS | Date: 10/08/13 | Project No. 8888
amec | DRAWING C-4

BOEING®

CALIBRE Systems Inc.
16935 SE 39th St
Bellevue, WA 98008

TITLE:
Figure 2-3. Building 4-79 SVE Treatment Area

DRAWN: GWD
CLIENT: BOEING
ACAD FILE: Figure 2-3.skf
LOCATION: BUILDING 4-78/79
BOEING RENTON FACILITY, RENTON, WA
DATE: 3/19/14
CHECKED: TJM
REVISION NO: 0
PROJECT NO:
FIGURE: 2-3



CALIBRE

BOEING®

REVISION NO.: 0	DATE: 3/10/2014		FILE: Piping Layout.SKD

Fig 2-4 Typical SVE System Process Flow and Valving
Boeing Renton Plant

DES'D: TJM	CLIENT: Boeing	PROJECT NO.:
CHK'D: GWD	LOCATION: Boeing Renton Plant	FIGURE: 2-4

Attachment A
Boeing Service Provider Manual

BOEING

Service Provider Manual

March 2010

Emergency Numbers

Prior to the start of work, please write in the correct emergency numbers you are given by your company representative or Boeing Onsite Activity Representative in the space provided below.

Emergency: ______________________________

____

Give the following information:

1. Your name and your employer's name.
2. Phone number from which you are calling.
3. Location of the incident:
   City, street address (if known)
   Building number and floor level
   Column number
   Nearest door number
4. Nature of emergency.

Don't hang up until told to do so!

You are a vital link in the emergency and must relay changes in the state of the emergency.

Boeing Onsite
Activity Representative: ______________________________

Other Numbers: ______________________________

____

____

____

____

____

TABLE OF CONTENTS

QUICK REFERENCE GUIDE BY SUBJECT

QUICK REFERENCE GUIDE BY SUBJECT

INTRODUCTION

The Boeing Company is committed to maintaining high safety, health, fire prevention, security, and environmental standards. As a service provider to The Boeing Company, you are expected to maintain the same high standards.

You will be interfacing with Boeing operations and working closely with personnel from various Boeing organizations and related service providers. Therefore, it is important that you, your employees, and your subcontractors are familiar with Boeing safety, health, fire prevention, security, and environmental requirements.

As a service provider, you are responsible for ensuring that all your subcontractors follow safe work practices and comply with all federal, state, local, and Boeing contract requirements.

This booklet is intended to help you comply with The Boeing Company safety, health, fire, security, and environmental requirements. Nothing herein shall relieve you of your responsibility to comply with federal, state, and local laws, codes, rules, regulations, and Boeing-contract requirements.

Your Boeing Onsite Activity Representative is your primary point of contact. Some work activities you are involved in may require additional coordination with Boeing Environment, Health and Safety (EHS), Fire, Security, and other entities as appropriate. The Boeing Onsite Activity Representative is responsible to ensure this coordination occurs. Throughout this manual activities requiring additional coordination are identified with the statement "Additional coordination is required."

Please read this booklet, and if you do not fully understand the information provided in all sections or there are site-specific issues, discuss your questions with your supervisor or your Boeing Onsite Activity Representative.

Ensure that each of your personnel and subcontractors that will be performing work for Boeing are aware of the requirements of this manual.

Requirements of some locations or activities may differ from those in this manual. Consult with your Boeing Onsite Activity Representative for questions and additional requirements that may apply to your contract.

Service provider employees violating Boeing requirements are subject to removal from the site and/or disciplinary action.

Your cooperation is expected and appreciated.

1.0 GENERAL INFORMATION

1.1 General Rules

a. All service providers are to stay within assigned work areas. Wandering in non-assigned work areas is strictly prohibited.

b. Use of offensive language and display of offensive materials is not permitted.

c. Horseplay, theft, fighting, harassment, gambling, and possession or use of alcohol or controlled substances, firearms (or other weapons), or ammunition are strictly prohibited.

d. Use of Boeing assets such as equipment, machinery, tools, phones, utilities, etc., is prohibited without prior permission from the Boeing Onsite Activity Representative. The use of Boeing assets by service providers is generally forbidden unless there is a specific business need such as unique tooling required for a project or additional risk incurred in operating portable equipment such as cranes.

e. Use of a photographic or camera-enabled device must be properly authorized using a Camera Permit.

f. Radio frequency devices, such as portable radios, are controlled on Boeing property and must be pre-approved before use.

g. Tobacco use of any kind is prohibited on Boeing property, including Company-owned or leased grounds, parking lots, private vehicles and buildings, in company-owned or leased vehicles, or in pre-delivered products.

h. Animals are not to be brought onto Boeing property. For guide dogs and other human service animals, please coordinate with your Boeing Onsite Activity Representative.

1.2 Badge Identification

a. You must obtain an identification badge and visibly display and wear the badge while on Boeing property.

Exception: In the event that Boeing provides notification that outward display of identification badges is not recommended, identification must still be on your person.

b. Lending or borrowing identification badges is strictly prohibited.

1.3 Vehicles

a. Personal and service provider vehicles and industrial mobile equipment used inside secured Boeing property are allowed with special permission only and may require a Boeing-issued parking pass.

b. Service provider vehicles, personal vehicles, and industrial mobile equipment and accessories shall be maintained in a safe operating condition.

c. Service provider vehicles, equipment, or supplies shall not block entrance ramps, truck doors, plant access aisles, emergency routes, and parking specified for Boeing equipment, facilities, or plant personnel without prior approval from the Boeing Onsite Activity Representative.

d. Posted speed limit and traffic signs shall be followed at all times while on Boeing property.

e. Pedestrians have the right of way at all times.

f. Service provider vehicles are not permitted on flight line ramps without prior approval.

g. Seat belts, when provided, shall be worn at all times.

h. Personnel shall not be transported in the beds of trucks.

i. Do not idle vehicles unnecessarily.

j. Do not idle vehicles in proximity to building air intakes or building entrances.

k. Operation of diesel and gasoline powered equipment is generally prohibited in Boeing buildings. This requirement does not apply to transient vehicles or short-term loading and unloading inside occupied buildings. If a diesel or gasoline powered device is to remain running inside a Boeing building for more than fifteen (15) minutes, then the exhaust shall be piped or vented to the outside of the building or shall use a Boeing approved filtering system.

1.4 Required Postings

The service provider is responsible for ensuring that all federal, state, and local agency permits and posters are placed at the entrance to the job site, or at a location as directed by the Boeing Onsite Activity Representative.

2.0 EMERGENCY PROCEDURES

2.1 Evacuations

a. In the event of a building or site evacuation, immediately evacuate through the nearest safe exit and report to your designated assembly point. If you do not know your assembly point, check with your immediate supervisor or Boeing Onsite Activity Representative. In all cases, instruction and directions given by your supervisor, security, or other emergency response personnel shall be followed.

b. In the event of a building or site incident in which you are asked to "Shelter In Place," follow the posted directions, or direction from the designated emergency response personnel, to the closest designated "Shelter in Place" location.

c. Do not leave the assembly point or shelter-in-place location until authorized to do so by Boeing or local emergency response agencies.

2.2 Emergency Notification

Immediately report all emergency and significant incident situations to the Boeing emergency number listed on page ii of this booklet and your Boeing Onsite Activity Representative.

You must know the building number, grid/column line number, floor level, door number, and location of the nearest phone.

Remember: do not hang up until the dispatcher tells you to do so. You are a vital link in the emergency and must relay changes in the state of the emergency.

Emergency and significant incident are defined as follows.

a. Emergency. Any event requiring emergency personnel and equipment, including but not limited to:

- Visible flame, smoke, noxious odors, or noise that may attract the attention of the surrounding community or that results in the evacuation of personnel.
- An event that places human life, environment, or property at risk.
- Environmental spills or releases.

b. Significant Incident. Any event involving one or more of the following.

- Death, serious injury, or exposure of an individual to hazardous substances that require attention beyond first aid, hospitalization, or results in permanent impairment.

- Property damage to Boeing or Boeing Customer assets.
- Damage or the potential for damage to a Boeing product or related production component or part.

2.3 Emergency Medical Care

Should you observe a medical emergency, call the appropriate emergency response agency listed on page ii of this booklet.

3.0 FIRE PREVENTION

3.1 Fire Extinguishers

As required and approved by the Boeing Fire Department or a Boeing Security and Fire representative, all service providers shall provide their own Factory Mutual (FM) Approved or Underwriters Laboratory (UL) Listed portable fire extinguishers in good working order. Fire extinguishers approved by the Boeing Fire Department or a Security and Fire Representative for the specific hazards of the location must be readily accessible in the immediate area.

3.2 General Housekeeping

a. Boeing trash receptacles shall not be used for construction debris.

b. All trash and debris receptacles shall be located away from any Boeing building or structure. If construction trash chutes are required, the location and design of the chute shall be approved by the Boeing Fire Department or a Boeing Security and Fire representative.

c. All work areas shall be maintained in a clean state. Clean up and remove trash, scrap, excess materials, and other debris. This shall be done at least daily and whenever the accumulation constitutes a fire hazard.

d. Burning of trash is prohibited.

e. Wood, sawdust, or shavings shall not be used as absorbents for spilled flammable or combustible liquids or petroleum lubricants.

3.3 Equipment Requirements

a. All equipment must be operated in accordance with the manufacturer’s instruction manual.

b. All powered equipment shall be refueled outdoors, away from storm drains and clear of structures, with engines shut off. Spill containment must be provided for equipment fueling. Spill clean up kits must be available at refueling locations.

c. Gasoline, liquid propane gas, or propane-powered equipment shall be allowed on building roofs only with prior written approval obtained through the Boeing Onsite Activity Representative. Additional coordination is required.

d. Electrical equipment used in areas where flammable atmospheres (vapors, dusts, or mists) may exist shall have appropriate National Fire Protection Association (NFPA) class and division ratings for explosion proofing.

e. Air monitoring shall be conducted, as necessary, to check for hazardous emissions from powered equipment operating within buildings or enclosed structures. Monitoring results shall be available for review if requested by Boeing.

3.4 Flammable Liquids

a. All flammable liquids, fuels, resins, lubricants, and solvents shall be segregated and labeled. All storage areas for flammable or combustible liquids shall be approved by the Boeing Onsite Activity Representative. Additional coordination is required.

b. Flammable liquids (flashpoint below 100°F or 38°C) shall not be used or stored inside Boeing buildings unless contained in an FM Approved, UL Listed, or Boeing-approved container and only in quantities needed to accomplish the immediate tasks.

c. The use of glass containers is strictly prohibited.

d. Effective methods of spill retention and cleanup of materials are required.

e. Containers and dispensing apparatus shall be electrically bonded and grounded when dispensing or transferring flammable liquids, except for portable containers less than five gallons in capacity and containers made of plastic.

f. The service provider shall comply with all safety regulations and codes pertaining to labeling, handling, and storage of flammable and combustible products.

3.5 Spray Painting, Flammable Resins, and Chemicals

a. Inspection and written approval are required before painting, including spray painting or cleaning with flammable materials. Additional coordination is required.

b. All electrical equipment shall be rated for Class I, Division 1 locations where flammable or combustible liquids are sprayed. Spray operations shall be conducted in well ventilated, unoccupied areas.

c. Only explosion-rated or intrinsically safe electrical equipment, including forklift trucks that are, for example, EE or EX rated, shall be used in areas such as flight hangars, paint booths, and tank lines, where explosion-proof electrical systems are required.

d. A minimum distance of 20 feet from ignition sources is required.

3.6 Heating Devices

a. Open-flame devices and sources of heat and spark-producing equipment shall not be used in areas with combustible materials or flammable liquids.

b. Open-flame devices and furnaces shall have a constant attendant.

c. The hot-work procedures outlined in section 3.7 shall be followed for heating devices.

3.7 Welding/Cutting Activities

a. A hot-work permit is required prior to performing all open-flame or spark-producing work.

b. Coordinate with the Boeing Onsite Activity Representative regarding hot-work permit requirements at your location.

c. Fire-retardant protective materials (such as fire blankets) shall be used to contain sparks and prevent them from falling against walls, on wooden floors, through flooring, on combustibles or valuable materials and equipment, or into hidden spaces.

d. Flash shields, fire-resistive curtains, or other suitable shields shall be placed around the welding area to protect any adjacent personnel from sparks and arc flash.

e. All flammable materials shall be a minimum of 35 feet away from hot-work areas.

f. Arc welding machines with the potential to interfere with implanted medical devices shall be posted per site safety and health requirements.

g. Local ventilation is required for welding operations that will generate welding fumes inside the building.

h. Service providers shall provide their own FM Approved or UL Listed portable fire extinguishers. Fire extinguishers approved for the specific hazards of the location must be readily accessible and fully charged.

i. The fire watch person shall be assigned and trained in the use of portable fire-fighting equipment. The fire watch person shall be dedicated to the assigned activity and remain on standby a minimum of 30 minutes following the end of any and all open-flame activities.

j. The assigned fire watch person shall notify the Boeing Fire Department, or other agency that issued the hot-work permit, upon completion of work.

k. Hot-work permits shall be removed and destroyed upon completion of work or when they expire.

3.8 Fire Protection Systems

a. Notify the Boeing Onsite Activity Representative 24 hours in advance of all proposed requests for fire protection system closure or impairments. Additional coordination is required.

b. Boeing requests a fourteen (14) day notice for all non-emergency utility shut off events, but realizes situations may arise where this is not always possible. However, under no circumstance shall the notice for non-emergency utility shut off events be less than seven (7) days.

c. Boeing shall be notified and shall approve, before use, the use of fire hydrants or building standpipe systems for temporary water supply. This approval is obtained from the Boeing Onsite Activity Representative. Additional coordination is required.

d. The service provider shall verify with the Boeing Onsite Activity Representative that all fire-extinguishing protection systems (sprinklers) are operational in an area of welding and open-flame cutting. Additional coordination is required.

3.9 Temporary Structures and Enclosures

a. A separation of 25 feet shall be maintained between temporary buildings and storage areas and other buildings or areas. All temporary installations must have prior approval by the Boeing Onsite Activity Representative. Temporary walls or partitions shall be noncombustible.

b. Plastic or Visqueen film shall be fire resistive UL Listed or FM Approved, meeting requirements of NFPA #701, “Standard Methods of Fire Tests for Flame Propagation of Textiles and Films.”

3.10 Storage of Combustible Building Materials

Contact the Boeing Onsite Activity Representative to obtain approval for the storage of combustible materials. Additional coordination is required.

3.11 Roofing

The Boeing Onsite Activity Representative shall be notified of all roof work involving welding, open flame equipment, and spark-producing or hot work before start of the work. Additional coordination is required.

3.12 Emergency Egress

Service providers shall not block or obstruct emergency exits or other means of egress.

4.0 SAFETY REQUIREMENTS

4.1 Project-Specific Safety Plans

a. The service provider shall prepare a written, project-specific safety plan with the details in the plan applicable for work being performed, and submit the plan, upon request, for Boeing review. Project-specific safety plans shall be available and communicated at the location where the work is being performed.

b. The service provider shall submit to The Boeing Company, on request, a copy of its company safety program.

c. The service provider shall provide written notification to the Boeing Onsite Activity Representative of the name and title of the service provider's on-site safety representative for the project.

d. Contact your Boeing Onsite Activity Representative for additional assistance on this section of the manual.

4.2 Personal Protective Equipment

a. The service provider shall provide their employees all required personal protective equipment (PPE) and ensure that it is used. Boeing does not provide PPE to service provider personnel.

b. The service provider employee's PPE shall be appropriate for the job and shall be maintained in a safe and sanitary condition when not in use. All PPE must conform to appropriate industry standards.

c. Examples of PPE are

- Industrial safety glasses with side shields.
- Face protection.
- Body protection.
- Ear plugs and muffs.
- Hard hats.
- Gloves and hand protection.
- Full-body safety harness and lanyards.
- Sturdy, low-heeled shoes with closed toe and heel.

4.3 Hazard Communication / Material Safety Data Sheets

a. The Boeing Company shall provide, on request, the material safety data sheet (MSDS) for any hazardous chemical under Boeing control within the assigned work area.

b. Before any hazardous chemicals arrive on site, the service provider shall furnish to the Boeing Onsite Activity Representative the following information on each hazardous chemical to be used:
    1. The identity of each hazardous chemical;
    2. An MSDS for each hazardous chemical; and
    3. The quantity of each hazardous chemical to be used and/or stored on site.

c. All hazardous chemical containers shall be properly identified and labeled as to their contents. Hazardous chemical container labels must include:
    1. The identity of the hazardous chemical;
    2. The manufacturer of the hazardous chemical; and
    3. Appropriate hazard warnings.

d. The service provider shall bring to the job site only the amount of hazardous chemicals necessary for the project.

4.4 Electrical Safety

a. All electrical incidents or near misses shall be reported immediately to the Boeing Onsite Activity Representative.

b. Equipment used by service providers must be approved by a nationally recognized testing laboratory.

c. The service provider shall supply ground fault circuit interrupters for all temporary electrical wiring cords and portable equipment and tools.

d. The service provider must comply with current OSHA and NFPA 70E standards for safe work on or near energized electrical systems. Work on or near energized exposed movable conductors (e.g., power lines) or energized equipment with exposed conductors operating at 50 volts or greater, shall only be done when approved in writing by the Boeing Onsite Activity Representative. Additional coordination is required.

e. Personal protective equipment and portable electrical equipment (e.g., extension cords, drills, etc.) shall be inspected by the service provider before use and maintained in a safe working condition.

f. Equipment, carts, or other items shall not be stored in front of electrical panels or substations.

g. Combustible materials shall not be stored in any substation or electrical room.

h. After completion of work, substations and electrical rooms shall be secured to prevent unauthorized access.

4.5 Lockout, Tag, Tryout Program

a. Prior to shutdown of any Boeing equipment, building system, or utility, the service provider shall notify the Boeing Onsite Activity Representative.

b. All equipment that could present a hazard from inadvertent activation or release of energy during maintenance or servicing shall have the energy supply locked out and tagged except where the energy supply is needed for testing, troubleshooting, inspecting, or servicing equipment.

c. Before working on any energized system, the service provider shall take the following steps.

   1. Isolate the energy source and release all energy or potential energy (e.g., electrical [stored], gravity, kinetic, pressure, thermal, pneumatic, and hydraulic).
   2. Refer to machine-specific instructions on controlling multiple energy sources.
   3. Install physical lockout device (e.g., lock) with your company lockout tag.
   4. Before proceeding with work, test or try out the system to ensure zero energy state.
   5. The following information shall be printed on all lockout tags in use:
      i. Employee name, company name, date, and phone number (or pager number).
      ii. Off-shift contact and phone number (requires someone to be available 24 hours per day).

4.6 Trenching and Excavations

a. Notify and obtain approval from the Boeing Onsite Activity Representative before excavating or opening any trench. Additional coordination is required.

b. Prior to commencing work, a qualified service shall be used to locate the approximate location of subsurface installations such as sewer, telephone, fuel, electric, water lines, or any subsurface installations that may be encountered during excavation work. While the excavation is open, subsurface installations shall be protected, supported, or removed as necessary to safeguard personnel.

c. Hand-digging shall be required where there is any risk of contacting underground utilities or structures.

d. The service provider shall physically barricade all excavations and trenches, and ensure that proper precautions are taken to prevent unauthorized access to trenches or excavations, trench and excavation equipment (idle or operating), and other service provider equipment used for trench and excavation projects.

e. Daily inspections of excavations, adjacent areas, and protective systems shall be made by a competent person for evidence of hazardous conditions. Inspections shall also be made after every rain storm or other hazard increasing occurrence. If a hazardous condition is observed, personnel shall be removed from the hazard area until the hazardous condition is corrected.

f. The service provider's competent person shall assess the soil condition to determine the method of shoring or sloping required for excavation.

g. All excavations and trenches 5 feet or more in depth shall be benched, shored, sloped, or otherwise protected to ensure that collapse does not occur.

h. Excavated soils must be placed not less than two feet away from the excavation.

i. Place excavated soils on the up-slope side of the trench whenever possible to capture sediment runoff in the event of rain.

4.7 Warning Signs and Barricades

a. Service providers shall supply appropriate signs, barricades, flashing light barricades, ground attendants, and flagging, as required, to keep unauthorized personnel out of potentially hazardous work areas.

b. Highly visible physical barriers such as warning tape shall be used by service providers to identify their work area and to prevent Boeing personnel and others not directly involved with the project from entering.

c. Substantial barricades, such as chain link fencing, standard guardrails, etc., are required around excavations, holes, or openings in floors, roof areas, edges of roofs, and elevated platforms. In addition, barricades are required around overhead work and wherever necessary to warn or protect all personnel.

4.8 Confined-Space Entry

a. All confined-space incidents or near misses shall be reported immediately to the Boeing Onsite Activity Representative.

b. Boeing will provide service providers with information on the hazards identified and protective requirements of existing confined space locations.

c. The service provider shall have and follow its own written confined space entry program, including an entry permit system, monitoring equipment, ventilation, retrieval system, and observation personnel, except as provided for in paragraph 4.8.d.

d. For jointly occupied confined spaces, the service provider shall coordinate its confined-space entry plan with the Boeing Onsite Activity Representative. Additional coordination is required.

e. The service provider shall have its written confined space entry program available at the worksite and post the confined-space entry permit at the point of entry.

f. Upon completion of confined-space entry, provide a copy of the closed permit to the Boeing Onsite Activity Representative.

4.9 Fall-Protection Program

a. A fall-protection plan is required when fall protection systems including anchorage points, static lines, lanyards, and full body harnesses must be utilized because fall hazards cannot be eliminated through the use of passive systems such as hand rails.

b. All fall-protection equipment and devices shall meet American National Standards Institute (ANSI) Z359 standards.

c. The service provider shall provide all necessary fall-protection equipment to its employees.

d. Boeing prohibits the use of “body belts” as fall protection.

e. The service provider shall inspect and maintain its fall-protection equipment and shall promptly remove from the worksite any fall protection equipment found to be defective.

f. Before considering the use of a crane or forklift to lift personnel, the service provider shall consult with the Boeing Onsite Activity Representative. Additional coordination is required.

g. Service providers must have measures in place to protect personnel in the area of elevated work from hazards resulting from dropped tools, work materials, etc. This may include the use of barricades, spotters, and nets. The inclusion of tool and parts control / inventory provisions in the project specific safety plan may be required. Contact the Boeing Onsite Activity Representative for more information.

4.10 Ladders and Scaffolding

a. Ladders shall be in good condition and used as intended (e.g., do not use portable A-frame step ladders as straight ladders).

b. Portable metal ladders shall not be used for electrical work. The use of metal ladders is completely prohibited at some Boeing sites. Contact the Boeing Onsite Activity Representative prior to use.

c. Ladders shall not be used in front of doorways without posting or otherwise protecting the area.

d. Scaffolding systems shall be erected and regularly inspected by a competent person. All scaffolding shall have work platforms fully planked; all braces, access ladders, proper guardrails, and toe boards must be installed. Where items may fall onto personnel working or passing below, safety netting shall be provided.

e. During scaffolding erection, dismantling, and use, all employees shall be fully protected from fall hazards.

4.11 Work Permits

There may be additional site-specific permit and licensing requirements other than those specified in this document. Check with the Boeing Onsite Activity Representative for further clarification. Additional coordination required.

4.12 Foreign Object Debris / Foreign Object Damage

a. Foreign Object Debris (FOD) is any substance, debris, or article which could find its way into a product system (e.g., aircraft, radar system, satellite, launch system, etc.) and cause damage. Service providers shall take the following steps to prevent Foreign Object Damage.

   1. Follow any posted FOD requirements when working in a FOD Critical, FOD Control, or FOD Awareness area.
   2. Maintain accountability for all tools, construction materials, hardware, and personal items brought into work areas.
   3. Properly contain and secure tools, construction materials,

hardware, and personal items to prevent them from falling off carts, being moved by weather events, or otherwise migrating into product systems.

4. Pick up any dropped tools, debris, or other objects promptly.
5. Clean up and remove trash, scrap, excess materials, and other debris at least daily.
6. Immediately report missing / lost tools and other items to the Boeing Onsite Activity Representative.
7. When work involves loose material (i.e., concrete, asphalt, gravel, dirt, etc.) that can migrate onto product system traveled surfaces or factories where product systems are manufactured, construct FOD barriers as necessary to surround the work area and contain all debris.

4.13 Overhead Crane Operations

a. The service provider shall obtain approval from the Boeing Onsite Activity Representative and schedule any work requiring access to and use of Boeing overhead cranes and crane space, work adjacent to Boeing overhead cranes, or work around Boeing overhead cranes. These activities may require the installation of bridge-crane rail stops, or inactivation of bridge cranes to preclude collision with service-provider equipment. Hazardous energy control requirements are found in section 4.5 Lockout, Tag, Tryout Program.

b. Mechanical, electronic, or other approved crane stop systems shall be installed in front and behind personnel while they are working in an elevated position, or while they are making a lift of materials through the crane travel zone, to protect them from the crane they may be working on and from any other crane entering from another area or adjacent bay.

c. The service provider shall provide and use cranes and rigging that have been proof loaded and have required certifications available at the job site.

d. Service providers that operate Boeing overhead cranes must receive crane safety training using a Boeing reviewed and accepted training curricula.

4.14 Utility Shutdowns

Service providers shall minimize service interruption during unavoidable utility shutdowns. Written authorization must be requested from the Boeing Onsite Activity Representative a minimum of two weeks before the scheduled utility shutdown or as soon as it is known to be required in order to perform required work.

4.15 Joint Occupancy Issues (Occupied Work Areas)

a. The service provider shall cooperate and coordinate work with The Boeing Company and other Boeing service providers so all work may be promptly and properly performed without undue interference or delay. The service provider shall afford The Boeing Company and other Boeing service providers reasonable opportunity for the execution of their work.

b. For work in close proximity to Boeing products or employees, a joint safety plan may be required. Contact your Boeing Onsite Activity Representative for more information.

4.16 Training

a. The service provider shall ensure that all of its employees are properly trained for all jobs and tasks that require specific training and/or competency to meet all applicable federal, state, and local regulations prior to conducting work for Boeing.

b. All service provider employees shall be trained in, and be knowledgeable of, the project-specific EHS plan.

c. The service provider shall submit to The Boeing Company, on request, validation of the training received.

d. Service provider employees must receive information/orientation as necessary to comply with site specific requirements.

4.17 Radiation Safety

a. Written approval must be obtained through the Boeing Onsite Activity Representative before the following activities occur. Additional coordination is required.

   1. Licensed radioactive material (e.g., gamma radiography equipment, moisture density gauges, etc.) are brought onsite.

   2. Class 3b or 4 lasers (as indicated by the label on the equipment) are brought onsite.

   3. Radio frequency sources capable of exposing personnel above OSHA limits are brought onsite. See section 1.1.f for more information.

   4. Machines that produce X-rays (X-ray machines, XRF units, etc.) are brought onsite.

5. Service providers work in any area restricted for purposes of radiation protection.
6. Service providers work with any radioactive material possessed under a Boeing license.

4.18 Compliance with Posted Safety Requirements

The service provider shall comply with all posted safety requirements, including but not limited to: hearing protection, eye protection, confined space entry, access barriers, parking, and driving requirements.

4.19 Traffic Control

a. Service providers delivering and receiving material shall ensure that traffic controls are in place, including flaggers, truck waiting areas, staging areas, and appropriate traffic guidance signs.

b. Any service provider causing a road hazard must place obvious warning devices to alert drivers approaching the hazard. These devices shall remain in place until the hazard is mitigated.

5.0 ENVIRONMENTAL

5.1 ISO 14001 Environmental Management System

a. Service providers at Boeing manufacturing facilities that are ISO 14001 certified must ensure that their employees are made aware of the Boeing Environmental Policy and written procedures established for activities, products, and services necessary to protect the environment.

b. Boeing’s environmental management system conforms to the ISO 14001 Environmental Management System (EMS).

c. The Boeing Environmental Policy is communicated to all persons who work for, or on behalf of the organization, including service providers working onsite at Boeing.

d. Service providers must be familiar with and comply with the Boeing Environmental Policy and have knowledge of how their actions may impact the environment, and the consequences of not following proper procedures.

e. Boeing Environmental Policy:

Boeing is committed to operating in a manner that promotes environmental stewardship. Boeing will strive to:

1. Conduct operations in compliance with applicable environmental laws, regulations, and Boeing policies and procedures.
2. Prevent pollution by conserving energy and resources, recycling, reducing waste, and pursuing other source reduction strategies.
3. Continually improve our environmental management system.
4. Work together with our stakeholders on activities that promote environmental protection.

f. For more information on the ISO 14001 program contact your Boeing Onsite Activity Representative.

5.2 Hazardous Materials

a. Hazardous materials stored on Boeing sites shall be stored under cover, in containment, and be clearly labeled. Storage areas must be approved by the Boeing Onsite Activity Representative. Additional coordination is required.

b. Secondary containment must be provided for operations involving transfer (e.g., pouring, pumping, or dispensing) of hazardous materials.

c. A utilization report may be required at some locations for hazardous materials that are brought on site. Verify requirements with the Boeing Onsite Activity Representative.

d. Keep containers closed when not in use.

e. When bringing hazardous materials onto a Boeing site, notify the Boeing Onsite Activity Representative. Additional coordination is required.

5.3 Hazardous Waste and Solid Waste Handling and Disposal

a. Service providers must submit a waste management plan to the Boeing Onsite Activity Representative for projects which generate hazardous or non-hazardous wastes. Additional coordination is required.

b. The Boeing Company disposes of all hazardous waste (including universal waste) that is generated on its property, regardless of the party that generates the waste. Service providers shall not take hazardous waste off site. If you are working under a contract on a Boeing site and need assistance with hazardous waste disposal, establishing a waste station, or complying with hazardous waste regulations, contact the Boeing Onsite Activity Representative.

c. All hazardous waste generated by the service provider shall be properly segregated, containerized, and labeled by the service provider, as directed by the Boeing Onsite Activity Representative. Additional coordination is required.

d. Keep all waste containers closed between waste additions to containers.

e. Monitor your waste stations on a daily basis. Inspect the stations for leaks and full containers of waste.

f. When a waste drum becomes full, it must be immediately removed from the work site as directed by the Boeing Onsite Activity Representative. Additional coordination is required.

g. Never allow a hazardous waste drum to accumulate waste for more than 60 days after the date shown on the hazardous waste label affixed to the drum.

h. Never dump or discharge hazardous waste into storm drains, building sanitary sewer drains, rest rooms, or solid-waste containers.

i. Some locations may require service providers to provide periodic reports to the Boeing Onsite Activity Representative documenting activity related to recyclable materials and construction, demolition, or land clearing (CDL) debris. Contact the Boeing Onsite Activity Representative to determine if this reporting is required. These reports must include:

1. A description of all recyclables, non-hazardous waste, and CDL debris removed from the site.
2. The quantity of recyclables and non-hazardous waste removed from the site by weight, for that period.
3. Classification of the recyclables according to the following categories:
    i. Concrete, asphalt and masonry,
    ii. Clean soil and gravel,
    iii. Metals,
    iv. Stumps and brush,
    v. Recyclables sorted off-site by a 3rd party provider.

5.4 Suspect Materials

a. Asbestos Awareness

1. Notify the Boeing Onsite Activity Representative prior to conducting activities that may disturb asbestos. Additional coordination is required.
2. Boeing project locations may contain asbestos-containing materials. Prior to the start of work, obtain a written asbestos determination from the Boeing Onsite Activity Representative regarding the presence or absence of asbestos-containing materials associated with the work.
3. Abatement of all ACM affected by the project shall be coordinated by The Boeing Company.
4. If, after the project commences, the service provider discovers a possible asbestos disturbance or new suspect materials, stop work immediately and notify the Boeing Onsite Activity Representative. Work shall remain stopped until a resolution can be coordinated by the Boeing Onsite Activity Representative.

b. Lead Awareness

1. Notify the Boeing Onsite Activity Representative prior to conducting activities that may disturb lead. Additional coordination is required.

2. Lead can be found in a variety of different products, such as greases, solders, sealants, paints, coatings, lead shielding in walls and around tables, lead pipes, and counterweights.
3. Operations or processes that may cause lead exposure include but are not limited to:
    - i. Spray painting with paints containing lead.
    - ii. Grinding, sanding, or welding on lead-based paints.
    - iii. Soldering activities.
    - iv. Demolition of oxidized lead shielding.
4. All painted surfaces are presumed to contain lead unless determined otherwise.
5. Lead containing paint shall be removed before proceeding with any grinding, sanding, or welding activities.
6. Never use compressed air to remove lead dust.
7. All lead-abatement activities are coordinated through the Boeing Onsite Activity Representative.
8. If, after the project commences, the service provider discovers a possible lead-containing material disturbance or new suspect material, work shall stop immediately until the Boeing Onsite Activity Representative can determine the next course of action.

c. Soils and Remediation

1. Final disposition of all soil shall be coordinated through the Boeing Onsite Activity Representative. Additional coordination is required.
2. Immediately contact the Boeing Onsite Activity Representative listed at the front of this document if you notice contaminated soil or water during excavation activities. Watch for fuel and solvent smells, visible oil sheen, and other indications of contamination. Stop work immediately until the Boeing Onsite Activity Representative can determine the next course of action.

5.5 Air Quality

a. If service provider activities may produce emissions of any air pollutant, the service provider must submit a written plan for minimizing these emissions to the Boeing Onsite Activity Representative. Additional coordination is required.

b. The Service Provider shall not emit any air contaminant in sufficient quantities and of such characteristics and duration that is likely to be injurious to human health, plant or animal life, or property, or which unreasonably interferes with enjoyment of life or property. Contact the Boeing Onsite Activity Representative if you are not sure your activity falls in this category.

c. Open burning is strictly prohibited.

d. Vehicles and equipment shall not leave the work site coated with dust, dirt, or mud.

e. Truck loads and roll-off containers with loose materials shall be covered. The service provider shall take appropriate measures to prevent drag-out and fugitive emissions.

f. All service providers shall take measures to prevent overspray and airborne emissions from painting and blasting operations from depositing on adjacent buildings and automobiles. Any such deposits must be swept up immediately.

g. Abrasive blasting and spray-painting operations shall be performed inside a booth designed to capture the blast grit or overspray. Outdoor blasting or painting of structures or items too large to be reasonably handled indoors shall employ control measures, such as curtailment during windy periods, and enclosure of the area being painted or blasted. Contact the Boeing Onsite Activity Representative for specific requirements before starting outdoor blasting or painting activities.

h. For grade-and-fill operations associated with construction and demolition projects, employ water spray as needed to prevent visible dust emissions. The application of water for dust control that does not infiltrate into the ground must be contained by use of the approved erosion and sediment controls.

i. Airborne and blowing dust and debris shall be controlled. The service provider is responsible to obtain any necessary dust control permits. Contact the Boeing Onsite Activity Representative before the start of any activity that may generate dust.

j. All material that contains volatile organic compounds (VOC), such as paints, coatings, sealants, or resins, that are to be used shall be pre-approved through the Boeing Onsite Activity Representative. Additional coordination is required.

5.6 Water Quality

a. If service provider activities may produce wastewater, or if the service provider may handle hazardous materials in an area that may be exposed to storm water, the service provider must submit a written plan to the Boeing Onsite Activity Representative for handling such wastewater or storm water. Additional coordination is required.

b. Wastewater, including, but not limited to, concrete slurry, water from dewatering, cooling water and storm water, shall be handled in accordance with instructions from the Boeing Onsite Activity Representative or the service provider’s written wastewater plan.

c. Never pour any liquid into a storm drain. Potable water cannot be discharged to a storm drain without written permission provided through the Boeing Onsite Activity Representative. Additional coordination is required.

d. Do not use a hose or pressure washer to clean pavement unless the resulting wastewater can be contained. Alternative methods, such as sweeping, shall be used.

e. No vehicle, equipment, or building washing is permitted outside without prior approval from the Boeing Onsite Activity Representative.

f. Equipment and vehicles shall be maintained in good working order to prevent leakage of fluids (e.g., fuel, hydraulic fluids, and antifreeze). Methods to prevent and contain leaks must be implemented by the service provider (e.g., drip pads).

g. Sanitary sewage and industrial wastewater shall be disposed of in accordance with instructions from the Boeing Onsite Activity Representative. Additional coordination is required.

h. Store all hazardous materials and hazardous waste (including contaminated demolition debris) in a covered and contained area to prevent possible storm water or soil contamination. The containment shall be large enough to hold 110% of the volume of the largest container. This applies to materials and waste that are both hazardous and nonhazardous in nature.

i. Implement the Boeing-approved Best Management Practices (BMPs) as needed, to prevent storm water contamination, such as, but not limited to, silt fences, tarps for rain covers, and drain covers.

j. Approved BMPs are available from the Boeing Onsite Activity Representative.

k. The Boeing Onsite Activity Representative will notify service providers regarding the need for a Stormwater Pollution Prevention Plan (SWPPP). If required:

    1. The service provider will submit a SWPPP to the Boeing Onsite Activity Representative. Additional coordination is required.
    2. A copy of the site SWPPP and National Pollution Discharge Elimination System (NPDES) General Permit must be kept at the construction site at all times during construction and prior to notification from the agency that the NPDES permit has been terminated.
    3. The service provider shall maintain a site log book that contains a record of the implementation of the SWPPP and other permit requirements including the installation and maintenance of BMPs, site inspections, and stormwater monitoring.

l. Refueling and mobile equipment repair shall be conducted away from storm drains and waterways. Refueling over unpaved areas must be fitted with temporary containment or spill control. Spill clean-up materials shall be staged on site, in well marked containers, and in sufficient quantity and locations to respond to spills such as hydraulic equipment leaks.

m. Portable toilets must be secured as necessary to prevent them from being blown or knocked over and must be leak free, maintained in good working order, and located at least 100 feet from any waterway or storm water conveyance structure. Portable toilets must be serviced by a permitted company and cannot be dumped at the site.

6.0 SITE-SPECIFIC REQUIREMENTS

Contact the Boeing Onsite Activity Representative for additional requirements for the location at which you are performing work.

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The Boeing Company
100 N. Riverside
Chicago, IL 60606-1596

MC 7A-UR

Service Provider Manual
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Attachment B
Standard Operating Procedures

Standard Operating Procedure-
Contractor Procedures for Management of Waste Streams at Boeing

1.0 MANAGEMENT OF PROCESS WASTE STREAMS

This standard operating procedure describes procedures that will be implemented to manage waste streams generated from various activities at Boeing facilities. Boeing Airplane Programs Safety/Health/Environmental Affairs (APSHEA) Environmental Engineers are responsible for designating all wastes generated on Boeing property and will determine the packaging, labeling, marking, and treatment requirements. If there are any questions about how to manage a waste stream generated from this project contact the Renton Environmental Site Contact Fred Wallace at (206) 930-0461.

Prior to generating waste, the contractor needs to contact the Boeing field representative or Accumulation Area for the appropriate containers and labels. The correct label is identified by the Profile number listed in Table1-1.

1.1 Handling of Waste Containers

All wastes will be packaged and transferred to the Renton Facility Accumulation Area on the same day it is generated. If required, based on activities, a maximum of one satellite drum categorized as CO592PL2 will be allowed in the contractor area. This satellite drum, when filled, will be managed as the other waste streams noted below.

Preparation of all containers of waste must include the following steps:

- Secure the label on the top 1/3 of the container immediately prior to placing the waste in the container (see Figure 1-2).
- Make sure that the label is completely filled out (see Figure1-1). The name in box 4 is the name of the person who first puts waste into the container. The manifest number in box 6 is left intentionally blank.
- Keep the container closed except for the 15 minutes prior to and following the addition of waste.
- Secure all waste containers on pallets as shown in Figure 1-2, 1-3 or 1-4 as appropriate.
- Attach a completed transportation tag (see Figure 1-5).
- Call dispatch at (206) 544-6500 for transfer of the pallet to the Renton Facility Accumulation Area.

1.2 Personnel Training

Personnel that perform operation, maintenance, or monitoring activities that produce a regulated waste stream must have the following training and certification:

- Current Hazwoper certification.
- Site Specific HASP orientation.
- SHEA Service Provider Manual orientation (Boeing document # D0-6000-5965).

Table 1-1 Examples of Regulated Waste Streams

Waste Stream	Origin	Example Contaminant	Estimated Quantity	Profile Number
Spent vapor phase activated carbon (GAC) media (*see note 1*)		PCE, TCE, DCE, VC, methylene chloride, and TPH-G		C0589PL2
Spent liquid phase activated carbon (GAC)		PCE, TCE, DCE, VC, methylene chloride, and TPH-G		C0297PL2
Condensate water		PCE, TCE, DCE, VC, methylene chloride, and TPH-G		AR001PL2
Sediment from condensate water (on cleaning rags)		PCE, TCE, DCE, VC, methylene chloride, and TPH-G		C0591PL2 or C0592PL2 for rags
Used oil (drain onto sorbent pads)		None		C0024BOE Or C0592PL2
Used air filters		None		C0592PL2
Solid Waste debris that has contacted TCE waste streams		PCE, TCE, DCE, VC, methylene chloride, and TPH-G		C0592PL2
Non-contaminated Debris and trash		none		garbage

Notes

1. The carbon media exchange procedures will be coordinated with Boeing. Boeing will provide specific direction regarding the location and management of the media exchange.

1.3 Emergency Preparedness and Response

The Contractor must have a Contingency Plan and Emergency Response Procedures within the Standard Operating Procedures plan for the specific activity taking place. Personnel that perform operation, maintenance, and monitoring activities must have access to a cellular phone when on site. The emergency contact numbers need to be posted at singular locations around the work area the numbers must be readily visible at several locations.

The following emergency response equipment will be maintained at the site:

- Spill containment pillows
- Appropriate Neutralization Agents for Potential Chemicals
- Absorbent material
- Shovel
- Broom

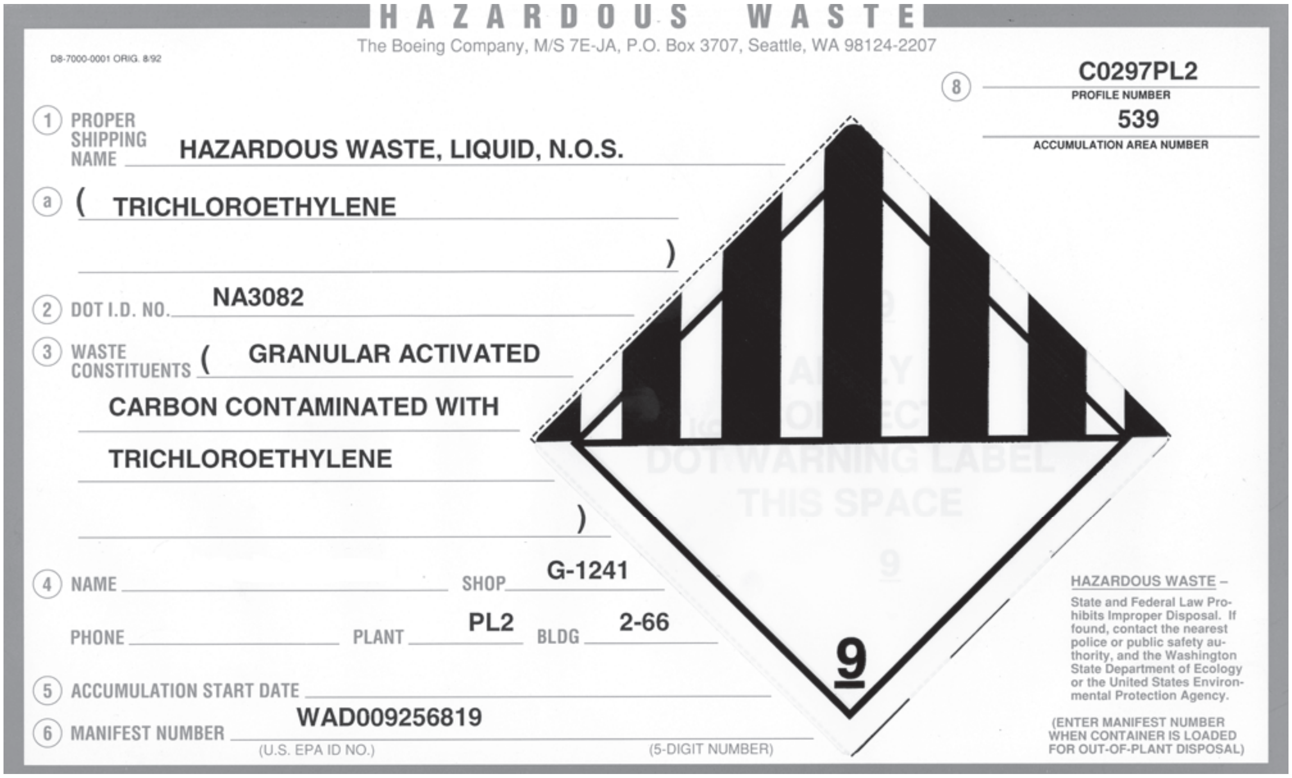
- Shop vac
- Portable eye wash kits
- PPE potentially including goggles and face shield, rubber gloves or equivalent, rubber over boots, coated Tyvek coveralls or equivalent, and a rubber apron
- Five-pound type ABC dry chemical fire extinguishers
- MSDS for the on-site materials
- Emergency contact numbers posted and easily visible

In the event of any emergency call:

1) Boeing Fire and Security (206) 655-2222
2) The designated Boeing Project representative
3) ______________________________

These contact numbers will be posted at the work area. The locations of the fire extinguishers, eye wash stations, first aid kits, and spill control materials shall be known and marked by the Contractor.

Figure 1-1 Sample Hazardous Waste Label



HAZARDOUS WASTE

The Boeing Company, M/S 7E-JA, P.O. Box 3707, Seattle, WA 98124-2207

D8-7000-0001 ORIG. 8/92

⑧ C0297PL2
PROFILE NUMBER
539
ACCUMULATION AREA NUMBER

① PROPER SHIPPING NAME HAZARDOUS WASTE, LIQUID, N.O.S.

ⓐ (TRICHLOROETHYLENE)

② DOT I.D. NO. NA3082

③ WASTE CONSTITUENTS (GRANULAR ACTIVATED CARBON CONTAMINATED WITH TRICHLOROETHYLENE)

④ NAME ______ SHOP G-1241

PHONE ______ PLANT PL2 BLDG 2-66

⑤ ACCUMULATION START DATE ______

⑥ MANIFEST NUMBER WAD009256819
(U.S. EPA ID NO.) (5-DIGIT NUMBER)

HAZARDOUS WASTE – State and Federal Law Prohibits Improper Disposal. If found, contact the nearest police or public safety authority, and the Washington State Department of Ecology or the United States Environmental Protection Agency.

(ENTER MANIFEST NUMBER WHEN CONTAINER IS LOADED FOR OUT-OF-PLANT DISPOSAL)

Figure 1-2 Pallet of Drums - 1 or 3

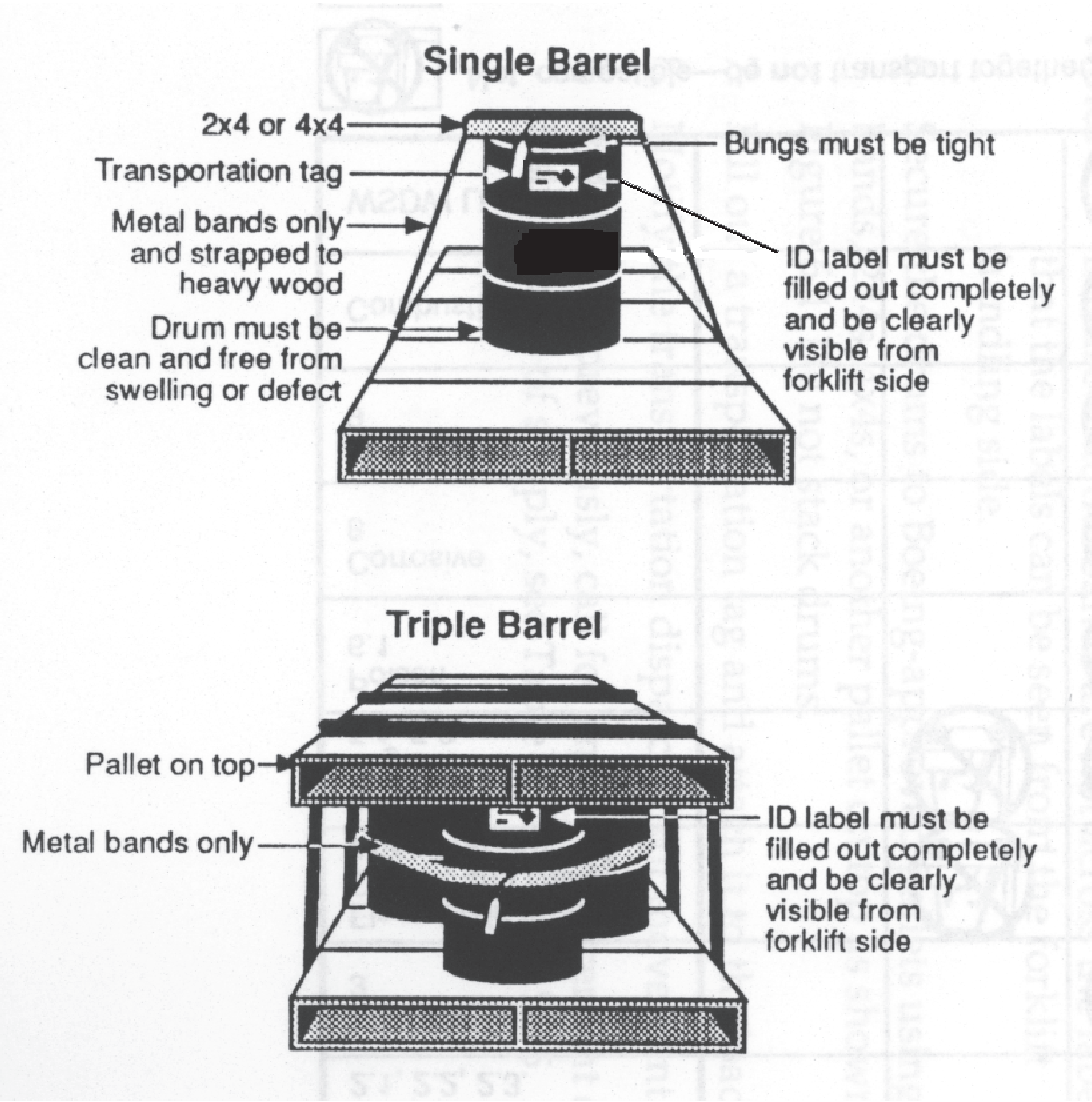


Figure 1-3 Pallet of Drums – 2 or 4

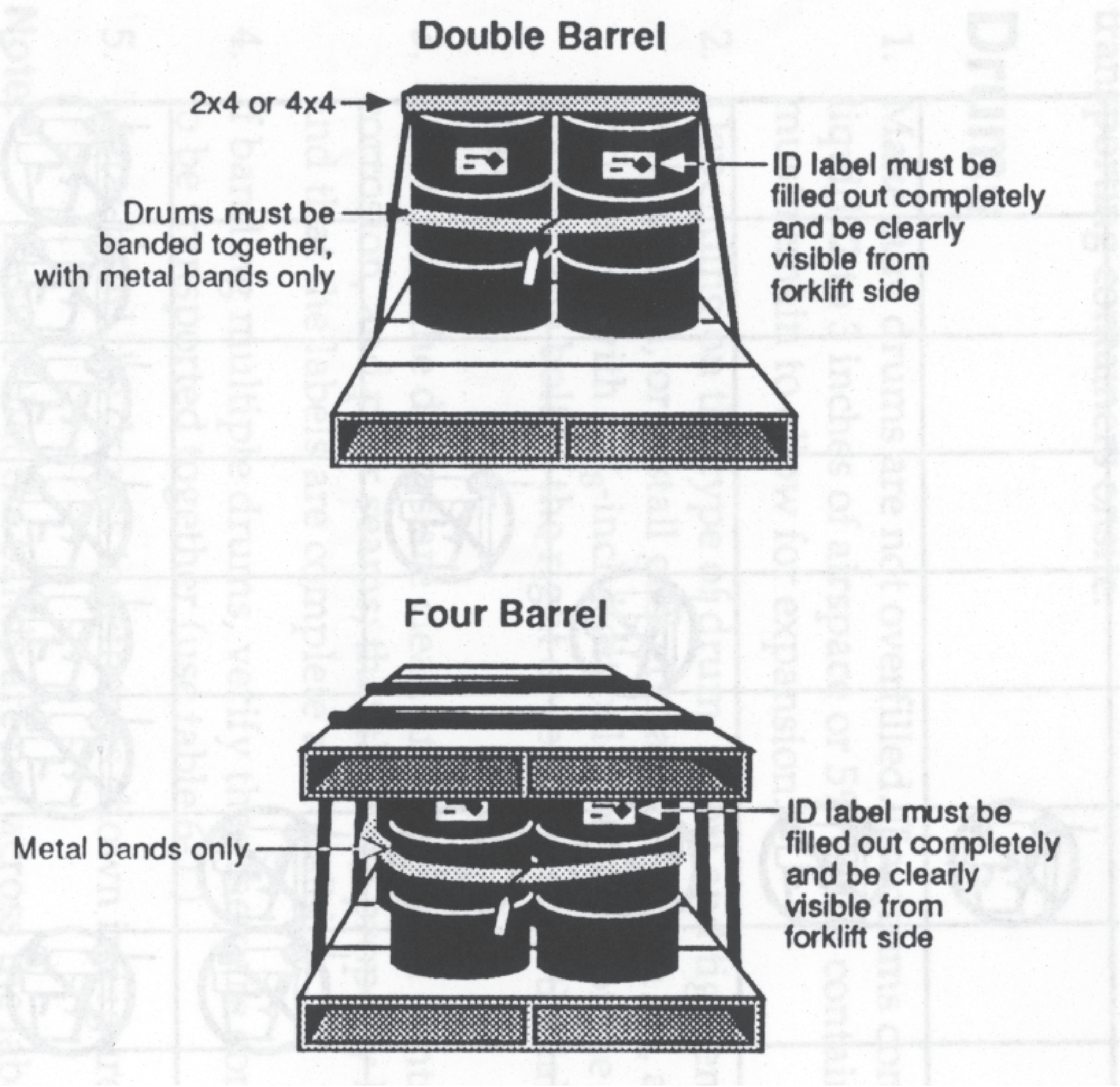
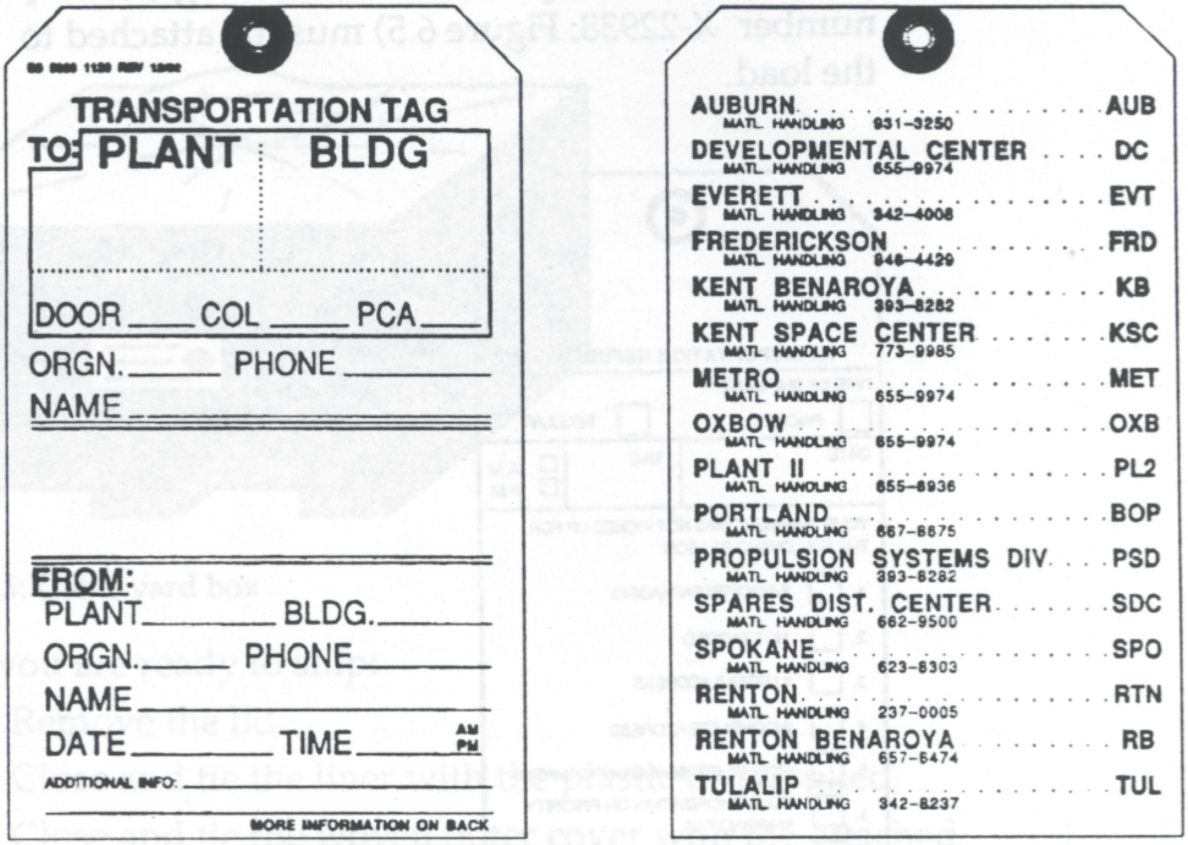


Figure 1-4 Waste Wrangler on Pallet

Figure 5-5 Transportation Tag



TRANSPORTATION TAG

TO: PLANT BLDG

DOOR ____ COL ____ PCA ____

ORGN. ____ PHONE ____

NAME ____

FROM:

PLANT ____ BLDG. ____

ORGN. ____ PHONE ____

NAME ____

DATE ____ TIME ____ AM PM

ADDITIONAL INFO: ____

MORE INFORMATION ON BACK

AUBURN	MATL. HANDLING 931-3250	AUB
DEVELOPMENTAL CENTER	MATL. HANDLING 655-9974	DC
EVERETT	MATL. HANDLING 342-4008	EVT
FREDERICKSON	MATL. HANDLING 846-4429	FRD
KENT BENAROYA	MATL. HANDLING 393-8282	KB
KENT SPACE CENTER	MATL. HANDLING 773-9985	KSC
METRO	MATL. HANDLING 655-9974	MET
OXBOW	MATL. HANDLING 655-9974	OXB
PLANT II	MATL. HANDLING 655-6936	PL2
PORTLAND	MATL. HANDLING 667-6675	BOP
PROPULSION SYSTEMS DIV	MATL. HANDLING 393-8282	PSD
SPARES DIST. CENTER	MATL. HANDLING 662-9500	SDC
SPOKANE	MATL. HANDLING 623-6303	SPO
RENTON	MATL. HANDLING 237-0005	RTN
RENTON BENAROYA	MATL. HANDLING 657-6474	RB
TULALIP	MATL. HANDLING 342-8237	TUL

LOCKOUT/TAGOUT
STANDARD OPERATING PROCEDURE

1.0 POLICY

It is the policy of CALIBRE Systems Inc. (CALIBRE) that any individual engaging in the maintenance, repairing, cleaning, servicing, or adjusting of prime movers, machinery, or equipment on jobsites will abide by the procedures outlined in this document. These procedures are designed to meet or exceed applicable OSHA standards for safe work practices.

Lockout is a first means of protection; warning tags only supplement the use of locks. Tags alone may be used only when the application of a lock is not practically feasible and with approval of the appropriate supervisor.

2.0 PURPOSE

The purpose of this Standard Operating Procedure (SOP) is to ensure that all individuals working on CALIBRE jobsites are protected from accidental or unexpected activation of mechanical and/or electrical equipment during maintenance, repairing, cleaning, servicing, or adjusting of prime movers, machinery, or equipment.

3.0 DEFINITIONS

3.1 LOCKOUT

Lockout is the practice of using keyed or combination security devices ("locks") to prevent the unwanted activation of mechanical or electrical equipment.

3.2 TAGOUT

Tagout is the practice of using tags in conjunction with locks to increase the visibility and awareness that equipment is not to be energized or activated until such devices are removed. Tagout devices may be a single use or reusable type, attachable by hand, self-locking, and non-releasable with a minimum unlocking strength of no less than 50 pounds.

3.3 ACTIVATION/ENERGIZATION

Activation/energization means to set machinery into motion by starting, switching, pushing, moving, or otherwise engaging power sources for such equipment; to provide a flow of electricity or complete a circuit that is the main power source for the machinery/equipment.

3.4 ENERGY CONTROL PROCEDURES

Energy control procedures are the use of lockout/tagout equipment to ensure safe work practices.

3.5 HAZARDOUS MOTION

Hazardous motion is the motion of equipment under mechanical stress or gravity that may abruptly release and cause injury. Hazardous motion may result even after power sources are disconnected. Examples are coiled springs, raised hydraulic equipment, and any sources of potential energy that may cause injury.

3.6 PRIME MOVER

Prime mover means power driven machinery and equipment.

4.0 RESPONSIBILITIES

4.1 PROJECT MANAGER

a. Ensure that the lockout/tagout procedures are in compliance with OSHA requirements.

b. Verify and/or provide employees with annual training if they must follow lockout/tagout procedures.

c. Inspect energy control procedures and practices at least annually to ensure that general and specific lockout/tagout procedures are being followed.

  i. Inspections must be carried out by persons other than those employees directly utilizing energy control procedures.

  ii. Inspections will include a review between the inspector and each authorized employee, of that employee's responsibilities under the energy control procedure being inspected.

  iii. Certify that periodic inspections have been performed (see RECORDKEEPING and LOCKOUT/TAGOUT INSPECTION FORM)

d. Maintain a file of CALIBRE equipment, machinery, and operations that require the use of lockout/tagout procedures. The file will include the location, description, power source, and primary hazards of equipment/ machinery, a list of the primary operators/maintenance personnel, and a list of lockout/tagout equipment that is used and maintained on site.

4.2 HEALTH AND SAFETY OFFICERS

a. Ensure that each supervisor adheres to procedures.

4.3 SUPERVISORS

a. Ensure that each employee engaging in work requiring locking/tagging out of energy sources understands and adheres to adopted procedures.

b. Assure that employees have received training in energy control procedures prior to operating the machinery or equipment.

c. Provide and maintain necessary equipment and resources, including accident prevention signs, tags, padlocks, seals and/or other similarly effective means.

d. Notify Human Resources of new or revised equipment, machinery, or operations that require the use of lockout/tagout devices during servicing, maintenance, or repair.

4.4 EMPLOYEES

a. Adhere to Specific Procedures as outlined in this document for all tasks that require the use of lockout/tagout procedures as defined.

b. Maintain lockout/tagout supplies in maintenance vehicles.

5.0 SPECIFIC PROCEDURES

5.1 PREPARATION FOR LOCKOUT/TAGOUT

Make a survey to locate and identify all isolating devices to be certain which switch (es), valve(s), or other energy isolating devices apply to the equipment to be locked or tagged out. More than one energy source (electrical, mechanical, stored energy, or others) may be involved.

5.2 SEQUENCE OF LOCKOUT OR TAGOUT SYSTEM PROCEDURE

1) Notify affected employees that a lockout or tagout system is going to be utilized and the reason therefore. The authorized employee shall know the type and magnitude of energy that the machine or equipment utilizes and shall understand the hazards thereof.
2) If the machine or equipment is operating, shut it down by the normal stopping procedure (depress stop button, open toggle switch, etc.).
3) Operate the switch, valve, or other energy isolating device(s) so that the equipment is isolated from it energy source(s). Stored energy (such as that in springs, elevated machine members, rotating flywheels, hydraulic systems, and air, gas, steam, or water pressure, etc.) must be dissipated or restrained by methods such as repositioning, blocking, bleeding down, etc.
4) Lockout/Tagout the energy isolating devices with assigned individual lock(s) or tag(s).
5) After ensuring that no personnel are exposed, and as a check on having disconnected the energy sources, operate the push button or other normal operating controls to make certain the equipment will not operate. CAUTION: Return operating control(s) to neutral or off position after the test.
6) The equipment is now locked out or tagged out.

5.3 RESTORING MACHINES OR EQUIPMENT TO NORMAL OPERATIONS

1) After the servicing and/or maintenance is complete and equipment is ready for normal production operations, check the area around the machines or equipment to ensure that no one is exposed.
2) After all tools have been removed from the machine or equipment, guards have been reinstalled and employees are in the clear, remove all lockout or tagout devices.
3) Operate the energy isolating devices to restore energy to the machine or equipment.

5.4 PROCEDURE INVOLVING MORE THAN ONE PERSON

In the preceding steps, if more than one individual is required to lockout or tagout equipment, each shall place his/her own personal lockout/tagout device on the energy isolating device(s). When an energy isolating device cannot accept multiple locks or tags, a multiple lockout or tagout device (hasp) may be used. If lockout is used, a single lock may be used to lockout the machine or equipment with the key being place in a lockout box or cabinet which allows the use of multiple locks to secure it. Each employee will then use his/her own lock to secure the box or cabinet. As each person no longer needs to maintain his or her lockout protection, that person will remove his/her lock from the box or cabinet.

5.5 TEMPORARY REMOVAL OF LOCKOUT/TAGOUT DEVICES

In situations where lockout/tagout devices must be temporarily removed from the energy isolating device and the machine or equipment energized to test or position the machine, equipment or component thereof, the following sequence of actions will be followed:

1) Remove non-essential items and ensure that machine or equipment components are operationally intact.
2) Notify affected employees that lockout/tagout devices have been removed and ensure that all employees have been safely positioned or removed from the area.
3) Have employees who applied the lockout/tagout devices remove the lockout/tagout devices.
4) Energize and proceed with testing or positioning.
5) De-energize all systems and reapply energy control measures in accordance with section 5.2 of these procedures.

5.6 MAINTENANCE REQUIRING UNDISRUPTED ENERGY SUPPLY

Where maintenance, repairing, cleaning, servicing, adjusting, or setting up operations cannot be accomplished with the prime mover or energy source disconnected, such operations may only be performed under the following conditions:

i. The operating station (e.g. external control panel) where the machine may be activated must at all times be under the control of a qualified operator.

ii. All participants must be in clear view of the operator or in positive communication with each other.

iii. All participants must be beyond the reach of machine elements that may move rapidly and present a hazard.

iv. Where machine configuration or size requires that the operator leave the control station to install tools, and where there are machine elements that may move rapidly, if activated, such elements must be separately locked out.

v. During repair procedures where mechanical components are being adjusted or replaced, the machine shall be de-energized or disconnected from its power source.

6.0 EMPLOYEE TRAINING

CALIBRE Employees will receive annual lockout/tagout training. This will typically be included as part of their annual 8-hour H&S training. Training requirements are outlined in 29CFR [Specifically 1910.147 (c)(7)(i),(ii), & (iii)].

7.0 RECORDKEEPING

7.1 INSPECTION RECORDS

Human Resources will maintain inspection records in accordance with 4.1 C.ii of this document.

Human Services will complete and maintain all LOCKOUT/TAGOUT INSPECTION FORMS.

7.2 TRAINING RECORDS

Training records will be maintained by the Human Resources Department. Training records will include an outline of topics covered and a sign in sheet of those employees attending.

8.0 REFERENCE

Code of Federal Regulations, Title 29, Part 1910, Section 147.

LOCKOUT/TAGOUT INSPECTION FORM

1. Inspection Date:____________________

2. Inspector (Printed Name/Signature):___________________________/____________________

3. Employee(s) Inspected
(Printed/Signature):______________________/____________________

______________________/____________________

______________________/____________________

______________________/____________________

4. Machine/equipment on which the energy control procedure was being utilized:

____

____

____

____

5. Inspection Checklist

Item	**Yes**	**No**
Does employee have or have access to adequate lockout/tagout devices?		
Has employee tested the effectiveness of his/her lockout/tagout devices?		
Has employee received CPR and lockout/tagout training in the last year?		
If this is an outside contractor, has an SSU supervisor informed him/her? Of the necessity for adhering to these procedures?		
Have all procedures been followed?		
Were tagouts legible and clearly displayed?		

6. Comments/Observations:____

____

____

____

____

Attachment C
SVE System Field Operation Log Form

Renton Cleanup Action SVE System – SWMU 172/174
Field Operations Log Form

Inspection Date: ______________________ Date of last inspection: ______________________

Periodic systems check:
1) Check flow rate, vacuum, pressure, moisture separator, water storage drums
2) Check selected SVE wells, VPC inlet, and VPC outlet with PID.

Operational Parameters - Monitoring interval is variable.		
Inspection Time:		
Blower	**Current Value**	**Other Notes**
Vacuum gauge		
Pressure gauge		
System flow rate		
Blower Temperature		
Temp.at lag VPC discharge		
Other notes: check oil level, drive belts, TEFC motor fan, any unusual noise/vibration		

PID Model:

Calibration time/date: Details:

Sampling Point	Time	PID Reading (1)	PID Reading repeated (2)	Flow Rate (cfm)	Other Notes
SVE-01					
SVE-02					
SVE-03					
VPC Inlet					
VPC Outlet					
Other:					

Vent Well ID	Design Flow rate (cfm)*	Adjusted Flow rate From Startup** (cfm)	Current Flow rate (cfm)	Notes
SVE-01	10			
SVE-02	10			
SVE-03	10			
Other:				

*For SWMU-172/174 Design flow rate is 10 cfm/well.
**After system startup flow from individual wells may be changed from original design.

Questions? Call Grant Dawson @ (509) 430-6752.

At the completion of a monitoring event scan monitoring forms and e-mail to Grant Dawson (grant.dawson@calibresys.com).

Signature ______________________ ______________________ ________
Printed Name Signature Date

Renton Cleanup Action SVE System – Building 4-78/79
Field Operations Log Form

Inspection Date: ______________________ Date of last inspection:______________________

Periodic systems check:
1) Check flow rate, vacuum, pressure, moisture separator, water storage drums
2) Check selected SVE wells, VPC inlet, and VPC outlet with PID.

Operational Parameters - Monitoring interval is variable.		
Inspection Time:		
Blower	**Current Value**	**Other Notes**
Vacuum gauge		
Pressure gauge		
System flow rate		
Blower Temperature		
Temp.at lag VPC discharge		
Other notes: check oil level, drive belts, TEFC motor fan, any unusual noise/vibration		

PID Model:

Calibration time/date: Details:

Sampling Point	Time	PID Reading (1)	PID Reading repeated (2)	Flow Rate (cfm)	Other Notes
SVE-01					
SVE-02					
SVE-03					
SVE-04					
SVE-05					
SVE-06					
SVE-07					
SVE-08					
SVE-09					
SVE-10					
SVE-11					
SVE-12					
SVE-13					
SVE-14					
SVE-15					
VPC Inlet					
VPC Outlet					

SVE Field Operations Building 4-78/79 Log Form Page 2

Inspection Date:

Vent Well ID	Design Flow rate (cfm)*	Adjusted Flow rate From Startup** (cfm)	Current Flow rate (cfm)	Notes
SVE-01	1.3			
SVE-02	1.3			
SVE-03	1.3			
SVE-04	1.3			
SVE-05	1.3			
SVE-06	1.3			
SVE-07	1.3			
SVE-08	1.3			
SVE-09	1.3			
SVE-10	1.3			
SVE-11	1.3			
SVE-12	1.3			
SVE-13	1.3			
SVE-14	1.3			
SVE-15	1.3			

*Building 4-78/79 is 1.3 cfm/well.
**After system startup flow from individual wells may be changed from original design.

Questions? Call Grant Dawson @ (509) 430-6752.

At the completion of a monitoring event scan monitoring forms and e-mail to Grant Dawson (grant.dawson@calibresys.com).

Signature ______________________ ______________________ ________

Printed Name Signature Date

Attachment D
Equipment Cut Sheets

(TO BE INCLUDED AFTER CONSTRUCTION)

Attachment E
SVE Emissions Monitoring Protocol

EMISSIONS MONITORING PROTOCOL

Building 4-78/79 SWMU/AOC Group and SWMU-172/174 SVE Systems
Boeing Renton

The operations and performance monitoring for both the SVE systems for Building 4-78/79 SWMU/AOC Group and SWMU-172/174 will follow the criteria in Chapter 173-460 WAC (CONTROLS FOR NEW SOURCES OF TOXIC AIR POLLUTANTS). The WAC provides the following relevant definitions at WAC 173-460-020:

> *"De minimis emissions"* means trivial levels of emissions that do not pose a threat to human health or the environment.
>
> *"Small quantity emission rate (SQER)"* means a level of emissions below which dispersion modeling is not required to demonstrate compliance with acceptable source impact levels.

The volatile COCs in soil identified in the CAP for the Building 4-78/79 SWMU/AOC Group include tetrachloroethene, trichloroethene, vinyl chloride, cis -1,2-dichloroethene, carbon disulfide, benzene, and TPH-G. The volatile COCs in soil identified in the CAP for SWMU-172/174 include tetrachloroethene, trichloroethene, vinyl chloride, 1,1-dichloroethene, cis -1,2-dichloroethene, methylene chloride, and benzene. These COCs and other volatile compounds present in soils will be removed by the SVE systems that will be constructed and operated for these two areas. Nonvolatile COCs, such as bis-2(ethylhexyl)phthalate, will not desorb to soil gas and will not be removed by SVE. Constituents such as naphthalene, that have a vapor pressure at least one order of magnitude lower than the other VOCs detected in site samples, will not be effectively removed by the SVE system.

Tables 1 and 2 show the total estimated recovery of each volatile constituent detected in both (1) soil investigations (including the remedial investigation and subsequent soil investigations used for preparing the Feasibility Study and CAP), and (2) groundwater monitoring within the past 5 years, for the Building 4-78/79 SWMU/AOC Group and SWMU-172/174, respectively. The total estimated recoveries shown in Tables 1 and 2 are based on the assumed 100% removal of constituent mass detected in the vadose zone and the upper 5 feet of groundwater during one year of operation. The recovered constituents will be treated with the emission control units included in the SVE system. The tables list the detected constituents defined by EPA as hazardous air pollutants (HAPs) and non-hazardous air pollutants (non-HAPs), both of which are regulated under the Clean Air Act. MTCA Method B air CULs, when available from CLARC, are also presented for each constituent in Tables 1 and 2. Table 1 shows that HAPS account for about 20% of the total estimated recovery at the Building 4-78/79 SWMU/AOC Group, with non-HAPs accounting for the remaining 80%. Table 2 shows that the HAPs account for 91% and non-HAPs account for 9% of total recovery at SWMU-172/174.

Effective and practical monitoring of emissions from the SVE systems requires that constituents be detectable using field instruments so that real-time measurements can be taken at the proper frequency and so that results are readily available for use in system operations. Tables 1 and 2 show that many constituents are present at very low levels, and thus would likely be undetectable in extracted soil vapors (the initial sampling during system startup will be used to verify). Indicator constituents recommended for use in monitoring SVE operations include constituents that are present at significant concentrations and that have low Method B CULs (indicating high toxicity). The recommended indicator constituents are shown in bold In Tables 1 and 2. These constituents were selected as follows:

- Constituents with estimated recovery rates exceeding 0.5 lb/yr and with an established Method B CUL.
- Constituents with estimated recovery rates less than 0.5 lb/yr and with an established Method B CUL less than 1 μg/m^3.

VOCs with no established Method B CUL were not selected as indicator constituents. For the Building 4-78/79 SWMU/AOC Group, the 10 proposed indicator constituents account for about 97% of the HAPs and about 46% of the non-HAPs, and account for about 56% of all VOCs estimated to be recovered. For SWMU 172/174, the 10 proposed indicator constituents include 99% of the HAPS and almost 74% of the non-HAPs, and account for 97% of the estimated total VOC recovery. Vinyl chloride, which has the lowest Method B CUL, is included in the proposed indicator constituents for both areas.

Tables 3 and 4 compare the estimated emissions for the indicator constituents from the two SVE systems (Building 4-78/79 SWMU/AOC Group and SWMU 172/174) to SQERs and de minimis emission rates taken from WAC 173-460-150. The estimated emissions are based on the Total Estimated Recovery (conservatively assuming 100% recovery of volatile constituents from soil and shallow groundwater). It was assumed that the two GAC/permanganate zeolite emission control units would remove 95% of the recovered constituents. The off-gas treatment includes two complete sets of GAC/permanganate zeolite vessels in series, and each set is capable of removing more than 95% of inlet VOCs. The estimated emission values are conservative estimates (i.e., they likely over-predict actual emissions), as it is expected that the emission control units will have a removal efficiency exceeding 95% for most constituents. The total estimated recoveries are based in part on old soil sampling data from the remedial investigation report; the old soil data typically include the highest concentrations measured in the area around each SWMU/AOC. As the concentrations of volatile constituents have likely decreased over the past 15 years since data were collected for the remedial investigation, it is expected that the estimated total recovery and potential emission data of Tables 3 and 4 are conservatively high. As shown in Tables 3 and 4, the conservative Total Estimated Recovery for many of the indicator constituents entering the emission control units *(i.e., uncontrolled)* are below the de minimis emission levels established in WAC 173-460-150 and all are well below the SQERs. Use of best available control technology (BACT) to treat the recovered vapor will reduce the actual emissions to levels well below the de minimis levels. The carbon and permanganate zeolite vessels for off-gas treatment, which are BACT for these constituents, will be conservatively sized to last the entire project duration. No breakthrough is expected..

Monitoring will be performed during operations to ensure that VOCs recovered with the SVE system are effectively removed. Routine performance monitoring, described below, will include field PID/Draeger tube monitoring of the input to the carbon vessels and at the midpoint between vessels (i.e., prior to entering the second vessel). The initial startup of the SVE systems, when constituent concentrations in the recovered soil gas are typically at worst case (i.e., maximum) levels, will include performance monitoring with lab samples to verify the specific constituents present in the recovered soil gas. Laboratory samples during startup testing will include collection of samples from the inlet to the treatment units and from the treated discharge from the lag treatment unit; these 2 sampling points will be sampled once per week for the first 4 weeks of system operation. Startup testing samples will be analyzed by a laboratory for the constituents listed in Table 1 for the Building 4-78/79 SWMU/AOC group and Table 2 for SWMU-172/174. This initial startup testing will be used to verify the actual compounds being recovered by the SVE systems (prior to treatment of the vapor with BACT), to determine initial concentrations, and to demonstrate effective treatment by meeting air cleanup requirements under Model Toxics Control Act (WAC 173-340) and toxic air pollutants emission requirements under Controls for New Sources of Toxic Air Pollutants (WAC 173-460) (from the discharge sample). When the lab data from initial startup testing (i.e., vapor samples collected before treatment) are received, they will be evaluated to confirm the list of indicator constituents using the same process described above. If the startup data (lab samples) demonstrate that specific constituents are not present in the treatment unit input vapor stream at concentrations above the De minimis emission levels) and constituents are not present in treated discharge samples at levels above both De-minimis emission levels and MTCA Method B air cleanup levels, then those compounds will be dropped from further consideration.

The need for carbon change-out will be determined by comparing the field measured mid-point concentrations (i.e., prior to the lag phase treatment vessel) to the concentrations calculated from the SQER emission rates. Routine monitoring will be conducted by measuring soil gas concentrations at the influent to the lead adsorber vessel and at the midpoint (between the lead and lag adsorbers). Readings will be taken using a field-calibrated PID. If the PID detects more than 1 ppmv of total VOCs in the midpoint sample, a second reading will be taken using a Draeger gas detector tube capable of measuring 0.5 ppmv of vinyl chloride. The Draeger tube reading will be compared to the breakthrough concentration listed in Tables 3 and 4. If the detected vinyl chloride concentration equals or exceeds the value in Table 3 for the Building 4-78/79 SWMU/AOC Group or in Table 4 for SWMU 172/174, adsorbent in the lead adsorber unit will be replaced and will be placed in operation as the lag unit (with the prior lag vessel moved to the lead position). This approach will ensure adequate treatment by continually maintaining an adsorber unit (with backup) to treat soil gas with concentrations below the breakthrough levels.

Based on the estimated maximum removal of volatile constituents from each site, discharges of all indicator constituents (after BACT treatment) are expected to be at or below de minimis emission values specified in WAC 173-460-150, demonstrating that they do not pose a threat to human health or the environment. Most other constituents that may be present in soil gas are expected to be below detection limits. The carbon vessels will have sufficient carbon capacity to last the entire duration of the SVE remedial operations.

TABLE 1
Estimated VOC Recovery and Proposed Indicator Constituents for the Building 4-78 / 4-79 AOC Group

Boeing Renton Facility
Renton, WA

Constituent	CAS#	Total Estimated Recovery[1] (lb/year)	% of Total Recovery for Site[2]	Indicator Constituent Recovery[3] (lb/year)	Method B Air CUL (µg/m^3)
Hazardous Air Pollutants (HAPs)					
Benzene	71-43-2	0.197	0.13%	0.20	0.320
Carbon Disulfide	75-15-0	0.046	0.03%	-	320
Chlorobenzene	108-90-7	0.009	0.01%	-	22.9
1,1-Dichloroethane	75-34-3	0.123	0.08%	-	1.56
1,1-Dichloroethene	75-35-4	0.002	0.00%	-	91.4
Ethylbenzene	100-41-4	3.95	2.6%	3.95	457
Methyl Chloride	74-87-3	0.003	0.00%	-	41.1
Dichloromethane	75-09-2	0.003	0.00%	-	250
Acetonitrile	75-05-8	0.002	0.00%	-	27.4
n-Hexane	110-54-3	3.94	2.6%	3.94	320
Vinyl Acetate	108-05-4	0.024	0.02%	-	91.4
Styrene	100-42-5	0.005	0.00%	-	457
Perchloroethylene	127-18-4	0.086	0.06%	-	9.62
Toluene	108-88-3	0.472	0.31%	-	2,290
1,1,1-Trichloroethane	71-55-6	0.071	0.05%	-	2,290
1,1,2-Trichloroethane	79-00-5	0.001	0.0005%	-	0.156
Trichloroethylene	79-01-6	7.84	5.20%	7.84	0.370
Total Xylenes	108-38-3	13.3	8.8%	13.3	45.7
Vinyl Chloride	75-01-4	0.583	0.39%	0.58	0.28
Subtotal, HAPs		**30.635**	**20.34%**	**29.79**	
Non-Hazardous Air Pollutants					
Acetone	67-64-1	0.287	0.19%	-	14,200
Octane	111-65-9	14.8	9.8%	-	NA
Pentane	109-66-0	3.79	2.5%	-	NA
Trans-1,2-dichloroethene	156-60-5	2.32	1.54%	2.32	27.4
Methyl Ethyl Ketone	78-93-3	0.059	0.04%	-	2,290
Trimethylbenzene	95-63-6	49.0	32.5%	49.0	3.20
Butylbenzene	104-51-8	2.95	2.0%	-	NA
Decane	124-18-5	13.3	8.84%	-	NA
Dodecane	112-40-3	30.0	19.9%	-	NA
Propylbenzene	103-65-1	2.44	1.62%	2.44	457
sec Butylbenzene	135-98-8	0.007	0.00%	-	NA
4-Isopropyltoluene	99-87-6	0.008	0.01%	-	NA
Isopropylbenzene	98-82-8	0.918	0.61%	0.918	183
1,1,2-Trichloro-1,2,2-Trifluoroethane	76-13-1	0.054	0.04%	-	13,700
Subtotal, non-HAPs	-	**119.979**	**79.66%**	**54.64**	-
TOTAL RECOVERY	-	**150.6**	**100.00%**	**84.43**	-

Notes

[1] Total estimated inventory is based on a conservative estimate for each constituent detected in soil or groundwater at the project site from prior investigations. Actual inventory may be less than these conservative estimates.

[2] Percent of total recovery is the percent each constituent represents for the total mass of emissions for all constituents found at the site.

[3] Indicator constituents included in Table 3.

TABLE 2
Estimated VOC Recovery and Proposed Indicator Constituents for the SWMU 172/174 SWMU/AOC Group

Boeing Renton Facility
Renton, WA

Constituent	CAS#	Total Estimated Recovery[1] (lb/year)	% of Total Recovery for Site[2]	Indicator Constituent Recovery[3] (lb/year)	Method B Air CUL (µg/m³)
Hazardous Air Pollutants (HAPs)					
Benzene	71-43-2	0.78	1.67%	0.78	0.320
Carbon Disulfide	75-15-0	0.023	0.05%	-	320
Chloroform	67-66-3	0.009	0.02%	0.009	0.109
1,1-Dichloroethane	75-34-3	0.011	0.02%	-	1.56
1,1-Dichloroethene	75-35-4	0.025	0.05%	-	91.4
Ethylbenzene	100-41-4	0.48	1.03%	0.48	457
Methyl Chloride	74-87-3	0.0003	0.00%	-	41.1
Dichloromethane	75-09-2	0.25	0.54%	-	250
Styrene	100-42-5	0.0095	0.02%	-	457
Perchloroethylene	127-18-4	32.3	69.20%	32.3	9.62
Toluene	108-88-3	2.06	4.40%	2.06	2,290
1,1,1-Trichloroethane	71-55-6	0.028	0.06%	-	2,290
Trichloroethylene	79-01-6	4.39	9.39%	4.39	0.370
Vinyl Chloride	75-01-4	0.042	0.09%	0.04	0.28
Total Xylenes	108-38-3	2.13	4.57%	2.13	45.7
Subtotal, HAPs		**42.551**	**91.13%**	**42.20**	
Non-Hazardous Air Pollutants					
Acetone	67-64-1	0.376	0.81%	-	14,200
Trans-1,2-dichloroethene	156-60-5	1.605	3.44%	1.60	27.4
Methyl Ethyl Ketone	78-93-3	0.071	0.15%	-	2,290
Trimethylbenzene	95-63-6	1.446	3.10%	1.45	3.20
Butylbenzene	104-51-8	0.062	0.13%	-	NA
Propylbenzene	103-65-1	0.289	0.62%	-	457
sec Butylbenzene	135-98-8	0.038	0.08%	-	NA
4-Isopropyltoluene	99-87-6	0.075	0.16%	-	NA
Isopropylbenzene	98-82-8	0.182	0.39%	-	183
Subtotal, non-HAPs	-	**4.144**	**8.87%**	**3.05**	-
TOTAL RECOVERY	-	**46.69**	**100.00%**	**45.25**	-

Notes

[1] Total estimated inventory is based on a conservative estimate for each constituent detected in soil or groundwater at the project site from prior investigations. Actual inventory may be less than these conservative estimates.

[2] Percent of total recovery is the percent each constituent represents for the total mass of emissions for all constituents found at the site.

[3] Indicator constituents included in Table 4.

TABLE 3
Proposed Breakthrough Monitoring Concentrations for the Building 4-78/79 SWMU/AOC Group

Boeing Renton Facility
Renton, WA

Indicator Constituent	Small Quantity Emission Rate[1] (lb/year)	De Minimus Emission Value[1] (lb/year)	Total Estimated Recovery[2] (lb/year)	Estimated Worst-Case Emissions[3] (lb/year)	Breakthrough Concentration[4] (ppmv)
Hazardous Air Pollutants					
Benzene	6.62	0.331	0.2	0.01	1
Ethylbenzene	76.8	3.84	3.9	0.20	9
n-Hexane	33,580	1,679	3.9	0.20	637
Trichloroethylene	95.9	4.8	7.8	0.39	9
Total Xylenes	10,585	529	13.3	0.664	1,236
Vinyl Chloride	2.46	0.123	0.6	0.03	0.5
Non-Hazardous Air Pollutants					
Trans-1,2-dichloroethene	38,743	1,937	2.3	0.116	4,960
Trimethylbenzene	NA	NA	49.0	2.45	NA
Propylbenzene	NA	NA	2.4	0.122	NA
Isopropylbenzene	NA	NA	0.92	0.046	NA

Notes

[1] De Minimus values (all are converted to lbs/year) represent "*trivial levels of emissions that do not pose a threat to human health or the environment* ". The Small Quantity Emission Rate is the maximum emission rate(all converted to lb/year) that does not require dispersion modeling to assess ground level impacts. Values taken from WAC 173-460-150

[2] Total estimated inventory is based on a conservative estimate for each constituent detected in soil or groundwater at the project site from prior investigations. Actual inventory may be less than these conservative estimates.

[3] Estimated worst-case emission is based on 100% removal of estimated inventory in one year (quantity of each constituent present at the project site) and typical removal efficiency for off-gas treatment based on engineering judgement.

[4] Breakthrough concentration based on the SQER for each constituent and the maximum estimated flowrate for the SVE system of 60 scfm.

TABLE 4
Proposed Breakthrough Monitoring Concentrations for the SWMU 172/174 SWMU/AOC Group

Boeing Renton Facility
Renton, WA

Constituent	Small Quantity Emission Rate[1] (lb/year)	De Minimus Emission Value[1] (lb/year)	Total Estimated Recovery[2] (lb/year)	Estimated Worst-Case Emissions[3] (lb/year)	Breakthrough Concentration[4] (ppmv)
Hazardous Air Pollutants (HAPs)					
Benzene	6.62	0.331	0.78	0.039	1.6
Chloroform	8.35	0.417	0.009	0.0005	2.4
Ethylbenzene	76.8	3.84	0.48	0.024	9
Perchloroethylene	32.4	1.62	32.3	1.62	3.6
Toluene	NA	NA	2.06	0.10	48,388
Trichloroethylene	95.9	4.8	4.39	0.22	14
Vinyl Chloride	2.46	0.123	0.042	0.002	0.7
Total Xylenes	10600	529	2.13	0.11	1,854
Non-Hazardous Air Pollutants					
Trans-1,2-dichloroethene	38743	1,937	1.60	0.080	7,440
Trimethylbenzene	NA	NA	1.45	0.072	NA

Notes

[1] De Minimus values (all are converted to lbs/year) represent "*trivial levels of emissions that do not pose a threat to human health or the environment* ". The Small Quantity Emission Rate is the maximum emission rate(all converted to lb/year) that does not require dispersion modeling to assess ground level impacts. Values taken from WAC 173-460-150

[2] Total estimated inventory is based on a conservative estimate for each constituent detected in soil and groundwater at the project site from prior investigations. Actual inventory may be less than these conservative estimates.

[3] Estimated worst-case emission is based on 100% removal of estimated inventory (quantity of each constituent present at the project site) and typical removal efficiency for off-gas treatment based on engineering judgement.

[4] Breakthrough concentration based on the SQER for each constituent and the maximum estimated flowrate for the SVE system of 40 scfm.

APPENDIX K

Duct Bank West and Southwest Marshalling Yard Additional Investigation Results

DUCT BANK WEST AND SOUTHWEST MARSHALLING YARD ADDITIONAL INVESTIGATION RESULTS

Boeing Renton Facility

Renton, Washington

Prepared for:

The Boeing Company
Seattle, Washington

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June 2014

Project No. 0088880100.2014.50

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DUCT BANK WEST AND SOUTHWEST MARSHALLING YARD ADDITIONAL INVESTIGATION RESULTS

Boeing Renton
Renton, Washington

1.0 INTRODUCTION

This report details methods and results of additional investigation that was conducted to assess subsurface contamination in the vicinity of two subsurface construction areas at the Boeing Renton Facility (Facility) in Renton, Washington (Figure 1). Both project sites are on the west-central portion of the Facility. The first investigation area is aligned north to south along the Facility road that lies west of Buildings 4-70 and 4-78 and east of Building 4-79; the northern portion of this road passes through the Building 4-78/79 Solid Waste Management Unit (SWMU)/Area of Concern (AOC) group. The second investigation area was within the parking lot north of Building 4-68 and south of Building 4-79 (Figure 1). Pre-construction soil and groundwater sampling conducted in December 2013 for these two areas identified evidence of contamination, as was previously reported to the Washington State Department of Ecology (Ecology). The objective of this additional investigation was to assess potential sources of the contamination found during the December 2013 construction support sampling.

1.1 SITE HISTORY AND BACKGROUND

The December 2013 construction characterization sampling in both project areas identified contaminated soil and groundwater within the Building 4-78/79 SWMU/AOC group exceeding cleanup levels specified in the Cleanup Action Plan (CAP). The detected contamination in this area is consistent with documented releases for the Building 4-78/79 SWMU/AOC area. Cleanup of this area is addressed in the CAP and the draft Engineering Design Report (EDR).

The December 2013 characterization also identified evidence of contamination south of the Building 4-78/79 SWMU/AOC group, as discussed below in Section 2.0. Two potential source areas for this contamination were identified. The first is SWMU 155, which is described in the Resource Conservation and Recovery Act (RCRA) Facility Assessment (RFA) (SAIC, 1991). This SWMU is located within Building 4-70 and has been used as a temporary dangerous waste storage area (less than 90 days) since 1989. The building has a concrete floor that is sloped to a series of blind trenches designed to contain and collect any spills. Drawings for Building 4-70 dated June 1988 do not show any sumps associated with the trenches. The RFA indicates that the building is above ground and has adequate secondary containment; the potential for releases from this SWMU was determined to be low in the RFA (SAIC, 1991). No further investigation has been conducted at or near SWMU 155.

A second potential source area that was identified is a pair of former cisterns, designated in the RFA as SWMU-177 and -178, which were reportedly used to manage waste from electroplating operations at Building 4-75 (SAIC, 1991). They were labeled as “leaching pits” on a 1961 facility drawing of Building 4-75, and were removed in 1987, along with adjacent soil, by Boeing Environmental Affairs (Landau Associates, 1990). Soil samples collected following cistern removal and subsequent soil excavation did not contain metals in excess of Extraction Procedure toxicity criteria (SAIC, 1991). Groundwater monitoring data collected between 1987 and 1990 in the vicinity of the cisterns and reported in the RFA indicated elevated concentrations of up to 14 micrograms per liter (µg/L) of vinyl chloride, up to 410 µg/L of trichloroethylene (TCE), and up to 300 µg/L of 1,2-dichloroethene (1,2-DCE). Concentrations for these constituents declined in samples collected after the cisterns were removed. The cisterns were located under what is now the north end of Building 4-68 (Figure 1). No further investigations were conducted for SWMU-177 and -178.

1.2 SITE HYDROGEOLOGIC CONDITIONS

Hydrogeologic conditions are based on groundwater monitoring and subsurface investigations that have been conducted at the Building 4-78/79 SWMU/AOC group, which is located near the investigation areas. Groundwater flow direction in the vicinity of the Building 4-78/79 SWMU/AOC group is generally to the west-northwest. Depths to groundwater noted during the December 2013 investigation ranged from 4 to 6 feet below ground surface (bgs), which is consistent with monitoring wells in the Building 4-78/79 SWMU/AOC group. The groundwater gradient for the Building 4-78/79 SWMU/AOC group is approximately 0.001 (AMEC, 2013).

2.0 DECEMBER 2013 CHARACTERIZATION RESULTS

The December 2013 construction characterization was conducted in the current Southwest Marshalling Yard area and along a road being assessed as a potential corridor for the Duct Bank West alignment. Analytical results from the Duct Bank West and Southwest Marshalling Yard soil and groundwater sampling are summarized in Tables 1 through 4. Samples collected along the potential Duct Bank West alignment were designated with the prefix ‘DBW,’ while samples collected from the Southwest Marshalling Yard were designated with the prefix ‘SWMY.’ These tables list the constituents detected in at least one sample from either the Duct Bank West or Southwest Marshalling Yard sampling areas. Copies of the laboratory reports are included in Appendix A.

2.1 DECEMBER 2013 SOIL SAMPLING RESULTS

Soil samples at the north end of the Duct Bank West alignment and Southwest Marshalling Yard, within the Building 4-78/79 SWMU/AOC group area, had the highest concentrations of total petroleum hydrocarbons as gasoline (TPH-G), benzene, and other volatile organic compounds (VOCs) (Tables 1 and 2). These analytes are constituents of concern (COCs) defined in the CAP for the Building 4-78/79 SWMU/AOC group. As noted above, cleanup of this area is planned, as described in the CAP and the draft EDR.

In the area south of the Building 4-78/79 SWMU/AOC group, TPH-G was detected in Duct Bank West sample DBW-7-4.0-5.5 at a concentration of 160 mg/kg. No other Building 4-78/79 SWMU/AOC group COCs were detected above the cleanup levels established in the CAP for the Building 4-78/79 SWMU/AOC group in samples from either the Duct Bank West or Southwest Marshalling Yard sampling areas. Follow-up investigation in the area south of the Building 4-78/79 SWMU/AOC group was conducted in March 2014 to better characterize soils surrounding boring DBW-7, as discussed in Section 3.

2.2 DECEMBER 2013 GROUNDWATER SAMPLING RESULTS

Groundwater samples along the Duct Bank West alignment within the Building 4-78/79 SWMU/AOC group had elevated concentrations of TPH-G, benzene, and chlorinated VOCs (Table 3). As noted previously, these analytes are COCs defined in the CAP for the Building 4-78/79 SWMU/AOC group and they are being addressed under ongoing cleanup activities.

Groundwater samples collected south of the Building 4-78/79 SWMU/AOC group, along the Duct Bank West alignment and in the Southwest Marshalling Yard area, had detections of COCs above the Building 4-78/79 SWMU/AOC group cleanup levels, as reported in Tables 3 and 4 and shown in Figure 2. These detections are summarized below:

- DBW-6-5.0-9.0 had a detection of *cis*-1,2-DCE at a concentration of 0.38 μg/L and vinyl chloride at a concentration of 0.57 μg/L.
- DBW-7-8.0-12.0 had a detection of vinyl chloride at a concentration of 0.33 μg/L.
- DBW-8-4.0-8.0 had a detection of *cis*-1,2-DCE at a concentration of 2.1 μg/L, TCE at a concentration of 0.83 μg/L, and vinyl chloride at a concentration of 2.8 μg/L.
- SWMY-10-8.0-12.0 had a detection of *cis*-1,2-DCE at a concentration of 0.42 μg/L and vinyl chloride at a concentration of 0.78 μg/L.
- SWMY-13-4.0-8.0 had a detection of vinyl chloride at a concentration of 0.32 μg/L.
- SWMY-15-4.0-8.0 had a detection of *cis*-1,2-DCE at a concentration of 0.21 μg/L.

Follow-up investigation was conducted in March of 2014 to further assess the chlorinated VOCs in the vicinity of these samples. Results of the March 2014 investigation are discussed in Section 3.

3.0 MARCH 2014 FOLLOW UP INVESTIGATION

Because TPH-G was detected in soil sample DBW-7-4.0-5.5 and chlorinated VOCs were detected in groundwater from borings DBW-6, DBW-7, DBW-8, SWMY-10, and SWMY-13 above Building 4-78/79 SWMU/AOC group cleanup levels, additional investigation was conducted in March 2014 to further assess this contamination. In the March 2014 investigation, borings were advanced using direct push drilling techniques. Sample collection and handling was conducted in accordance with the Ecology-approved RI Work Plan (Weston, 1998), as amended with subsequent revisions. The RI work plan includes field methods for sample collection, sample designation, equipment decontamination, and documentation. Soil samples were analyzed for TPH-G, and groundwater samples were analyzed for VOCs, TPH-G, and metals. Soil sampling procedures for TPH-G incorporated U.S. Environmental Protection Agency (EPA) Method 5035A following Ecology's Implementation Memo #5 (Ecology, 2004), and the Quality Assurance Project Plan for the Facility (AMEC, 2012). This method requires a discrete soil sampler to minimize VOC loss and storing the soil samples in 40-milliliter glass vials with Teflon© septa.

The March 2014 investigation was conducted in accordance with the Duct Bank West and Southwest Marshalling Yard Additional Investigation Work Plan (AMEC, 2014), with the following exceptions:

- Proposed boring SWMY-17 could not be advanced due to refusal during multiple drilling attempts.
- A groundwater sample from boring SWMY-16 was collected from a temporary screen interval from 10 to 14 feet bgs rather than the proposed 4 to 8 feet bgs.
- Only three of the four proposed borings surrounding boring DBW-7 were advanced; the presence of utilities prevented installation of the northern boring.
- The borings surrounding DBW-7 were renamed from the proposed boring IDs shown in the work plan figure. The borings were identified by the prefix 'DBW-7' and a letter to indicate the direction of offset from DBW-7. For example, boring 'DBW-7E' was installed east of DBW-7.
- Additional groundwater data were collected east of Building 4-70 during a later construction related sampling event. The additional data from this sampling are included here because the borings were located upgradient of the December 2013 borings.

Samples were submitted to Analytical Resources, Inc. of Tukwila, Washington, a Washington State Certified analytical laboratory. Results are summarized on Tables 5 and 6.

3.1 MARCH 2014 SOIL SAMPLING RESULTS

Three borings were advanced to evaluate TPH-G concentrations in soil surrounding boring DBW-7 (DBW-7W, DBW-7E, and DBW-7S); TPH-G was detected at 160 mg/kg in soil from DBW-7 in

December 2013. A soil sample was collected from 4.0 – 5.0 feet bgs at each of the three new boring locations and analyzed for TPH-G. Analytical results for these samples are presented in Table 5; all three soil samples were below the laboratory detection limit.

3.2 MARCH 2014 GROUNDWATER SAMPLING RESULTS

Results of the March 2014 groundwater sampling are presented in Table 6 and shown on Figure 2. Two borings, SWMY-17 and SWMY-18, were located downgradient from the former cistern locations to collect groundwater samples. Boring SWMY-17 could not be advanced due to repeated refusal encountered during drilling. Boring SWMY-18 was advanced approximately 100 feet west-northwest of the former cisterns, and groundwater was collected from a depth interval of 4.0 – 8.0 feet bgs. Two constituents of concern, *cis*-1,2-DCE and TCE, were detected in this sample at concentrations of 0.32 and 0.20 µg/L, respectively. Neither detection exceeds cleanup levels defined in the CAP for the Building 4-78/79 SWMU/AOC group. Another boring, SWMY-16, was installed to assess the extent of vinyl chloride west of Building 4-70. SWMY-16 had a detection of vinyl chloride at a concentration of 0.45 µg/L, but no other VOCs were detected at this location.

Three borings (DBW-9, DBW-10, and DBW-11) were advanced to assess the extent of VOCs in groundwater near boring DBW-8. Borings DBW-9 and DBW-11 were advanced north of boring DBW-8 and directly west of Building 4-70. DBW-10 was advanced south of DBW-8, just off the southwest corner of Building 4-70. Groundwater was collected from a depth interval of 4.0 – 8.0 feet bgs in each boring. TCE was detected in groundwater samples collected from the three boring locations, with the highest concentration (17 µg/L) at DBW-11. Biodegradation products from TCE were detected in groundwater samples from locations DBW-9 and DBW-11.

Based on these results, the highest concentrations of TCE in groundwater appear to be in the vicinity of DBW-11. Groundwater samples from the borings located west (downgradient) of borings DBW-8, DBW-9, and DBW-11 contained only TCE degradation products.

3.3 DUCT BANK WEST – ALTERNATIVE ALIGNMENT A GROUNDWATER SAMPLING RESULTS

On April 3, 2014, AMEC conducted additional groundwater sampling at the Facility to assess groundwater conditions for an alternate Duct Bank West corridor alignment. The Duct Bank West – Alternative Alignment A is located along the plant road east of Building 4-70 (Figure 2). Three groundwater samples were collected at locations DBW-Alt-A-3, DBW-Alt-A-5, and DBW-Alt-A-6. Sampling methods were as described above for the Duct Bank West and Southwest Marshalling Yard sampling. Analytical results for these samples are presented in Table 7. No VOCs were detected above laboratory reporting limits in groundwater samples from any of the DBW-Alt-A borings (Table 7).

4.0 CONCLUSIONS AND RECOMMENDATIONS

In December 2013, a soil sample from boring DBW-7 had detections of TPH-G at 160 mg/kg. Follow-up soil samples from three shallow borings west, east, and south of DBW-7 (DBW-7W, DBW-7E, and DBW-7S) did not contain TPH-G above laboratory reporting limits. TPH-G was not detected in groundwater samples collected from other borings located near DBW-7. These results indicate a limited extent of TPH-G affected soil in this area.

In December 2013, chlorinated VOCs were detected in groundwater at multiple locations along the potential alignment for Duct Bank West construction. Sampling conducted within the Building 4-78/79 SWMU/AOC group identified COCs being addressed by the cleanup actions specified in the CAP. Sampling conducted south of the Building 4-78/79 SWMU/AOC group identified COCs in an area that is not being addressed by cleanup actions specified in the CAP. Additional investigation was conducted in March 2014 to assess the extent of affected groundwater in the area south of the Building 4-78/79 SWMU/AOC group and west of Building 4-70.

Results of groundwater sampling presented in Figure 2 indicate that the source area is located nearest to boring DBW-11. This suggests that the former cisterns are likely not the source of the VOCs present in groundwater in this area. A groundwater sample collected upgradient of Building 4-70 (boring DBW-ALT-6) did not contain VOCs above laboratory reporting limits.

To address the elevated concentrations of chlorinated VOCs in groundwater west of Building 4-70, five bioremediation injection wells are proposed along the west side of Building 4-70, as shown on Figure 2. Installation of one new monitoring well is also proposed downgradient of DBW-11, which had the highest detected concentration of TCE. The five injection wells and the monitoring well will be installed and sampled after development to collect baseline groundwater quality data. The injection wells will then be used for injection of electron donor (either a sugar or emulsified vegetable oil solution) to enhance biodegradation of chlorinated VOCs, as is being done for other areas within the Facility. Electron donor injections will be performed in accordance with the procedures used at other areas of the Facility and as described in the draft EDR. The monitoring well will be sampled semiannually to track biodegradation in this area. Analytes for the monitoring well will include TCE, *cis*-1,2-DCE, VC, and the bioremediation parameters listed in Table 3 of the draft EDR for chlorinated solvent-related sites. Monitoring results for this area will be included in the quarterly reports.

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TABLES

TABLE 1

DUCT BANK WEST - SOIL ANALYTICAL RESULTS[1,2]
DECEMBER 22-24, 2013
Boeing Renton Facility
Renton, Washington

	SAMPLE ID [3, 4]													
Constituent	**DBW-2-5.0-6.0**	**DBW-2-8.0-9.0**	**DBW-3-3.0-4.0**	**DBW-3-8.0-9.0**	**DBW-4-3.0-3.5**	**DBW-4-8.0-9.0**	**DBW-5-4.0-5.0**	**DBW-5-8.0-9.0**	**DBW-6-4.0-5.0**	**DBW-6-8.0-9.0**	**DBW-7-4.0-5.5**	**DBW-7-8.0-9.0**	**DBW-8-3.0-4.0**	**DBW-8-8.0-9.0**
Volatile Organic Compounds (µg/kg)														
Acetone	620 U	580 UJ	**29**	**160**	**23**	**42**	**23**	**120**	**8.9**	**70**	**52**	**22**	**13**	**5.3**
1,1-Dichloroethene	120 U	120 U	**3.8**	2.2 U	1.2 U	1.4 U	1.4 U	2.0 U	1.0 U	1.7 U	1.4 U	1.7 U	1.0 U	1.0 U
1,1-Dichloroethane	120 U	120 U	**7.5**	**15**	**12**	**62**	1.4 U	2.0 U	1.0 U	1.7 U	1.4 U	1.7 U	1.0 U	1.0 U
Benzene	**990**	**880**	2.2 U	**52**	1.2 U	**2.8**	1.4 U	2.0 U	1.0 U	1.7 U	**1.6**	1.7 U	1.0 U	1.0 U
2-Butanone	620 U	580 U	4.4 U	**35**	**6.2**	**9.0**	6.9 U	**32**	5.0 U	**16**	**15**	8.4 U	5.1 U	4.9 U
Carbon Disulfide	120 U	120 U	16 J	2.2 U	**1.9**	1.4 U	1.4 U	**2.5**	1.0 U	**4.6**	1.4 U	1.7 U	**3.1**	1.0 U
cis -1,2-Dichloroethene	120 U	120 U	**210**	2.2. U	**97**	1.4 U	**2.0**	**5.6**	1.0 U	1.7 U	1.4 U	1.7 U	1.0 U	**3.5**
Chloroethane	120 U	120 U	0.9 U	2.2 U	1.2 UJ	11 J	1.4 UJ	2.0 UJ	1.0 U	1.7 U	1.4 U	1.7 U	1.0 U	1.0 U
Ethylbenzene	**3,700**	120 U	0.9 U	2.2 U	1.2 U	1.4 U	1.4 U	**3.3**	1.0 U	1.7 U	**54**	1.7 U	1.0 U	1.0 U
Isopropylbenzene	**530**	120 U	0.9 U	2.2 U	1.2 U	1.4 U	1.4 U	2.0 U	1.0 U	1.7 U	**29**	1.7 U	1.0 U	1.0 U
4-Isopropyltoluene	250 U	120 U	0.9 U	2.2 U	1.2 U	1.4 U	1.4 U	2.0 U	1.0 U	1.7 U	**33**	1.7 U	1.0 U	1.0 U
Methylene Chloride	250 U	230 UJ	**4.7**	**5.8**	2.5 U	2.7 U	2.7 U	3.9 U	2.0 U	3.4 U	2.7 U	3.4 U	**2.5**	2.0 U
Napthalene	**2,900**	580 U	4.4 U	11 U	6.2 U	6.8 U	6.9 U	9.8 U	5.0 U	8.5 U	**56**	8.4 U	5.1 U	4.9 U
n-Propylbenzene	**3,400**	**580**	0.9 U	2.2 U	1.2 U	1.4 U	1.4 U	2.0 U	1.0 U	1.7 U	**59**	1.7 U	1.0 U	1.0 U
n-Butylbenzene	**3,300**	**190**	0.9 UJ	2.2 U	1.2 U	1.4 U	1.4 U	2.0 U	1.0 U	1.7 U	**60**	1.7 U	1.0 U	1.0 U
sec-Butylbenzene	**390**	120 U	0.9 U	2.2 U	1.2 U	1.4 U	1.4 U	2.0 U	1.0 U	1.7 U	**35**	1.7 U	1.0 U	1.0 U
Toluene	120 U	120 U	0.9 U	2.2 U	**2.0**	**9.2**	1.4 U	**7.4**	1.0 U	1.7 U	**40**	1.7 U	1.0 U	1.0 U
trans -1,2-Dichloroethene	120 U	120 UJ	**4.1**	2.2 U	**1.5**	**6.6**	1.4 U	2.0 U	1.0 U	1.7 U	1.4 U	1.7 U	1.0 U	1.0 U
Tetrachloroethene	120 U	120 U	**7.6**	2.2 U	1.2 U	1.4 U	1.4 U	2.0 U	1.0 U	1.7 U	1.4 U	1.7 U	1.0 U	1.0 U
Trichloroethene	120 U	120 U	**3,000**	2.2 U	**4.2**	1.4 U	1.4 U	**2.2**	1.0 U	1.7 U	1.4 U	1.7 U	**1.5**	**24**
1,1,1-Trichloroethane	120 U	120 U	**5.2**	2.2 U	1.2 U	1.4 U	1.4 U	2.0 U	1.0 U	1.7 U	1.4 U	1.7 U	1.0 U	1.0 U
1,1,2-Trichloro-1,2.2-Trifluoroethane	250 U	230 U	**12**	4.3 U	**31**	2.7 U	2.7 U	3.9 U	2.0 U	3.4 U	2.7 U	3.4 U	2.0 U	2.0 U
1,3,5-Trimethylbenzene	**1,000**	**180**	0.9 U	2.2 U	1.2 U	1.4 U	1.4 U	2.0 U	1.0 U	1.7 U	**95**	1.7 U	1.0 U	1.0 U
1,2,4-Trimethylbenzene	120 U	120 U	0.9 U	2.2 U	1.2 U	1.4 U	1.4 U	2.0 U	1.0 U	1.7 U	**1,400**	1.7 U	1.0 U	1.0 U
Vinyl Chloride	120 U	120 UJ	38 J	2.2 U	**100**	1.6 J	2.3 J	2.0 J	1.0 U	1.7 U	1.4 U	1.7 U	1.0 U	1.0 U
m,p-Xylene	**900**	**600**	0.9 U	2.2 U	1.2 U	1.4 U	1.4 U	**27**	1.0 U	1.7 U	**220**	1.7 U	1.0 U	1.0 U
o-Xylene	**170**	120 U	0.9 U	2.2 U	1.2 U	1.4 U	1.4 U	**7.9**	1.0 U	1.7 U	**100**	1.7 U	1.0 U	1.0 U
Metals (mg/kg)														
Aluminum	**27,200**	**22,100**	**13,000**	**22,700**	**16,300**	**25,600**	**26,800**	**26,100**	**23,400**	**30,000**	**19,100**	**27,700**	**23,300**	**13,200**
Arsenic	10 U	8 U	6 U	9 U	6 U	8 U	7 U	10 U	7 U	8 U	7 U	8 U	6 U	6 U
Barium	**132**	**103**	**48.1**	**109**	**74.5**	**121**	**123**	**124**	**109**	**140**	**94.8**	**135**	**109**	**59.6**
Calcium	**6,900**	**6,360**	**6,010**	**6,140**	**6,020**	**6,560**	**6,560**	**8,110**	**6,410**	**7,060**	**6,300**	**5,820**	**6,630**	**5,200**
Chromium	**52**	**43.0**	**26.6**	**44.1**	**31.2**	**45.3**	**52.2**	**46**	**41.5**	**49.0**	**33.3**	**50.4**	**53.4**	**19.4**
Cobalt	**12.3**	**10.3**	**7.8**	**10.0**	**9.9**	**11.6**	**13.2**	**9.3**	**12.0**	**11.0**	**11.0**	**10.8**	**12.8**	**8.4**
Copper	**39.9**	**30.6**	**15.6**	**49.5**	**23.0**	**37.4**	**39.5**	**37.0**	**35.6**	**34.6**	**32.2**	**34.3**	**42.4**	**17.2**
Iron	**29,400**	**23,100**	**20,200**	**23,300**	**21,400**	**24,000**	**30,700**	**24,400**	**29,400**	**28,700**	**25,000**	**28,600**	**29,100**	**18,700**
Lead	**7**	**4**	2 U	**5**	**4**	**4**	**6**	**4**	**4**	**5**	**4**	**5**	**4**	2 U
Magnesium	**7,700**	**6,730**	**5,510**	**6,860**	**6,190**	**6,840**	**9,190**	**7,130**	**7,490**	**8,070**	**6,060**	**6,990**	**7,700**	**5,140**
Mercury	**0.12**	**0.06**	0.02 U	**0.08**	**0.05**	**0.08**	**0.09**	0.04 U	**0.10**	**0.08**	**0.06**	**0.09**	**0.07**	0.02 U
Molybdenum	1 U	**1.0**	0.6 U	**1.5**	0.6 U	**0.9**	**0.7**	**1**	0.7 U	**1.0**	0.7 U	0.8 U	**2.1**	0.6 U
Nickel	**43**	**34**	**22**	**34**	**28**	**35**	**45**	**34**	**37**	**37**	**32**	**39**	**41**	**21**
Silver	0.6 U	0.5 U	0.3 U	0.5 U	0.4 U	0.5 U	0.4 U	0.6 U	0.4 U	0.5 U	**0.4**	0.5 U	0.4 U	0.4 U
Zinc	**57**	**48**	**39**	**53**	**49**	**54**	**65**	**59**	**53**	**55**	**49**	**47**	**52**	**40**
Total Petroleum Hydrocarbons (mg/kg)														
Gasoline range	**2,000**	12 U	5.5 U	5.5 U	7.9 U	13 U	8.4 U	17 U	7.2 U	12 U	**160**	13 U	6.4 U	6.6 U
Diesel range	**69**	**25**	5.9 U	**28**	**20**	**25**	7.3 U	**40**	6.5 U	**11**	**230**	8.6 U	**29**	6.4 U
Motor oil	**100**	**220**	**23**	**270**	**80**	**310**	**58**	**430**	13 U	**120**	**190**	**82**	**21**	**15**

Notes
1. Data qualifiers are as follows:
U = The analyte was not detected at the reporting limit indicated.
J = The value is an estimate.
2. Analytes only shown on the table if they were detected in at least one sample
from either the Duct Bank West or Southwest Marshalling Yard.
3. Sample IDs consist of the sample location followed by the depth interval from which each sample was collected in feet bgs.
4. Detections are shown in **bold**.

Abbreviations
µg/kg = micrograms per kilogram
bgs = below ground surface
mg/kg = milligrams per kilogram

TABLE 2

SOUTHWEST MARSHALLING YARD – SOIL ANALYTICAL RESULTS[1, 2]
DECEMBER 22–24, 2013
Boeing Renton Facility
Renton, Washington

	SAMPLE ID [3, 4]													
Constituent	**SWMY-1-1.0-1.8**	**SWMY-2-1.0-1.5**	**SWMY-3-1.0-1.5**	**SWMY-4-1.0-1.5**	**SWMY-5-1.0-1.8**	**SWMY-6-1.0-1.8**	**SWMY-7-1.0-1.5**	**SWMY-8-1.0-1.5**	**SWMY-9-1.0-1.5**	**SWMY-9-4.0-5.0**	**SWMY-10-1.0-2.0**	**SWMY-10-4.0-5.0**	**SWMY-11-3.0-3.5**	**SWMY-12-2.5-3.2**
Volatile Organic Compounds (µg/kg)														
1,1,2-Trichloro-1,2.2-Trifluoroethane	1.7 U	1.7 U	1.7 U	1.7 U	1.7 U	1.5 U	1.8 U	1.9 U	1.9 U	2.3 U	1.8 U	1.0 U	2.0 U	1.9 U
1,1,2-Trichloroethane	0.9 U	0.9 U	0.9 U	0.9 U	0.8 U	0.7 U	0.9 U	0.9 U	0.9 U	1.2 U	0.9 U	1.0 U	1.0 U	1.0 U
1,1-Dichloroethane	0.9 U	0.9 U	0.9 U	0.9 U	0.8 U	0.7 U	0.9 U	0.9 U	0.9 U	1.2 U	0.9 U	1.0 U	1.0 U	1.0 U
1,1-Dichloroethene	0.9 U	0.9 U	0.9 U	0.9 U	0.8 U	0.7 U	0.9 U	0.9 U	0.9 U	1.2 U	0.9 U	1.0 U	1.0 U	1.0 U
1,2,4-Trimethylbenzene	0.9 U	0.9 U	0.9 U	0.9 U	0.8 U	0.7 U	0.9 U	0.9 U	0.9 U	1.2 U	0.9 U	1.0 U	1.0 U	1.0 U
1,2-Dichlorobenzene	0.9 U	0.9 U	0.9 U	0.9 U	0.8 U	0.7 U	0.9 U	0.9 U	0.9 U	1.2 U	0.9 U	1.0 U	1.0 U	1.0 U
1,3,5-Trimethylbenzene	0.9 U	0.9 U	0.9 U	0.9 U	0.8 U	0.7 U	0.9 U	0.9 U	0.9 U	1.2 U	0.9 U	1.0 U	1.0 U	1.0 U
2-Butanone	**17**	4.3 U	4.4 U	4.3 U	4.2 U	**3.8**	4.4 U	4.6 U	4.6 U	**8.1**	**44**	1.0 U	5.0 U	4.9 U
4-Isopropyltoluene	0.9 U	0.9 U	0.9 U	0.9 U	0.8 U	0.7 U	0.9 U	0.9 U	0.9 U	1.2 U	0.9 U	1.0 U	1.0 U	1.0 U
Acetone	**18**	4.3 U	**9.6**	**18**	**9.7**	**25**	**12**	**33**	**14**	**42**	5 U	**64**	**17**	**30**
Benzene	0.9 U	0.9 U	0.9 U	0.9 U	0.8 U	0.7 U	0.9 U	0.9 U	0.9 U	1.2 U	0.9 U	1.0 U	1.0 U	1.0 U
Carbon Disulfide	0.9 UJ	0.9 UJ	0.9 UJ	0.9 UJ	0.8 UJ	1.4 J	0.9 UJ	0.9 U	0.9 U	**2.3**	0.9 UJ	1.0 UJ	1.0 U	1.0 U
cis-1,2-Dichloroethene	0.9 U	0.9 U	0.9 U	0.9 U	0.8 U	0.7 U	0.9 U	0.9 U	0.9 U	**4.4**	0.9 U	1.0 U	1.0 U	1.0 U
Ethylbenzene	0.9 U	0.9 U	0.9 U	0.9 U	0.8 U	0.7 U	0.9 U	0.9 U	0.9 U	1.2 U	0.9 U	1.0 U	1.0 U	1.0 U
Isopropylbenzene	0.9 U	0.9 U	0.9 U	0.9 U	0.8 U	0.7 U	0.9 U	0.9 U	0.9 U	1.2 U	0.9 U	1.0 U	1.0 U	1.0 U
m,p-Xylene	0.9 U	0.9 U	0.9 U	0.9 U	0.8 U	**0.7**	0.9 U	0.9 U	0.9 U	1.2 U	0.9 U	1.0 U	1.0 U	1.0 U
Methylene Chloride	1.7 U	**1.8**	1.7 U	**1.8**	1.7 U	1.5 U	1.8 U	**1.9**	1.9 U	2.3 U	**6.1**	**3.1**	2.0 U	1.9 U
Napthalene	4.3 U	4.3 U	4.4 U	4.3 U	4.2 U	3.6 U	4.4 U	4.6 U	4.6 U	5.8 U	4.5 U	5.0 U	5.0 U	4.9 U
n-Propylbenzene	0.9 U	0.9 U	0.9 U	0.9 U	0.8 U	0.7 U	0.9 U	0.9 U	0.9 U	1.2 U	0.9 U	1.0 U	1.0 U	1.0 U
o-Xylene	0.9 U	0.9 U	0.9 U	0.9 U	0.8 U	0.7 U	0.9 U	0.9 U	0.9 U	1.2 U	0.9 U	1.0 U	1.0 U	1.0 U
Tetrachloroethene	0.9 U	0.9 U	0.9 U	**1.4**	0.8 U	0.7 U	0.9 U	0.9 U	0.9 U	1.2 U	0.9 U	1.0 U	1.0 U	1.0 U
Toluene	0.9 U	0.9 U	0.9 U	0.9 U	0.8 U	**1.1**	0.9 U	0.9 U	0.9 U	1.2 U	0.9 U	1.0 U	1.0 U	**1.1**
Trichloroethene	0.9 U	**3.4**	**3.2**	**2.4**	0.8 U	0.7 U	0.9 U	0.9 U	**2.9**	1.2 U	0.9 U	1.0 U	1.0 U	1.0 U
Trichlorofluoromethane	0.9 U	0.9 U	0.9 U	0.9 U	0.8 U	0.7 U	0.9 U	0.9 U	0.9 U	1.2 U	0.9 U	1.0 U	1.0 U	1.0 U
Vinyl Chloride	0.9 UJ	0.9 UJ	0.9 UJ	0.9 UJ	0.8 UJ	0.7 UJ	0.9 UJ	0.9 U	0.9 U	1.2 U	0.9 UJ	1.0 UJ	1.0 U	1.0 U
Metals (mg/kg)														
Aluminum	**13,700**	**13,000**	**13,400**	**15,100**	**12,800**	**16,200**	**14,900**	**15,500**	**13,300**	**28,000**	**13,900**	**24,800**	**13,600**	**17,000**
Arsenic	6 U	5 U	5 U	5 U	5 U	**16**	5 U	5 U	5 U	7 U	7	7 U	**8**	5 U
Barium	**55.1**	**62.9**	**48.4**	**52.4**	**55.5**	**95.0**	**59.2**	**61.9**	**60.1**	**131**	**55.6**	**113**	**52.4**	**67.1**
Cadmium	0.2 U	0.2 U	0.2 U	**0.2**	0.2 U	**0.2**	0.2 U	**0.2**	0.2 U	0.3 U	0.2 U	0.3 U	**0.2**	**0.3**
Calcium	**10,700**	**5,660**	**5,520**	**12,300**	**6,880**	**50,100**	**7,640**	**5,430**	**6,080**	**6,780**	**6,890**	**6,550**	**9,290**	**6,740**
Chromium	**23.4**	**21.4**	**26.9**	**33.6**	**26.2**	**28.8**	**24.2**	**27.9**	**26.8**	**50.2**	**35.2**	**48.2**	**25.7**	**27.5**
Cobalt	**8.3**	**8.9**	**8.0**	**10.2**	**9.1**	**10.6**	**7.4**	**8.1**	**8.1**	**12.3**	**7.9**	**12.9**	**7.3**	**9.1**
Copper	17.4 J	15.1 J	16.1 J	43.0 J	25.5 J	40.1 J	19.3 J	23.1 J	16.1 J	42.7 J	**22.9**	**35.9**	22.8 J	50.9 J
Iron	**19,900**	**17,300**	**19,100**	**21,700**	**18,500**	**17,800**	**17,400**	**18,200**	**17,800**	**28,700**	**20,400**	**32,900**	**17,200**	**20,100**
Lead	**3**	2 U	2 U	**6**	**5**	**16**	**2**	**5**	**2**	**6**	**8**	**5**	**7**	**4**
Magnesium	**5,530**	**4,850**	**5,320**	**7,770**	**5,790**	**5,860**	**5,280**	**5,640**	**4,950**	**8,840**	**5,200**	**7,810**	**5,430**	**6,640**
Mercury	**0.02**	**0.02**	0.03 U	**0.03**	0.02 U	**0.05**	**0.04**	**0.21**	**0.05**	**0.08**	**0.14**	**0.10**	**0.62**	**0.47**
Molybdenum	0.6 U	0.5 U	0.5 U	**0.7**	0.5 U	**1.0**	0.5 U	0.5 U	0.5 U	**0.8**	**0.5**	0.7 U	**0.6**	0.5 U
Nickel	**20**	**22**	**23**	**26**	**23**	**25**	**27**	**26**	**23**	**42**	**23**	**39**	**24**	**26**
Silver	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.4 U	0.3 U	0.4 U	0.3 U	0.3 U
Zinc	**48**	**39**	**41**	**61**	**52**	**93**	**39**	**43**	**42**	**62**	**50**	**50**	**50**	**58**
Total Petroleum Hydrocarbons (mg/kg)														
Gasoline range	4.8 U	5.5 U	4.8 U	4.3 U	5.2 U	4.3 U	4.1 U	4.8 U	4.5 U	8.3 U	4.8 U	8.1 U	5.5 U	5.9 U
Diesel range	**35**	5.5 U	5.5 U	**8.3**	**18**	**66**	5.5 U	**15**	5.6 U	**7.6**	**6.6**	6.9 U	5.4 U	**80**
Motor oil	**55**	11 U	11 U	**44**	**38**	**440**	**35**	**24**	11 U	**49**	**31**	14 U	11 U	**660**

TABLE 2

SOUTHWEST MARSHALLING YARD – SOIL ANALYTICAL RESULTS[1, 2]
DECEMBER 22–24, 2013
Boeing Renton Facility
Renton, Washington

	SAMPLE ID[3, 4]				
Constituent	**SWMY-13-2.5-3.0**	**SWMY-13-4.6-6.0**	**SWMY-14-1.0-1.5**	**SWMY-14-4.0-6.0**	**SWMY-15-4.0-5.0**
Volatile Organic Compounds (µg/kg)					
1,1,2-Trichloro-1,2.2-Trifluoroethane	1.9 U	2.2 U	2.2 U	2 U	1.9 U
1,1,2-Trichloroethane	0.9 U	1.1 U	1.1 U	1.0 U	0.9 U
1,1-Dichloroethane	0.9 U	1.1 U	1.1 U	1.0 U	0.9 U
1,1-Dichloroethene	0.9 U	1.1 U	1.1 U	1.0 U	0.9 U
1,2,4-Trimethylbenzene	**7.2**	1.1 U	1.1 U	1.0 U	0.9 U
1,2-Dichlorobenzene	0.9 U	1.1 U	1.1 U	1.0 U	0.9 U
1,3,5-Trimethylbenzene	**2.0**	1.1 U	1.1 U	1.0 U	0.9 U
2-Butanone	**9.1**	5.5 U	5.5 U	5.1 U	4.7 U
4-Isopropyltoluene	**1**	1.1 U	1.1 U	1.0 U	0.9 U
Acetone	**53**	**37**	**67**	**28**	**13**
Benzene	0.9 U	1.1 U	1.1 U	1.0 U	0.9 U
Carbon Disulfide	0.9 U	1.1 U	1.1 U	1.0 U	0.9 U
cis-1,2-Dichloroethene	0.9 U	1.1 U	1.1 U	1.0 U	0.9 U
Ethylbenzene	**2.8**	1.1 U	1.1 U	1.0 U	0.9 U
Isopropylbenzene	0.9 U	1.1 U	1.1 U	1.0 U	0.9 U
m,p-Xylene	**15**	1.1 U	1.1 U	1.0 U	0.9 U
Methylene Chloride	1.9 U	2.2 U	2.2 U	2.0 U	1.9 U
Napthalene	4.6 U	5.5 U	5.5 U	5.1 U	4.7 U
n-Propylbenzene	0.9 U	1.1 U	1.1 U	1.0 U	0.9 U
o-Xylene	**9.1**	1.1 U	1.1 U	1.0 U	0.9 U
Tetrachloroethene	0.9 U	1.1 U	1.1 U	1.0 U	0.9 U
Toluene	**7.3**	1.1 U	1.1 U	1.0 U	0.9 U
Trichloroethene	0.9 U	1.1 U	1.1 U	1.0 U	0.9 U
Trichlorofluoromethane	0.9 U	1.1 U	1.1 U	1.0 U	0.9 U
Vinyl Chloride	0.9 U	1.1 U	1.1 U	1.0 U	0.9 U
Metals (mg/kg)					
Aluminum	**15,200**	**16,800**	**20,200**	**25,400**	**14,200**
Arsenic	**19**	6 U	**7**	**7**	5 U
Barium	**98.2**	**85.5**	**90.7**	**118**	**52.7**
Cadmium	**0.6**	**0.3**	**0.3**	0.3 U	**0.2**
Calcium	**54,000**	**4,930**	**10,300**	**6,460**	**10,500**
Chromium	**37.8**	**32.6**	**39.6**	**43.7**	**23.8**
Cobalt	**8.1**	**9.0**	**10.9**	**12.3**	**10.6**
Copper	61.8 J	29.9 J	34.7 J	39.6 J	37.5 J
Iron	17,000	**23,200**	**23,500**	**30,600**	**18,900**
Lead	**19**	**4**	**14**	**5**	**12**
Magnesium	**6,840**	**5,140**	**6,490**	**7,380**	**7,450**
Mercury	**0.06**	**0.09**	**0.10**	**0.07**	**0.04**
Molybdenum	**1.4**	0.6 U	**0.6**	0.7 U	0.5 U
Nickel	**32**	**29**	**34**	**36**	**26**
Silver	0.3 U	0.4 U	0.4 U	0.4 U	0.3 U
Zinc	**97**	**62**	**63**	**59**	**66**
Total Petroleum Hydrocarbons (mg/kg)					
Gasoline range	**7.5**	8.1 U	5.9 U	7.7 U	5.6 U
Diesel range	5.4 U	**8.2**	**8.1**	7.2 U	5.7 U
Motor oil	**12**	**59**	**66**	**53**	**18**

Notes
1. Data qualifiers are as follows:
    U = The analyte was not detected at the reporting limit indicated.
    UJ = The analyte was not detected at the estimated reporting limit indicated
    J = The value is an estimate.
2. Analytes only shown on the table if they were detected in at least one sample from Southwest Marshalling Yard.
3. Sample IDs consist of the sample location followed by the depth interval from which each sample was collected in feet bgs.
4. Detections are shown in **bold**.

Abbreviations
µg/kg = micrograms per kilogram
mg/kg = milligrams per kilogram
bgs = below ground surface

TABLE 3

DUCT BANK WEST - GROUNDWATER ANALYTICAL RESULTS[1, 2]
DECEMBER 22-24, 2013
Boeing Renton Facility
Renton, Washington

	SAMPLE ID [3, 4]						
Constituent	**DBW-2-8.0-12.0**	**DBW-3-8.0-12.0**	**DBW-4-7.5-11.5**	**DBW-5-5.5-9.5**	**DBW-6-5.0-9.0**	**DBW-7-8.0-12.0**	**DBW-8-4.0-8.0**
Volatile Organic Compounds (µg/L)							
Acetone	5.0 U	5.0 U	**88**	5.0 U	5.0 U	5.0 U	5.0 U
1,1-Dichloroethene	0.20 U	0.20 U	**48**	0.20 U	0.20 U	0.20 U	0.20 U
1,1-Dichloroethane	0.20 U	**2.4**	**380**	0.20 U	0.20 U	0.20 U	0.20 U
Benzene	**100**	**5.6**	**2.5**	0.20 U	0.20 U	0.20 U	0.20 U
2-Butanone	5.0 U	5.0 U	**8.7**	5.0 U	5.0 U	5.0 U	5.0 U
cis -1,2-Dichloroethene	0.20 U	**4.7**	**21,000**	**0.27**	**0.38**	0.20 U	**2.1**
Chlorobenzene	**0.46**	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U
Chloroethane	0.20 U	**3.3**	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U
1,2-Dichlorobenzene	0.20 U	0.20 U	**0.37**	0.20 U	0.20 U	0.20 U	0.20 U
Ethylbenzene	**5.6**	0.20 U	**2.8**	0.20 U	0.20 U	**0.26**	**0.23**
Isopropylbenzene	**1.8**	0.20 U	**0.64**	0.20 U	0.20 U	0.20 U	0.20 U
Napthalene	0.50 U	0.50 U	0.50 U	**0.82**	0.50 U	0.50 U	0.50 U
n-Propylbenzene	**7.8**	0.20 U	**1.2**	0.20 U	0.20 U	0.20 U	0.20 U
n-Butylbenzene	**0.85**	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U
sec-Butylbenzene	**0.31**	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U
Toluene	**3.2**	**0.30**	**670**	**0.29**	0.20 U	**0.38**	**0.32**
trans -1,2-Dichloroethene	0.20 U	0.20 U	**67**	0.20 U	0.20 U	0.20 U	0.20 U
Trichloroethene	0.20 U	**12**	**10**	0.20 U	0.20 U	0.20 U	**0.83**
Trichlorofluoromethane	0.20 U	0.20 U	**110**	0.20 U	0.20 U	0.20 U	0.20 U
1,1,2-Trichloroethane	0.20 U	0.20 U	**2.3**	0.20 U	0.20 U	0.20 U	0.20 U
1,1,2-Trichloro-1,2.2-Trifluoroethane	0.20 U	**0.77**	**5,300**	0.20 U	0.20 U	0.20 U	0.20 U
1,3,5-Trimethylbenzene	**1.4**	0.20 U	**1.6**	**0.43**	0.20 U	**0.34**	**0.31**
1,2,4-Trimethylbenzene	**1.7**	0.20 U	**3.0**	**2.0**	**0.47**	**1.4**	**1.6**
Vinyl Chloride	0.20 U	**0.76**	**2,900**	**0.28**	**0.57**	**0.33**	**2.8**
m,p-Xylene	**18**	0.40 U	**7.7**	**1.1**	0.20 U	**1.1**	**1.1**
o-Xylene	**4.1**	0.20 U	**5.2**	**0.68**	0.20 U	**0.64**	**0.62**
Semi-Volatile Organic Compounds (µg/L)							
1-Methylnaphthalene	1.0 U	1.0 U	1.0 U	**1.1**	1.0 U	1.0 U	1.0 U
Phenol	**3.4**	1.0 U	**1.1**	1.0 U	1.0 U	1.0 U	1.0 U
2-Methylphenol	1.0 U	1.0 U	**13**	1.0 U	1.0 U	1.0 U	1.0 U
4-Methylphenol	2.0 U	2.0 U	**49**	2.0 U	2.0 U	2.0 U	2.0 U
Metals (mg/L)							
Total Iron	**22.2**	**41.6**	**36.4**	**37.3**	**26.5**	**15.3**	**10.2**
Total Manganese	**1.10**	**2.56**	**1.56**	**1.65**	**1.27**	**0.747**	**0.833**
Dissolved Iron	**21.0**	**38.6**	**27.0**	**33.6**	**25.4**	**7.44**	**9.32**
Dissolved Manganese	**1.10**	**2.49**	**1.42**	**1.55**	**1.23**	**0.661**	**0.820**
Total Petroleum Hydrocarbons (mg/L)							
Gasoline range	**0.70**	0.25 U	**2.5**	0.25 U	0.25 U	0.25 U	0.25 U
Diesel range	0.10 U	**0.15**	**0.40**	**0.12**	0.10 U	**0.18**	**0.17**
Motor oil	0.20 U	0.27 U	0.20 U	0.20 U	0.20 U	0.29 U	0.20 U

Notes
1. Data qualifiers are as follows:
   U = The analyte was not detected at the reporting limit indicated.
2. Analytes only shown on the table if they were detected in at least one sample from either the Duct Bank West or Southwest Marshalling Yard.
3. Sample IDs consist of the sample location followed by the depth interval from which each sample was collected in feet bgs.
4. Detections are shown in **bold**.

Abbreviations
µg/L = micrograms per liter
mg/L = milligrams per liter
bgs = below ground surface

TABLE 4

SOUTHWEST MARSHALLING YARD - GROUNDWATER ANALYTICAL RESULTS [1, 2]
DECEMBER 22-24, 2013

Boeing Renton Facility
Renton, Washington

Constituent	SAMPLE ID [3, 4] SWMY-9-8.0-12.0	SWMY-10-8.0-12.0	SWMY-13-4.0-8.0	SWMY-15-4.0-8.0
Volatile Organic Compounds (µg/L)				
Acetone	5.0 U	5.0 U	5.0 U	5.0 U
cis -1,2-Dichloroethene	0.20 U	**0.42**	0.20 U	**0.21**
Ethylbenzene	0.20 U	0.20 U	**0.51**	0.20 U
Napthalene	0.50 U	0.50 U	**0.90**	0.50 U
n-Propylbenzene	0.20 U	0.20 U	**0.21**	0.20 U
Toluene	**0.50**	0.20 U	**0.86**	0.20 U
1,3,5-Trimethylbenzene	0.20 U	0.20 U	**0.78**	0.20 U
1,2,4-Trimethylbenzene	**0.54**	0.20 U	**3.5**	0.20 U
Vinyl Chloride	0.20 U	**0.78**	**0.32**	0.20 U
m,p-Xylene	**0.46**	0.40 U	**2.7**	0.40 U
o-Xylene	**0.26**	0.20 U	**1.5**	0.20 U
Semi-Volatile Organic Compounds (µg/L)				
1-Methylnaphthalene	1.0 U	1.0 U	**1.6**	1.0 U
2-Methylnaphthalene	1.0 U	1.0 U	**1.5**	1.0 U
Metals (mg/L)				
Total Iron	**53.6**	**16.8**	**236**	**19.2**
Total Manganese	**1.74**	**0.795**	**3.19**	**0.522**
Dissolved Iron	**25.6**	**14.0**	**18.6**	0.05 U
Dissolved Manganese	**1.32**	**0.773**	**0.916**	**0.001**
Total Petroleum Hydrocarbons (mg/L)				
Gasoline range	0.25 U	0.25 U	0.25 U	0.25 U
Diesel range	**0.13**	0.10 U	**0.36**	0.10 U
Motor oil	0.24 U	0.20 U	**0.53**	0.20 U

Notes

1. Data qualifiers are as follows:
   U = The analyte was not detected at the reporting limit indicated.
3. Analytes only shown on the table if they were detected in at least one sample from Southwest Marshalling Yard
3. Sample IDs consist of the sample location followed by the depth interval from which each sample was collected in feet bgs.
4. Detections are shown in **bold**.

Abbreviations

µg/L = micrograms per liter
bgs = below ground surface
mg/L = milligrams per liter

TABLE 5

DUCT BANK WEST AND SOUTHWEST MARSHALLING YARD[1]
ADDITIONAL INVESTIGATION - SOIL ANALYTICAL RESULTS
MARCH 26, 2014

Boeing Renton Facility
Renton, Washington

	SAMPLE ID[2]		
Constituent	**DBW-7S-4.0-5.0**	**DBW-7E-4.0-5.0**	**DBW-7W-4.0-5.0**
Total Petroleum Hydrocarbons (mg/kg)			
Gasoline range	5.1 U	5.2 U	4.7 U

Notes

1. Data qualifiers are as follows:
   U = The analyte was not detected at the reporting limit indicated.
2. Sample IDs consist of the sample location followed by the depth interval from which each sample was collected in feet bgs.

Abbreviations

bgs = below ground surface
mg/kg = milligrams per kilogram

TABLE 6

DUCT BANK WEST AND SOUTHWEST MARSHALLING YARD[1,2]
ADDITIONAL INVESTIGATION - GROUNDWATER ANALYTICAL RESULTS
MARCH 25-26, 2014

Boeing Renton Facility
Renton, Washington

	SAMPLE ID [3]				
Constituent	**DBW-9-4.0-8.0**	**DBW-10-4.0-8.0**	**DBW-11-4.0-8.0**	**SWMY-16-10.0-14.0**	**SWMY-18-4.0-8.0**
Volatile Organic Compounds (µg/L)					
Chloromethane	5.0 U	5.0 U	5.0 U	5.0 UJ	5.0 U
Bromomethane	1.0 UJ	1.0 UJ	1.0 UJ	1.0 U	1.0 UJ
Vinyl Chloride	0.20 U	0.20 U	**0.71**	**0.45**	0.20 U
Chloroethane	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U
Methylene Chloride	1.0 UJ	1.0 UJ	1.0 UJ	1.0 U	1.0 UJ
Acetone	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
Carbon Disulfide	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U
1,1-Dichloroethene	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U
1,1-Dichloroethane	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U
trans-1,2-Dichloroethene	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U
cis-1,2-Dichloroethene	**0.66**	0.2 U	**4.7**	0.2 U	**0.32**
Chloroform	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U
1,2-Dichloroethane	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U
2-Butanone	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
1,1,1-Trichloroethane	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U
Carbon Tetrachloride	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U
Vinyl Acetate	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U
Bromodichloromethane	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U
1,2-Dichloropropane	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U
cis-1,3-Dichloropropene	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U
Trichloroethene	**7.3**	**0.98**	**17**	0.20 U	**0.20**
Dibromochloromethane	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U
1,1,2-Trichloroethane	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U
Benzene	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U
trans-1,3-Dichloropropene	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U
2-Chloroethylvinylether	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Bromoform	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U
4-Methyl-2-Pentanone (MIBK)	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
2-Hexanone	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
Tetrachloroethene	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U
1,1,2,3-Tetrachloroethane	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U
Toluene	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U
Chlorobenzene	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U
Ethylbenzene	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U
Styrene	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U
Trichlorofluoromethane	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U
1,1,2-Trichloro-1,2,2-trifluoroethane	0.20 U	0.20 U	**0.81**	0.20 U	0.20 U
m,p-Xylene	0.40 U	0.40 U	0.40 U	0.40 U	0.40 U
o-Xylene	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U
1,2-Dichlorobenzene	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U
1,3-Dichlorobenzene	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U
1,4-Dichlorobenzene	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U
Acrolein	5.0 U	5.0 U	5.0 U	5.0 UJ	5.0 U
Iodomethane	1.0 UJ	1.0 UJ	1.0 UJ	1.0 U	1.0 UJ
Bromoethane	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U
Acrylonitrile	1.0 U	1.0 U	1.0 U	1.0 UJ	1.0 U
1,1-Dichloropropene	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U
Dibromomethane	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U
1,1,1,2-Tetrachloroethane	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U
1,2-Dibromo-3-chloropropane	0.50 U	0.50 U	0.50 U	0.50 UJ	0.50 U
1,2,3-Trichloropropane	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U
trans-1,4-Dichloro-2-butene	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,3,5-Trimethylbenzene	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U
1,2,4-Trimethylbenzene	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U
Hexachlorobutadiene	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U
1,2-Dibromoethane	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U
Bromochloromethane	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U
2,2-Dichloropropane	0.20 U	0.20 U	0.20 U	0.20 UJ	0.20 U
1,3-Dichloropropane	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U
Isopropylbenzene	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U
n-Propylbenzene	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U
Bromobenzene	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U
2-Chlorotoluene	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U
4-Chlorotoluene	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U
tert-Butylbenzene	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U
sec-Butylbenzene	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U
4-Isopropyltoluene	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U
n-Butylbenzene	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U
1,2,4-Trichlorobenzene	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U
Naphthalene	0.50 UJ	0.50 UJ	0.50 UJ	0.50 U	0.50 UJ
1,2,3-Trichlorobenzene	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U
Total Metals (µg/L)					
Aluminum	**900**	**1,290**	**10,100**	**4,410**	**12,400**
Arsenic	**2.6**	**2.0**	**4.2**	**5.8**	**10.7**
Barium	**13.4**	**12.3**	**64.0**	**20.0**	**163.0**
Cadmium	0.1 U	**0.7**	**0.1**	0.1 U	**0.4**
Calcium	**33,200**	**13,500**	**21,600**	**13,200**	**17,500**
Chromium	**2.7**	**57.3**	**18**	**6**	**66**
Cobalt	**1.5**	**6.9**	**8.9**	**1.3**	**17**
Copper	**11.4**	**12.0**	**19.0**	**9.0**	**55.1**
Iron	**6,360**	**3,720**	**17,700**	**19,400**	**21,100**
Lead	**0.7**	**0.8**	**2.5**	**0.9**	**6.1**
Magnesium	**9,810**	**2,940**	**9,480**	**4,870**	**6,290**
Molybdenum	**1.4**	**1.0**	**0.6**	**0.9**	**3.9**
Nickel	**5.4**	**2.3**	**19.6**	**4.4**	**41.7**
Silver	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
Zinc	4 U	**4**	**26**	**8**	**62**

TABLE 6

DUCT BANK WEST AND SOUTHWEST MARSHALLING YARD[1,2]
ADDITIONAL INVESTIGATION - GROUNDWATER ANALYTICAL RESULTS
MARCH 25-26, 2014

Boeing Renton Facility
Renton, Washington

	SAMPLE ID [3]				
Constituent	**DBW-9-4.0-8.0**	**DBW-10-4.0-8.0**	**DBW-11-4.0-8.0**	**SWMY-16-10.0-14.0**	**SWMY-18-4.0-8.0**
Dissolved Metals (µg/L)					
Aluminum	50 U	50 U	**60**	50 U	**60**
Arsenic	**0.8**	**0.5**	**0.8**	**4.5**	**4.2**
Barium	**6.8**	**2.2**	**5.1**	**5.0**	**4.5**
Cadmium	0.1 U	0.2	0.1 U	0.1 U	0.1 U
Calcium	**33,300**	**12,900**	**18,500**	**12,200**	**9,690**
Chromium	**0.9**	**4.2**	**0.8**	**1.2**	**0.5**
Cobalt	**1.2**	**1.8**	**3.5**	**0.2** U	**0.4**
Copper	**4.9**	**1.4**	**2.0**	**0.5** U	**0.8**
Iron	**1,700**	**590**	**3,410**	**15,300**	**3,720**
Lead	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U
Magnesium	**9,800**	**2,760**	**6,620**	**3,930**	**2,660**
Molybdenum	**1.7**	**1.2**	**0.5**	**0.6**	**5.0**
Nickel	**3.5**	**1.1**	**2.6**	**0.7**	**1.1**
Silver	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
Zinc	4 U	4 U	4 U	4 U	4 U
Total Petroleum Hydrocarbons (mg/L)					
Gasoline range	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U

Notes
1. Data qualifiers are as follows:
   U = The analyte was not detected at the reporting limit indicated.
   UJ = The analyte was not detected at the estimated reporting limit indicated
2. Sample IDs consist of the sample location followed by the depth of the temporary well screen in feet bgs.
3. Detections are shown in **bold**.

Abbreviations
µg/L = micrograms per liter
bgs = below ground surface
mg/L = milligrams per liter

TABLE 7

DUCT BANK WEST ALIGNMENT ALTERNATIVE A - GROUNDWATER ANALYTICAL RESULTS[1]
APRIL 1-3, 2014
Boeing Renton Facility
Renton, Washington

Constituent	Sample ID [2]		
	DBW-Alt-A-3-8.0-12.0	**DBW-Alt-A-5-5.0-10.0**	**DBW-Alt-A-6-7.0-12.0**
Volatile Organic Compounds (µg/L)			
Chloromethane	0.50 U	0.50 U	0.50 U
Bromomethane	1.0 U	1.0 U	1.0 U
Vinyl Chloride	0.20 U	0.20 U	0.20 U
Chloroethane	0.20 U	0.20 U	0.20 U
Methylene Chloride	1.0 U	1.0 U	1.0 U
Acetone	5.0 U	5.0 U	5.0 U
Carbon Disulfide	0.20 U	0.20 U	0.20 U
1,1-Dichloroethene	0.20 U	0.20 U	0.20 U
1,1-Dichloroethane	0.20 U	0.20 U	0.20 U
trans-1,2-Dichloroethene	0.20 U	0.20 U	0.20 U
cis-1,2-Dichloroethene	0.20 U	0.20 U	0.20 U
Chloroform	0.20 U	0.20 U	0.20 U
1,2-Dichloroethane	0.20 U	0.20 U	0.20 U
2-Butanone	5.0 UJ	5.0 UJ	5.0 UJ
1,1,1-Trichloroethane	0.20 U	0.20 U	0.20 U
Carbon Tetrachloride	0.20 U	0.20 U	0.20 U
Vinyl Acetate	0.20 U	0.20 U	0.20 U
Bromodichloromethane	0.20 U	0.20 U	0.20 U
1,2-Dichloropropane	0.20 U	0.20 U	0.20 U
cis-1,3-Dichloropropene	0.20 U	0.20 U	0.20 U
Trichloroethene	0.20 U	0.20 U	0.20 U
Dibromochloromethane	0.20 U	0.20 U	0.20 U
1,1,2-Trichloroethane	0.20 U	0.20 U	0.20 U
Benzene	0.20 U	0.20 U	0.20 U
trans-1,3-Dichloropropene	0.20 U	0.20 U	0.20 U
2-Chloroethylvinylether	1.0 U	1.0 U	1.0 U
Bromoform	0.20 U	0.20 U	0.20 U
4-Methyl-2-Pentanone (MIBK)	5.0 U	5.0 U	5.0 U
2-Hexanone	5.0 UJ	5.0 UJ	5.0 UJ
Tetrachloroethene	0.20 U	0.20 U	0.20 U
1,1,2,3-Tetrachloroethane	0.20 U	0.20 U	0.20 U
Toluene	0.20 U	0.20 U	0.20 U
Chlorobenzene	0.20 U	0.20 U	0.20 U
Ethylbenzene	0.20 U	0.20 U	0.20 U
Styrene	0.20 U	0.20 U	0.20 U
Trichlorofluoromethane	0.20 U	0.20 U	0.20 U
1,1,2-Trichloro-1,2,2-trifluoroethane	0.20 U	0.20 U	0.20 U
m,p-Xylene	0.40 U	0.40 U	0.40 U
o-Xylene	0.20 U	0.20 U	0.20 U
1,2-Dichlorobenzene	0.20 U	0.20 U	0.20 U
1,3-Dichlorobenzene	0.20 U	0.20 U	0.20 U
1,4-Dichlorobenzene	0.20 U	0.20 U	0.20 U
Acrolein	5.0 U	5.0 U	5.0 U
Iodomethane	1.0 U	1.0 U	1.0 U
Bromoethane	0.20 U	0.20 U	0.20 U
Acrylonitrile	1.0 UJ	1.0 UJ	1.0 UJ
1,1-Dichloropropene	0.20 U	0.20 U	0.20 U
Dibromomethane	0.20 U	0.20 U	0.20 U
1,1,1,2-Tetrachloroethane	0.20 U	0.20 U	0.20 U
1,2-Dibromo-3-chloropropane	0.50 U	0.50 U	0.50 U
1,2,3-Trichloropropane	0.50 U	0.50 U	0.50 U
trans-1,4-Dichloro-2-butene	1.0 U	1.0 U	1.0 U
1,3,5-Trimethylbenzene	0.20 U	0.20 U	0.20 U
1,2,4-Trimethylbenzene	0.20 U	0.20 U	0.20 U
Hexachlorobutadiene	0.50 U	0.50 U	0.50 U
1,2-Dibromoethane	0.20 U	0.20 U	0.20 U
Bromochloromethane	0.20 U	0.20 U	0.20 U
2,2-Dichloropropane	0.20 U	0.20 U	0.20 U
1,3-Dichloropropane	0.20 U	0.20 U	0.20 U
Isopropylbenzene	0.20 U	0.20 U	0.20 U
n-Propylbenzene	0.20 U	0.20 U	0.20 U
Bromobenzene	0.20 U	0.20 U	0.20 U
2-Chlorotoluene	0.20 U	0.20 U	0.20 U
4-Chlorotoluene	0.20 U	0.20 U	0.20 U
tert-Butylbenzene	0.20 U	0.20 U	0.20 U
sec-Butylbenzene	0.20 U	0.20 U	0.20 U
4-Isopropyltoluene	0.20 U	0.20 U	0.20 U
n-Butylbenzene	0.20 U	0.20 U	0.20 U
1,2,4-Trichlorobenzene	0.50 U	0.50 U	0.50 U
Naphthalene	0.50 U	0.50 U	0.50 U
1,2,3-Trichlorobenzene	0.50 U	0.50 U	0.50 U
Total Metals (µg/L)			
Aluminum	**500**	**6,750**	**3,310**
Arsenic	**7.0**	**11.4**	**5.7**
Barium	**6.7**	**31.4**	**18. 8**
Cadmium	0.1 U	**0.1**	0.1 U
Calcium	**15,400**	**38,900**	**12,700**
Chromium	1 U	**6**	**4**
Cobalt	**0.5**	**3**	**1**
Copper	**4.9**	**7.1**	**6.4**
Iron	**17,900**	**51,400**	**22,200**
Lead	**0.5**	**1.1**	**1.1**
Magnesium	**5,050**	**11,900**	**4 ,080**
Molybdenum	**1.8**	**0.5**	**0.6**
Nickel	**1.0**	**5.9**	**3.0**
Silver	0.2 U	0.2 U	0.2 U
Zinc	4 U	**11**	**5**

TABLE 7

DUCT BANK WEST ALIGNMENT ALTERNATIVE A - GROUNDWATER ANALYTICAL RESULTS[1]

APRIL 1-3, 2014

Boeing Renton Facility
Renton, Washington

	Sample ID[2]		
Constituent	**DBW-Alt-A-3-8.0-12.0**	**DBW-Alt-A-5-5.0-10.0**	**DBW-Alt-A-6-7.0-12.0**
Dissolved Metals (µg/L)			
Aluminum	50 U	50 U	**60**
Arsenic	**6.4**	**11.1**	**4.6**
Barium	**4.4**	**11.9**	**8.1**
Cadmium	0.1 U	0.1 U	0.1 U
Calcium	**15,300**	**37,400**	**12,100**
Chromium	**0.6**	1 U	**2**
Cobalt	**0.3**	**0.9**	0.5 U
Copper	**0.6**	0.5 U	**0.6**
Iron	**17,900**	**43,400**	**19,200**
Lead	0.1 U	0.1 U	**0.1**
Magnesium	**5,030**	**10,100**	**3,460**
Molybdenum	**1.8**	**0.4**	**0.4**
Nickel	**0.7**	**0.5**	**0.7**
Silver	0.2 U	0.2 U	0.2 U
Zinc	4 U	4 U	4 U
Total Petroleum Hydrocarbons (mg/L)			
Gasoline range	0.25 U	0.25 U	0.25 U
Diesel range	0.10 U	0.10 U	0.10 U
Motor oil	0.20 U	0.20 U	0.20 U

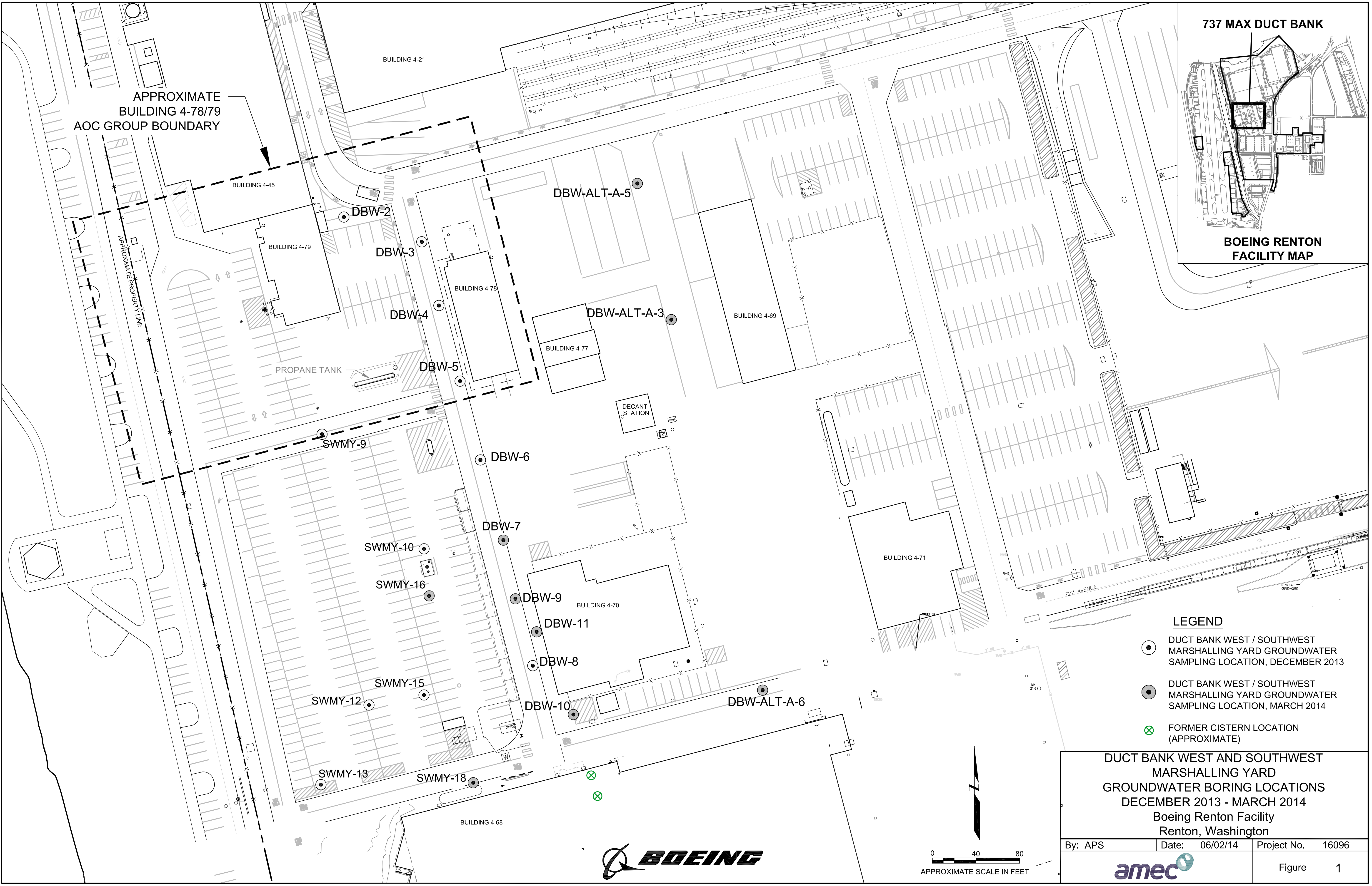
Notes

1. Data qualifiers are as follows:
   U = The analyte was not detected at the reporting limit indicated.
   UJ = The analyte was not detected at the estimated reporting limit indicated
2. Detections are shown in **bold**.

Abbreviations

µg/L = micrograms per liter
mg/L = milligrams per liter

FIGURES



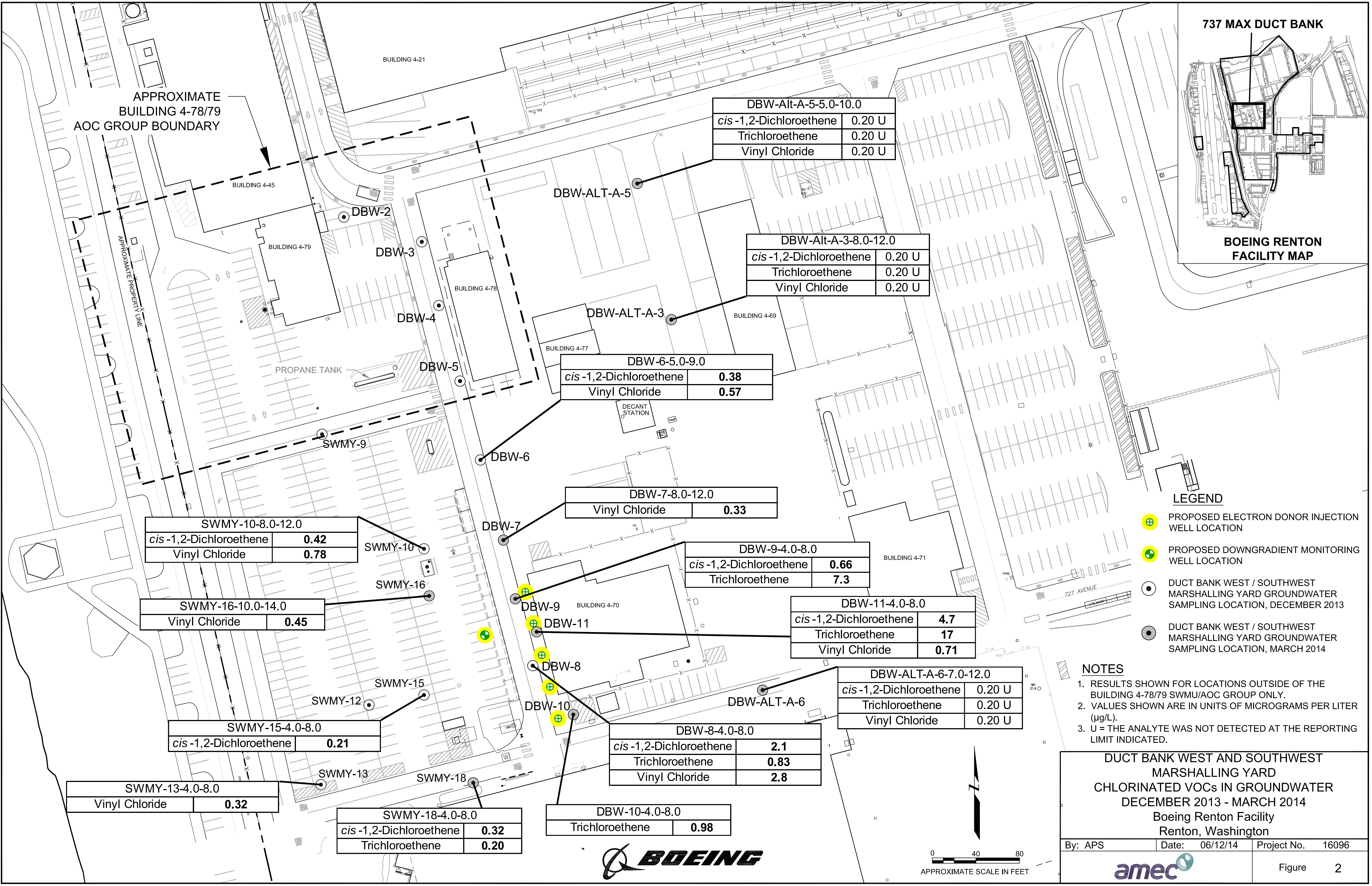
LEGEND

- ⊙ DUCT BANK WEST / SOUTHWEST MARSHALLING YARD GROUNDWATER SAMPLING LOCATION, DECEMBER 2013
- ◉ DUCT BANK WEST / SOUTHWEST MARSHALLING YARD GROUNDWATER SAMPLING LOCATION, MARCH 2014
- ⊗ FORMER CISTERN LOCATION (APPROXIMATE)

DUCT BANK WEST AND SOUTHWEST
MARSHALLING YARD
GROUNDWATER BORING LOCATIONS
DECEMBER 2013 - MARCH 2014
Boeing Renton Facility
Renton, Washington

By: APS	Date: 06/02/14	Project No. 16096
amec		Figure 1

Plot Date: 06/02/14 - 8:54am, Plotted by: adam.stenberg
Drawing Path: S:\16096\002_Duct Bank_ Drawing Name: BoeingRenton_737-DuctBank-SiteMap_053014.dwg



DBW-Alt-A-5-5.0-10.0	
cis-1,2-Dichloroethene	0.20 U
Trichloroethene	0.20 U
Vinyl Chloride	0.20 U

DBW-Alt-A-3-8.0-12.0	
cis-1,2-Dichloroethene	0.20 U
Trichloroethene	0.20 U
Vinyl Chloride	0.20 U

DBW-6-5.0-9.0	
cis-1,2-Dichloroethene	**0.38**
Vinyl Chloride	**0.57**

DBW-7-8.0-12.0	
Vinyl Chloride	**0.33**

SWMY-10-8.0-12.0	
cis-1,2-Dichloroethene	**0.42**
Vinyl Chloride	**0.78**

DBW-9-4.0-8.0	
cis-1,2-Dichloroethene	**0.66**
Trichloroethene	**7.3**

SWMY-16-10.0-14.0	
Vinyl Chloride	**0.45**

DBW-11-4.0-8.0	
cis-1,2-Dichloroethene	**4.7**
Trichloroethene	**17**
Vinyl Chloride	**0.71**

DBW-ALT-A-6-7.0-12.0	
cis-1,2-Dichloroethene	0.20 U
Trichloroethene	0.20 U
Vinyl Chloride	0.20 U

SWMY-15-4.0-8.0	
cis-1,2-Dichloroethene	**0.21**

DBW-8-4.0-8.0	
cis-1,2-Dichloroethene	**2.1**
Trichloroethene	**0.83**
Vinyl Chloride	**2.8**

SWMY-13-4.0-8.0	
Vinyl Chloride	**0.32**

SWMY-18-4.0-8.0	
cis-1,2-Dichloroethene	**0.32**
Trichloroethene	**0.20**

DBW-10-4.0-8.0	
Trichloroethene	**0.98**

LEGEND

- ⊕ PROPOSED ELECTRON DONOR INJECTION WELL LOCATION
- ⊕ PROPOSED DOWNGRADIENT MONITORING WELL LOCATION
- ⊙ DUCT BANK WEST / SOUTHWEST MARSHALLING YARD GROUNDWATER SAMPLING LOCATION, DECEMBER 2013
- ● DUCT BANK WEST / SOUTHWEST MARSHALLING YARD GROUNDWATER SAMPLING LOCATION, MARCH 2014

NOTES

1. RESULTS SHOWN FOR LOCATIONS OUTSIDE OF THE BUILDING 4-78/79 SWMU/AOC GROUP ONLY.
2. VALUES SHOWN ARE IN UNITS OF MICROGRAMS PER LITER (µg/L).
3. U = THE ANALYTE WAS NOT DETECTED AT THE REPORTING LIMIT INDICATED.

DUCT BANK WEST AND SOUTHWEST
MARSHALLING YARD
CHLORINATED VOCs IN GROUNDWATER
DECEMBER 2013 - MARCH 2014
Boeing Renton Facility
Renton, Washington

By: APS
Date: 06/12/14
Project No. 16096

amec

Figure 2

Plot Date: 06/12/14 - 9:33am, Plotted by: adam.stenberg
Drawing Path: S:\16096\002_Duct Bank\, Drawing Name: BoeingRenton_737-DuctBank-SiteMap_061214.dwg

APPENDIX A

Summary Data Quality Reviews and
Laboratory Analytical Data Packages (on CD)

Memo

To: Larry McGaughey, Project Manager
From: Crystal Neirby
Tel: (206) 342-1760
Fax: (206) 342-1761
Date: April 15, 2014

Project: 0088880100.2014
cc: Project File

Subject: Summary Data Quality Review
Duct Bank West and Southwest Marshalling Yard Additional Soil and Groundwater Investigation
ARI Sample Delivery Groups: YE27 and YE47

This memo presents the summary data quality review of five groundwater samples, three soil samples, and one trip blank collected on March 25 and 26, 2014. The samples were submitted to Analytical Resources Inc., (ARI), located in Tukwila, Washington, a laboratory accredited by the Washington State Department of Ecology (Ecology). The groundwater samples were analyzed for the following:

- Volatile organic compounds (VOCs) by U.S. Environmental Protection Agency (EPA) Method 8260C;
- Total petroleum hydrocarbons as gasoline (TPH-G) by Ecology Method NWTPH-Gx; and
- The following total and dissolved metals: aluminum, calcium, iron, and magnesium) by EPA Method 6010C; and arsenic, barium, cadmium, chromium, cobalt, copper, lead, molybdenum, nickel, silver, and zinc by EPA Method 200.8.

The soil samples were analyzed for:

- Total petroleum hydrocarbons as gasoline (TPH-G) by Ecology Method NWTPH-Gx.

The samples and the analyses conducted on the samples are listed below.

Sample ID	Matrix	Laboratory Sample ID	Requested Analyses
SWMY-16-10.0-14.0	Groundwater	YE27A/YE27B	VOCs, TPH-G, and metals
DBW-10-4.0-8.0	Groundwater	YE47A/YE47E	VOCs, TPH-G, and metals
DBW-9-4.0-8.0	Groundwater	YE47B/YE47F	VOCs, TPH-G, and metals
DBW-11-4.0-8.0	Groundwater	YE47C/YE47G	VOCs, TPH-G, and metals
SWMY-18-4.0-8.0	Groundwater	YE47D/YE47H	VOCs, TPH-G, and metals
DBW-7S-4.0-5.0	Soil	YE47I	TPH-G
DBW-7E-4.0-8.0	Soil	YE47J	TPH-G
DBW-7W-4.0-5.0	Soil	YE47K	TPH-G
Trip Blank	Trip Blank	YE47L	VOCs and TPH-G

AMEC Environment & Infrastructure, Inc.
600 University Street, Suite 600
Seattle, Washington
USA 98101-4107
Tel (206) 342-1760
Fax (206) 342-1761
www.amec.com

Data were reviewed in accordance with the appropriate method procedures and criteria documented in the Quality Assurance Project Plan (QAPP) (AMEC, 2012). The control limits provided in the QAPP are advisory limits; therefore, the most current control limits provided by the laboratory were used to evaluate the quality control data. In cases where the laboratory did not track limits for an analyte, the limits in the QAPP were used.

Holding times, method/trip blanks, surrogate recoveries, laboratory control samples (LCS) and laboratory control sample duplicates (LCSD), matrix spike/matrix spike duplicates (MS/MSD), field duplicates, and reporting limits were reviewed where available to assess compliance with applicable methods. If qualification was required, data were qualified based on the definitions and use of qualifying flags outlined in EPA guidelines (EPA, 2008 and 2010).

ARI received the samples the days they were collected. The temperatures of the coolers were recorded upon receipt and were below the maximum acceptable temperature of 6 degrees Celsius (°C). Though a trip blank was indicated on the COC submitted with SDG YE27, one was not submitted for analysis. The sample results are not affected and are not qualified.

ORGANIC ANALYSES

Samples were analyzed for VOCs and TPH as gasoline. Laboratory data were evaluated for the following parameters:

1. Preservation and Holding Times – Acceptable
2. Blanks – Acceptable
3. Surrogates – Acceptable
4. LCS/LCSD – Acceptable except as noted:

   VOCs by EPA 8260C: The recovery for chloroethane in the LCS samples associated with SDG YE27 was 142 percent, greater than the control limits of 68 to 133 percent. The associated LCSD recovery was acceptable; therefore, sample results were not affected and were not qualified.

   The recoveries for the following compounds were outside of the control limits in the LCS and/or LCSD associated with SDG YE47: bromomethane at 47.5 and 47 percent, below the control limits of 68 to 130 percent; iodomethane at 49.8 and 53.2 percent, below the control limits of 76 to 123 percent; bromoethane at 75.1 in the LCS, below the control limits of 77 to 122 percent; and naphthalene in the LCSD at 132 percent, above the control limits of 80 to 128 percent. The bromomethane and iodomethane results in the associated samples were qualified as estimated and flagged with a "UJ" due to the potential low bias. The bromoethane and naphthalene results were not qualified due to acceptable LCS and/or LCSD recoveries.

5. MS/MSD

   Additional sample volume was not submitted for MS/MSD analyses with samples collected from this site. Sample results are evaluated based on LCS/LCSD results.

6. Field Duplicates

   Field duplicates were not collected at this site during this sampling event.

7. Reporting Limits and Laboratory Flags – Acceptable except as noted:

   VOCs by EPA 8260C: The laboratory noted in the case narrative for SDG YE27 that the responses for the following compounds in the CCAL were below the criteria of 20 percent: chloromethane, acrolein, acrylonitrile, 1,2-dibromo-3-chloropropane, and 2,2-dichloropropane. The affected analytes were not detected in the associated samples; therefore, the results are qualified as estimated and flagged with a "UJ" due to the possible low bias.

   The laboratory noted in the case narrative for SDG YE47 that the responses for the following compounds in the CCAL were below the criteria of 20 percent: bromomethane, acetone, iodomethane, and naphthalene. The bromomethane and iodomethane results in the associated samples were previously qualified due to LCS/LCSD recoveries and are not qualified further. Acetone and naphthalene were not detected in the associated samples; therefore, the results are qualified as estimated and flagged with a "UJ" due to the possible low bias.

INORGANIC ANALYSES

Samples were analyzed for total and dissolved metals. Laboratory data were evaluated for the following parameters:

1. Preservation and Holding Times – Acceptable
2. Blanks – Acceptable
3. LCS/LCSD – Acceptable
4. MS/MSD

   Additional sample volume was not submitted for MS/MSD analyses with samples collected from this site. Sample results are evaluated based on LCS/LCSD results.

5. Field Duplicates

   Field duplicates were not collected at this site during this sampling event.

6. Reporting Limits and Laboratory Flags – Acceptable.

OVERALL ASSESSMENT OF DATA

The table below summarizes the data review. The completeness of SDGs YE27 and YE47 is 100 percent. Evaluation of the usefulness of these data is based on EPA guidance documents referenced in the introduction to this report. Few problems were identified, and analytical performance was generally within specified limits. The data meet the project's data quality objectives.

Sample ID	Analysis Method	Qualified Analyte	Qualified Result	Qualifier Reason
SWMY-16-10.0-14.0	VOCs	chloromethane acrolein acrylonitrile 1,2-dibromo-3-chloropropane 2,2-dichloropropane	0.50 UJ 5.0 UJ 1.0 UJ 0.50 UJ 0.20 UJ	CCAL responses
DBW-10-4.0-8.0	VOCs	bromomethane iodomethane acetone naphthalene	1.0 UJ 1.0 UJ 5.0 UJ 0.50 UJ	LCS/LCSD recoveries “ CCAL responses “
DBW-9-4.0-8.0	VOCs	bromomethane iodomethane acetone naphthalene	1.0 UJ 1.0 UJ 5.0 UJ 0.50 UJ	LCS/LCSD recoveries “ CCAL responses “
DBW-7S-4.0-5.0		none		
DBW-11-4.0-8.0	VOCs	bromomethane iodomethane acetone naphthalene	1.0 UJ 1.0 UJ 5.0 UJ 0.50 UJ	LCS/LCSD recoveries “ CCAL responses “
DBW-7E-4.0-8.0		none		
SWMY-18-4.0-8.0	VOCs	bromomethane iodomethane acetone naphthalene	1.0 UJ 1.0 UJ 5.0 UJ 0.50 UJ	LCS/LCSD recoveries “ CCAL responses “
DBW-7W-4.0-5.0		none		
Trip Blank	VOCs	bromomethane iodomethane acetone naphthalene	1.0 UJ 1.0 UJ 5.0 UJ 0.50 UJ	LCS/LCSD recoveries “ CCAL responses “

REFERENCES

AMEC Environment & Infrastructure, Inc. (AMEC), 2012, Quality Assurance Project Plan, Boeing Renton Facility, Renton, Washington: Prepared for the Boeing Company, February.

U.S. Environmental Protection Agency (EPA), 2008, U.S. EPA Contract Laboratory Program National Functional Guidelines for Superfund Organic Methods Data Review: EPA 540-R-08-001, June.

EPA, 2010, U.S. EPA Contract Laboratory Program National Functional Guidelines for Inorganic Superfund Data Review: EPA 540-R-10-011, January.

Memo

To:	Larry McGaughey, Project Manager	Project:	0088880100.2014
From:	Crystal Neirby	cc:	Project File
Tel:	(206) 342-1760		
Fax:	(206) 342-1761		
Date:	April 17, 2014		

Subject: **Summary Data Quality Review**
Duct Bank West
Construction Activities Soil and Groundwater Investigation
ARI Sample Delivery Groups: YF36

This memo presents the summary data quality review of three groundwater samples and one trip blank collected April 3, 2014. The samples were submitted to Analytical Resources Inc., (ARI), located in Tukwila, Washington, a laboratory accredited by the Washington State Department of Ecology (Ecology). The soil and groundwater samples were selectively analyzed for the following:

- Volatile organic compounds (VOCs) by U.S. Environmental Protection Agency (EPA) Method 8260C;
- Total petroleum hydrocarbons as gasoline (TPH-G) by Ecology Method NWTPH-Gx;
- TPH as diesel (TPH-D) by Ecology Method NWTPH-Dx; and
- Total and dissolved metals (aluminum, arsenic, barium, cadmium, calcium, chromium, cobalt, copper, iron, lead, magnesium, molybdenum, nickel, silver, and zinc) by EPA Method 6010C.

The sample IDs, the sample matrix, the laboratory sample ID, and the analyses conducted on the samples are listed below.

Sample ID	Matrix	Laboratory Sample ID	Requested Analyses
DBW-Alt-A-3-8.0-12.0	Groundwater	YF36A/YF36E	all
DBW-Alt-A-5-5.0-10.0	Groundwater	YF36B/YF36F	all
DBW-Alt-A-6-7.0-12.0	Groundwater	YF36C/YF36G	all
Trip Blank	Trip Blank	YF36D	VOCs

Data were reviewed in accordance with the appropriate method procedures and criteria documented in the Quality Assurance Project Plan (QAPP) (AMEC, 2012). The control limits provided in the QAPP are advisory limits; therefore, the most current control limits provided by the laboratory were used to evaluate the quality control data. In cases where the laboratory did not track limits for an analyte, the limits in the QAPP were used.

Holding times, method/trip blanks, surrogate recoveries, laboratory control samples (LCS) and laboratory control sample duplicates (LCSD), matrix spike/matrix spike duplicates (MS/MSD), field duplicates, and reporting limits were reviewed where available to assess compliance with applicable methods. If qualification was required, data were qualified based on the definitions and use of qualifying flags outlined in EPA guidelines (EPA, 2008 and 2010).

ARI received the samples the days they were collected. The temperatures of the coolers were recorded upon receipt and were below the maximum acceptable temperature of 6 degrees Celsius (°C).

ORGANIC ANALYSES

Samples were analyzed for the methods listed in the introduction of this report. Laboratory data were evaluated for the following parameters:

1. Preservation and Holding Times – Acceptable
2. Blanks – Acceptable
3. Surrogates – Acceptable
4. LCS/LCSD – Acceptable except as noted:

   VOCs by EPA 8260C
   The recoveries of the following compounds in the LCS and/or LCSD associated with analysis on April 4, 2014 were outside of the control limits: 2-hexanone at 72 and 79.2, below the control limits of 80 to 129 percent; 4-isopropyltoluene at 77.5 percent in the LCSD, below the control limits of 80 to 124 percent; n-butylbenzene at 67.9 percent in the LCSD, below the control limits of 80 to 124 percent; and 1,2,3-trichlorobenzene at 79 percent in the LCSD, below the control limits of 80 to 125 percent. The 2-hexanone results in the associated samples were qualified as estimated and flagged with a "UJ" due to the possible low bias, the remaining results were not qualified since the associated LCS recoveries were acceptable.

5. MS/MSD – Acceptable except as noted:

   Extra volume was not submitted with field samples to perform MS/MSD analyses. Sample results are evaluated based on LCS/LCSD results.

6. Field Duplicates

   Field duplicates were not collected at this site during this sampling event.

7. Reporting Limits and Laboratory Flags – Acceptable except as noted:

   VOCs by EPA 8260C
   The laboratory noted in the case narrative that the response for 2-butanone, 2-hexanone, and acrylonitrile were below the control limits in the CCAL associated with analysis on April 4, 2014. The low responses equate to a low bias in the samples, and

the affected compounds were not detected in the samples. Therefore, the results are qualified as estimated and flagged with a “UJ”.

INORGANIC ANALYSES

Samples were analyzed for metals. Laboratory data were evaluated for the following parameters:

1. Preservation and Holding Times – Acceptable
2. Blanks – Acceptable
3. LCS – Acceptable
4. MS/MSD – Extra volume was not submitted with project samples to perform MS/MSD analyses. Sample results were evaluated based on LCS results.
5. Laboratory Duplicates - Extra volume was not submitted with project samples to perform laboratory duplicate analyses. Sample results were evaluated based on LCS results
6. Field Duplicates

   Field duplicates were not collected at this site during this sampling event.
7. Reporting Limits and Laboratory Flags – Acceptable

OVERALL ASSESSMENT OF DATA

The table below summarizes the data review. The completeness of SDG YF36 is 100 percent. Evaluation of the usefulness of these data is based on EPA guidance documents referenced in the introduction to this report. Few problems were identified, and analytical performance was generally within specified limits. The data meet the project’s data quality objectives.

Sample ID	Analysis Method	Qualified Analyte	Qualified Result	Qualifier Reason
DBW-Alt-A-3-8.0-12.0	VOCs	2-butanone 2-hexanone acrylonitrile	5.0 UJ 5.0 UJ 1.0 UJ	CCAL responses
DBW-Alt-A-5-5.0-10.0	VOCs	2-butanone 2-hexanone acrylonitrile	5.0 UJ 5.0 UJ 1.0 UJ	CCAL responses
DBW-Alt-A-6-7.0-12.0	VOCs	2-butanone 2-hexanone acrylonitrile	5.0 UJ 5.0 UJ 1.0 UJ	CCAL responses
Trip Blank		none		

REFERENCES

AMEC Environment & Infrastructure, Inc. (AMEC), 2012, Quality Assurance Project Plan, Boeing Renton Facility, Renton, Washington: Prepared for the Boeing Company, February.

U.S. Environmental Protection Agency (EPA), 2008, U.S. EPA Contract Laboratory Program National Functional Guidelines for Superfund Organic Methods Data Review: EPA 540-R-08-001, June.

EPA, 2010, U.S. EPA Contract Laboratory Program National Functional Guidelines for Inorganic Superfund Data Review: EPA 540-R-10-011, January.

Memo

To: Larry McGaughey, Project Manager
From: Crystal Neirby
Tel: (206) 342-1760
Fax: (206) 342-1761
Date: April 17, 2014

Project: 0088880100.2014
cc: Project File

Subject: **Summary Data Quality Review**
Duct Bank West
Construction Activities Soil and Groundwater Investigation
ARI Sample Delivery Groups: XS54, XS56, XS69, and XS71

This memo presents the summary data quality review of seven groundwater samples, 14 soil samples, and two trip blanks collected December 23 through 24, 2013. The samples were submitted to Analytical Resources Inc., (ARI), located in Tukwila, Washington, a laboratory accredited by the Washington State Department of Ecology (Ecology). The soil and groundwater samples were selectively analyzed for the following:

- Volatile organic compounds (VOCs) by U.S. Environmental Protection Agency (EPA) Method 8260C;
- Semivolatile organic compounds (SVOCs) by EPA Method 8270D;
- Total petroleum hydrocarbons as gasoline (TPH-G) by Ecology Method NWTPH-Gx;
- TPH as diesel (TPH-D) by Ecology Method NWTPH-Dx; and
- Cyanide (CN) by EPA Method 335.4

The soil samples were additionally analyzed for:

- Total metals (aluminum, arsenic, barium, cadmium, calcium, chromium, cobalt, copper, iron, lead, magnesium, molybdenum, nickel, silver, and zinc) by EPA Method 6010C and mercury by EPA Method 7471A.

The groundwater samples were additionally analyzed for:

- Total and dissolved iron and manganese by EPA Method 6010C.

The sample IDs, the sample matrix, the laboratory sample ID, and the analyses conducted on the samples are listed below.

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Sample ID	Matrix	Laboratory Sample ID	Requested Analyses
DBW-8-4.0-8.0	Groundwater	XS54A/XS54G	all
DBW-7-8.0-12.0	Groundwater	XS54B/XS54H	all
DBW-6-5.0-9.0	Groundwater	XS54C/XS54I	all
DBW-5-5.5-9.5	Groundwater	XS54D/XS54J	all
DBW-4-7.5-11.5	Groundwater	XS54E/XS54K	all
Trip Blank	Trip Blank	XS54F	VOCs
DBW-8-3.0-4.0	Soil	XS56A	VOCs, TPH-G, TPH-D, CN, metals
DBW-8-8.0-9.0	Soil	XS56B	VOCs, TPH-G, TPH-D, CN, metals
DBW-7-4.0-5.5	Soil	XS56C	VOCs, TPH-G, TPH-D, CN, metals
DBW-7-8.0-9.0	Soil	XS56D	VOCs, TPH-G, TPH-D, CN, metals
DBW-6-4.0-5.0	Soil	XS56E	VOCs, TPH-G, TPH-D, CN, metals
DBW-6-8.0-9.0	Soil	XS56F	VOCs, TPH-G, TPH-D, CN, metals
DBW-5-4.0-5.0	Soil	XS56G	VOCs, TPH-G, TPH-D, CN, metals
DBW-5-8.0-9.0	Soil	XS56H	VOCs, TPH-G, TPH-D, CN, metals
DBW-4-3.0-3.5	Soil	XS56I	VOCs, TPH-G, TPH-D, CN, metals
DBW-4-8.0-9.0	Soil	XS56J	VOCs, TPH-G, TPH-D, CN, metals
DBW-3-8.0-12.0	Groundwater	XS69A/XS69D	all
DBW-3-8.0-12.0	Groundwater	XS69B/XS69E	all
Trip Blank	Trip Blank	XS69C	VOCs
DBW-3-3.0-4.0	Soil	XS71A	VOCs, TPH-G, TPH-D, CN, metals
DBW-3-8.0-9.0	Soil	XS71B	VOCs, TPH-G, TPH-D, CN, metals
DBW-2-5.0-6.0	Soil	XS71C	VOCs, TPH-G, TPH-D, CN, metals
DBW-2-8.0-9.0	Soil	XS71D	VOCs, TPH-G, TPH-D, CN, metals

Data were reviewed in accordance with the appropriate method procedures and criteria documented in the Quality Assurance Project Plan (QAPP) (AMEC, 2012). The control limits provided in the QAPP are advisory limits; therefore, the most current control limits provided by the laboratory were used to evaluate the quality control data. In cases where the laboratory did not track limits for an analyte, the limits in the QAPP were used.

Holding times, method/trip blanks, surrogate recoveries, laboratory control samples (LCS) and laboratory control sample duplicates (LCSD), matrix spike/matrix spike duplicates (MS/MSD), field duplicates, and reporting limits were reviewed where available to assess compliance with applicable methods. If qualification was required, data were qualified based on the definitions and use of qualifying flags outlined in EPA guidelines (EPA, 2008 and 2010).

ARI received the samples the days they were collected. The temperatures of the coolers were recorded upon receipt and were below the maximum acceptable temperature of 6 degrees Celsius (°C).

ORGANIC ANALYSES

Samples were analyzed for the methods listed in the introduction of this report. Laboratory data were evaluated for the following parameters:

1. Preservation and Holding Times – Acceptable
2. Blanks – Acceptable
3. Surrogates – Acceptable
4. LCS/LCSD – Acceptable except as noted:

   VOCs by EPA 8260C

   SDG XS54 and XS69
   The recoveries of acrolein in the LCS/LCSD associated with analysis on 1/2/2014 were 127 and 133 percent, greater than the control limits of 60 to 124 percent. Acrolein was not detected in the associated samples; therefore, sample results are not affected by the possible high bias and are not qualified.

   SDG XS56
   The recoveries of 2-butanone and 1,1-dichloropropene in the LCSD associated with analysis on 12/27/2013 were below the control limits. The associated LCS recoveries were acceptable; therefore, sample results were not qualified. Acetone was recovered below the control limits in the LCS associated with analysis on 1/3/2014. The LCSD recovery was acceptable; therefore, sample results were not qualified.

   SDG XS71
   The recoveries of the following compounds were below the control limits in the LCS and LCSD associated with analysis on 1/1/2014: carbon disulfide at 74.2 and 75 percent, below the control limits of 77 to 124 percent; 1,4-dichlorobenzene at 78.4 percent, below the control limits of 80 to 120 percent; iodomethane at 71.6 and 74.4 percent, below the control limits of 76 to 123 percent; hexachlorobutadiene at 77.4 and 79.4 percent, below the control limits of 80 to 135 percent; 1,2,4-trichlorobenzene at 68.4 and 68.2 percent, below the control limits of 77 to 127 percent; and 1,2,3-trichlorobenzene at 74 and 76.4 percent, below the control limits of 80 to 125 percent. The low recoveries equate to a low bias in the samples; therefore results are qualified as estimated and flagged with a "UJ."

   The recoveries for acetone in both of the LCS associated with analysis on 1/3/2014 were 54.4 and 54.2 percent, below the control limits of 64 to 125 percent. The associated LCSD recovery was acceptable; therefore, sample results were not qualified.

SVOCs by EPA 8270D
SDG XS54
The recoveries for 3-nitroaniline in the LCS/LCSD were 144 and 157 percent, greater than the control limits of 36 to 120 percent. The high recoveries equate to a high bias in the samples. 3-Nitroaniline was not detected in the associated samples; therefore, sample results are not affected and are not qualified.

5. MS/MSD – Acceptable except as noted:

VOCs by EPA 8260C
SDG XS71
The recoveries for the following compounds were outside of the control limits in the MS/MSD performed with sample DBW-2-8.0-9.0: vinyl chloride at 72.7 and 68.4 percent, below the control limits of 74 to 123 percent; methylene chloride at 65.8 and 64.4 percent, below the control limits of 71 to 125 percent; acetone at 46.5 and 54.2 percent, below the control limits of 64 to 125 percent; trans-1,2-dichloroethene at 70.8 and 68.4 percent, below the control limits of 75 to 120 percent; iodomethane at 69.8 and 68.1 percent, below the control limits of 76 to 123 percent; and bromomethane at 76 and 74.5 percent, below the control limits of 77 to 122 percent. The results of the affected compounds in sample DBW-2-8.0-9.0 were qualified as estimated due to the low bias with detections flagged with a “J” and non-detections flagged with a “UJ.”

6. Field Duplicates

Field duplicates were not collected at this site during this sampling event.

7. Reporting Limits and Laboratory Flags – Acceptable except as noted:

VOCs by EPA 8260C

XS54
The vinyl chloride, 1,1-dichloroethane, cis-1,2-dichloroethene, toluene, trichlorofluoromethane, and 1,1,2-trichloro-1,2,2-trifluoroethane results in the initial analysis of sample DBW-4-7.5-11.5 were flagged with an “ES” and the trichlorofluoromethane result was flagged with an “E” to indicate the results were greater than the calibration range of the instrument. The sample was diluted and reanalyzed. The affected results are reported from the reanalysis and the remaining results are reported from the initial analysis.

The laboratory noted in the case narrative that the response for acrolein the CCAL associated with analysis on 1/2/2014 and the responses for acrolein and acetone in the CCAL associated with analysis on 1/3/2014 were greater than the control limit. The affected compounds were not detected in the associated samples. Therefore, samples are not affected by the possible high bias and are not qualified.

XS56
The laboratory flagged the vinyl chloride results in samples DBW-5-4.0-5.0, DBW-5-8.0-9.0, and DBW-4-8.0-9.0 with an “M” to indicate an estimated value for an analyte detected and confirmed, but with low spectral match parameters. The results were qualified as estimated and flagged with a “J.” The laboratory also flagged the chloromethane results in samples DBW-5-8.0-9.0 and DBW-4-8.0-9.0 with a “Y” to indicate a raised reporting limit due to chromatographic interference. The results were qualified as not detected and flagged with a “U.”

The 1,2,4-trimethylbenzene result in the initial analysis of sample DBW-7-4.0-5.5 was flagged with an “E” to indicate the result was greater than the calibration range of the instrument. The sample was diluted and reanalyzed. The 1,2,4-trimethylbenzene result is reported from the reanalysis and the remaining results are reported from the initial analysis.

The laboratory also indicated in the case narrative associated with this SDG that the response for chloroethane in the CCAL associated with analysis on 12/27/2013 was below the criteria. The chloroethane results in the associated samples are qualified as estimated due to the possible low bias with detections flagged with a “J” and non-detects flagged with a “UJ.”

XS69
The laboratory flagged the benzene result in sample DBW-2-8.0-12.0 with an “E” to indicate the result was greater than the calibration range of the instrument. The laboratory diluted and reanalyzed the sample. The benzene result is reported from the reanalysis and the remaining results are reported from the initial analysis.

XS70 and XS71
The laboratory noted in the case narrative that the responses for the following compounds in the CCAL associated with analysis on 12/31/13 at 23:14 were below the criteria: vinyl chloride, carbon disulfide, 1,4-dichlorobenzene, iodomethane, hexachlorobutadiene, n-butylbenzene, 1,2,4-trichlorobenzene, and 1,2,3-trichlorobenzene. The results of the affected compounds in the associated samples, if not previously qualified due to the LCS and LCSD recoveries, were qualified as estimated due to the potential low bias with detections flagged with a “J” and non-detections flagged with a “UJ.”

XS71
The laboratory flagged the cis-1,2-dichloroethene and trichloroethene results in sample DBW-3-3.0-4.0 with “E” and “ES,” respectively, to indicate the concentrations were greater than the calibration range of the instrument. The laboratory diluted and reanalyzed the sample. The cis-1,2-dichloroethene and trichloroethene results are

reported from the reanalysis, and the remaining results are reported from the initial analysis.

INORGANIC ANALYSES

Samples were analyzed for metals. Laboratory data were evaluated for the following parameters:

1. Preservation and Holding Times – Acceptable except as noted:

   The pH of the sample bottles submitted for cyanide analysis were not greater than 12 upon receipt at the laboratory. The laboratory adjusted the pH with additional preservative and proceeded with analysis.

2. Blanks – Acceptable except as noted:

   <u>Total Metals by EPA 6010C</u>
   <u>SDG XS56</u>
   Total zinc was detected in the method blank at a concentration of 2 mg/kg. The zinc results in the associated samples were greater than 10 times the concentration detected in the blank; therefore, sample results were not affected and were not qualified.

3. LCS/LCSD – Acceptable

4. MS/MSD

   <u>Total Metals by EPA 6010C</u>
   <u>SDG XS56</u>
   The recoveries for aluminum and magnesium were above the control limits and the recovery for iron was below the control limits in the MS performed with sample DBW-8-3.0-4.0. The concentrations of these compounds in the samples were four times greater than the spike added; therefore, the control limits are not applicable and sample results are not qualified.

   <u>SDG XS71</u>
   The recoveries for aluminum and iron were greater than the control limits in the MS performed with sample DBW-3-3.0-4.0. The concentrations of these compounds in the spiked sample were four times greater than the spike added; therefore, the control limits are not applicable and sample results are not qualified.

5. Laboratory Duplicates

   <u>SDG XS56</u>
   The laboratory duplicate relative percent difference (RPD) for molybdenum, evaluated using the alternate criteria for sample results that are not greater than five times the reporting limit, was greater than the criteria of the absolute difference between the primary and duplicate sample being lower than the value of the RL. National functional guidelines suggest an alternative value of two times the RL for non-homogenous soil

samples; using the alternative criteria, the molybdenum RPD is acceptable. The laboratory duplicate was performed with sample DBW-8-3.0-4.0.

6. Field Duplicates

   Field duplicates were not collected at this site during this sampling event.

7. Reporting Limits and Laboratory Flags – Acceptable.

OVERALL ASSESSMENT OF DATA

The table below summarizes the data review. The completeness of SDGs XS54, XS56, XS69, and XS71 is 100 percent. Evaluation of the usefulness of these data is based on EPA guidance documents referenced in the introduction to this report. Few problems were identified, and analytical performance was generally within specified limits. The data meet the project's data quality objectives.

Sample ID	Analysis Method	Qualified Analyte	Qualified Result	Qualifier Reason
DBW-8-4.0-8.0		none		
DBW-7-8.0-12.0		none		
DBW-6-5.0-9.0		none		
DBW-5-5.5-9.5		none		
DBW-4-7.5-11.5		none		
Trip Blank		none		
DBW-8-3.0-4.0	VOCs	chloroethane	1.0 UJ	CCAL recovery
DBW-8-8.0-9.0	VOCs	chloroethane	1.0 UJ	CCAL recovery
DBW-7-4.0-5.5	VOCs	chloroethane	1.4 UJ	CCAL recovery
DBW-7-8.0-9.0	VOCs	chloroethane	1.7 UJ	CCAL recovery
DBW-6-4.0-5.0	VOCs	chloroethane	1.0 UJ	CCAL recovery
DBW-6-8.0-9.0	VOCs	chloroethane	1.7 UJ	CCAL recovery
DBW-5-4.0-5.0	VOCs	vinyl chloride chloroethane	2.3 J 1.4 UJ	flagged "M" by laboratory CCAL recovery
DBW-5-8.0-9.0	VOCs	vinyl chloride chloroethane	2.0 J 2.0 UJ	flagged "M" by laboratory CCAL recovery
DBW-4-3.0-3.5	VOCs	chloromethane chloroethane	1.7 U 1.2 UJ	flagged "Y" by laboratory CCAL recovery
DBW-4-8.0-9.0	VOCs	chloromethane vinyl chloride chloroethane	2.4 U 1.6 J 11 J	flagged "Y" by laboratory flagged "M" by laboratory CCAL response
DBW-3-8.0-12.0		none		
DBW-3-8.0-12.0		none		
Trip Blank		none		

Sample ID	Analysis Method	Qualified Analyte	Qualified Result	Qualifier Reason
DBW-3-3.0-4.0	VOCs	vinyl chloride carbon disulfide 1,4-dichlorobenzene iodomethane hexachlorobutadiene n-butylbenzene 1,2,4-trichlorobenzene 1,2,3-trichlorobenzene	38 J 16 J 0.9 UJ 0.9 UJ 4.4 UJ 0.9 UJ 4.4 UJ 4.4 UJ	CCAL Response LCS Recovery LCS Recovery LCS Recovery LCS Recovery CCAL Response LCS Recovery LCS Recovery
DBW-3-8.0-9.0		none		
DBW-2-5.0-6.0		none		
DBW-2-8.0-9.0	VOCs	vinyl chloride methylene chloride acetone trans-1,2-dichloroethene iodomethane bromoethane	120 UJ 230 UJ 580 UJ 120 UJ 120 UJ 230 UJ	MS/MSD Recovery

REFERENCES

AMEC Environment & Infrastructure, Inc. (AMEC), 2012, Quality Assurance Project Plan, Boeing Renton Facility, Renton, Washington: Prepared for the Boeing Company, February.

U.S. Environmental Protection Agency (EPA), 2008, U.S. EPA Contract Laboratory Program National Functional Guidelines for Superfund Organic Methods Data Review: EPA 540-R-08-001, June.

EPA, 2010, U.S. EPA Contract Laboratory Program National Functional Guidelines for Inorganic Superfund Data Review: EPA 540-R-10-011, January.

Memo

To: Larry McGaughey, Project Manager
From: Crystal Neirby
Tel: (206) 342-1760
Fax: (206) 342-1761
Date: April 17, 2014

Project: 0088880100.2014
cc: Project File

Subject: **Summary Data Quality Review**
Southwest Marshalling Yard
Construction Activities Soil and Groundwater Investigation
ARI Sample Delivery Groups: XS55, XS61, XS67, and XS70

This memo presents the summary data quality review of four groundwater samples, 19 soil samples, and four trip blanks collected December 22 through 24, 2013. The samples were submitted to Analytical Resources Inc., (ARI), located in Tukwila, Washington, a laboratory accredited by the Washington State Department of Ecology (Ecology). The soil and groundwater samples were selectively analyzed for the following:

- Volatile organic compounds (VOCs) by U.S. Environmental Protection Agency (EPA) Method 8260C;
- Semivolatile organic compounds (SVOCs) by EPA Method 8270D;
- Total petroleum hydrocarbons as gasoline (TPH-G) by Ecology Method NWTPH-Gx;
- TPH as diesel (TPH-D) by Ecology Method NWTPH-Dx; and
- Cyanide (CN) by EPA Method 335.4

The soil samples were additionally analyzed for:

- Total metals (aluminum, arsenic, barium, cadmium, calcium, chromium, cobalt, copper, iron, lead, magnesium, molybdenum, nickel, silver, and zinc) by EPA Method 6010C and mercury by EPA Method 7471A.

The groundwater samples were additionally analyzed for:

- Total and dissolved iron and manganese by EPA Method 6010C.

The sample IDs, the sample matrix, the laboratory sample ID, and the analyses conducted on the samples are listed below.

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Sample ID	Matrix	Laboratory Sample ID	Requested Analyses
SWMY-13-4.0-8.0	Groundwater	XS55A/XS55E	all
SWMY-15-4.0-8.0	Groundwater	XS55B/XS55F	all
SWMY-9-8.0-12.0	Groundwater	XS55C/XS55G	all
Trip Blank	Trip Blank	XS55D	VOCs
SWMY-13-2.5-3.0	Soil	XS61A	VOCs, TPH-G, TPH-D, metals
SWMY-13-4.6-6.0	Soil	XS61B	VOCs, TPH-G, TPH-D, metals
SWMY-12-2.5-3.2	Soil	XS61C	VOCs, TPH-G, TPH-D, metals
SWMY-15-4.0-5.0	Soil	XS61D	VOCs, TPH-G, TPH-D, metals
SWMY-14-1.0-1.5	Soil	XS61E	VOCs, TPH-G, TPH-D, metals
SWMY-14-4.0-6.0	Soil	XS61F	VOCs, TPH-G, TPH-D, metals
SWMY-8-1.0-1.5	Soil	XS61G	VOCs, TPH-G, TPH-D, metals
SWMY-9-1.0-1.5	Soil	XS61H	VOCs, TPH-G, TPH-D, metals
SWMY-9-4.0-5.0	Soil	XS61I	VOCs, TPH-G, TPH-D, metals
SWMY-4-1.0-1.5	Soil	XS61J	VOCs, TPH-G, TPH-D, metals
SWMY-5-1.0-1.8	Soil	XS61K	VOCs, TPH-G, TPH-D, metals
SWMY-1-1.0-1.8	Soil	XS61L	VOCs, TPH-G, TPH-D, metals
SWMY-2-1.0-1.5	Soil	XS61M	VOCs, TPH-G, TPH-D, metals
SWMY-3-1.0-1.5	Soil	XS61N	VOCs, TPH-G, TPH-D, metals
SWMY-6-1.0-1.8	Soil	XS61O	VOCs, TPH-G, TPH-D, metals
SWMY-11-3.0-3.5	Soil	XS61P	VOCs, TPH-G, TPH-D, metals
SWMY-7-1.0-1.5	Soil	XS61Q	VOCs, TPH-G, TPH-D, metals
Trip Blank	Trip Blank	XS61R	VOCs
SWMY-10-8.0-12.0	Groundwater	XS67A/XS67B	VOCs, SVOCs, TPH-G, TPH-D, metals, CN
Trip Blank	Trip Blank	XS67C	VOCs
SWMY-10-1.0-2.0	Soil	XS70A	VOCs, SVOCs, TPH-G, TPH-D, metals
SWMY-10-4.0-5.0	Soil	XS70B	VOCs, SVOCs, TPH-G, TPH-D, metals
Trip Blank	Trip Blank	XS70C	VOCs

Data were reviewed in accordance with the appropriate method procedures and criteria documented in the Quality Assurance Project Plan (QAPP) (AMEC, 2012). The control limits provided in the QAPP are advisory limits; therefore, the most current control limits provided by the laboratory were used to evaluate the quality control data. In cases where the laboratory did not track limits for an analyte, the limits in the QAPP were used.

Holding times, method/trip blanks, surrogate recoveries, laboratory control samples (LCS) and laboratory control sample duplicates (LCSD), matrix spike/matrix spike duplicates (MS/MSD), field duplicates, and reporting limits were reviewed where available to assess compliance with applicable methods. If qualification was required, data were qualified based on the definitions and use of qualifying flags outlined in EPA guidelines (EPA, 2008 and 2010).

ARI received the samples the days they were collected. The temperatures of the coolers were recorded upon receipt and were below the maximum acceptable temperature of 6 degrees Celsius (°C). The laboratory noted the following upon sample receipt:

- SDG XS67: Sample bottles were received for CN analysis, but the analysis was not requested on the chain-of-custody. The laboratory proceeded with analysis after confirming the analysis request. The pH of the sample was not greater than 12 upon receipt; it was adjusted in the laboratory prior to analysis and sample results are not qualified.

ORGANIC ANALYSES

Samples were analyzed for VOCs and TPH as gasoline. Laboratory data were evaluated for the following parameters:

1. Preservation and Holding Times – Acceptable
2. Blanks – Acceptable
3. Surrogates – Acceptable
4. LCS/LCSD – Acceptable except as noted:

   VOCs by EPA 8260C
   SDG XS55
   The recoveries of acrolein in the LCS/LCSD were 127 and 133 percent, greater than the control limits of 60 to 124 percent. The high recovery equates to a high bias in the samples. Acrolein was not detected in the associated samples; therefore, sample results are not affected and are not qualified.

   SDG XS61
   The recoveries 1,2,4-trichlorobenzene were 68.4 and 68.2 percent, below the control limits of 75 to 130 percent. The low recoveries equate to a low bias in the samples; therefore the 1,2,4-trichlorobenzene results in the associated samples are qualified as estimated and flagged with a “UJ” due to the potential low bias. The recoveries for bromoethane in the LCSD and 1,2,3-trichlorobenzene in the LCS were below the control limits. The results were not qualified due to acceptable LCS and LCSD recoveries.

   SDG XS70
   The recoveries of the following compounds were below the control limits in the LCS and LCSD: carbon disulfide at 74.2 and 75 percent, below the control limits of 77 to 124 percent; 1,4-dichlorobenzene at 78.4 percent, below the control limits of 80 to

120 percent; iodomethane at 71.6 and 74.4 percent, below the control limits of 76 to 123 percent; hexachlorobutadiene at 77.4 and 79.4 percent, below the control limits of 80 to 135 percent; 1,2,4-trichlorobenzene at 68.4 and 68.2 percent, below the control limits of 77 to 127 percent; and 1,2,3-trichlorobenzene at 74 and 76.4 percent, below the control limits of 80 to 125 percent. The low recoveries equate to a low bias in the samples; therefore results are qualified as estimated and flagged with a "UJ."

SVOCs by EPA 8270D
SDG XS55
The recoveries for 3-nitroaniline in the LCS/LCSD were 144 and 157 percent, greater than the control limits of 36 to 120 percent. The high recoveries equate to a high bias in the samples. 3-Nitroaniline was not detected in the associated samples; therefore, sample results are not affected and are not qualified.

SDG XS67
The recoveries for 3-nitroaniline in the LCS/LCSD were 151 and 145 percent, greater than the control limits of 36 to 120 percent. The high recoveries equate to a high bias in the samples. 3-Nitroaniline was not detected in the associated samples; therefore, sample results are not affected and are not qualified.

5. MS/MSD – Acceptable

   Additional sample volume was not submitted for MS/MSD analyses with samples collected from this site. Sample results are evaluated based on LCS/LCSD results.

6. Field Duplicates

   Field duplicates were not collected at this site during this sampling event.

7. Reporting Limits and Laboratory Flags – Acceptable except as noted:

VOCs by EPA 8260C
XS55
The laboratory noted in the case narrative that the response for acrolein in the CCAL associated with analysis on 1/2/2014 and the responses for acetone and acrolein in the CCALs associated with analysis on 1/3/2014 were above the criteria. The affected analytes were not detected in the associated samples; therefore, the results are qualified as estimated and flagged with a "UJ" due to the possible low bias.

XS61
The laboratory noted in the case narrative that the response for chloroethane in the CCAL associated with analysis on 12/31/13 at 11:40 was greater than the criteria. Chloroethane was not detected in the associated samples; therefore, results are not affected by the potential high bias and are not qualified. The laboratory also noted that the responses for the following compounds in the CCAL associated with analysis on 12/31/13 at 23:14 were below the criteria: vinyl chloride, carbon disulfide,

1,4-dichlorobenzene, iodomethane, hexachlorobutadiene, n-butylbenzene, 1,2,4-trichlorobenzene, and 1,2,3-trichlorobenzene. The results of the affected compounds in the associated samples were qualified as estimated due to the potential low bias with detections flagged with a “J” and non-detections flagged with a “UJ.”

XS70
The laboratory noted in the case narrative that the responses for the following compounds in the CCAL associated with analysis on 12/31/13 at 23:14 were below the criteria: vinyl chloride, carbon disulfide, 1,4-dichlorobenzene, iodomethane, hexachlorobutadiene, n-butylbenzene, 1,2,4-trichlorobenzene, and 1,2,3-trichlorobenzene. The results of the affected compounds in the associated samples, if not previously qualified due to the LCS and LCSD recoveries, were qualified as estimated due to the potential low bias with detections flagged with a “J” and non-detections flagged with a “UJ.”

SVOCs by EPA 8270D
XS55
The laboratory noted in the case narrative that the response for benzyl alcohol was less than the criteria and the response for 2,6-dinitrotoluene was greater than the criteria in the CCAL associated with analysis on 12/30/2014. The benzyl alcohol results in the associated samples were qualified as estimated and flagged with a “UJ” due to the low possible bias. The 2,6-dinitrotoluene results were not qualified since they were all below detection in the associated samples and therefore not affected by the potential high bias.

INORGANIC ANALYSES

Samples were analyzed for metals. Laboratory data were evaluated for the following parameters:

1. Preservation and Holding Times – Acceptable
2. Blanks – Acceptable
3. LCS/LCSD – Acceptable
4. MS/MSD

Total and Dissolved Metals by EPA 6010C
SDG XS55
Total iron was not recovered in the MS performed with sample SWMY-13-4.0-8.0. The concentration of the spiked sample was four times greater than the spike added; therefore, the control limits are not applicable and sample results were not qualified.

SDG XS61
The recovery for copper in the MS performed with sample SWMY-13-2.5-3.0 was 63.1 percent, below the control limits of 75 to 125 percent. The copper results in the associated samples were qualified as estimated due to the potential low bias. The

recoveries for aluminum, calcium, and iron were all greater than the control limits, while the recovery for magnesium was below the control limits. The concentrations of these compounds in the samples were four times greater than the spike added; therefore, the control limits are not applicable and sample results are not qualified.

Additional sample volume was not submitted for MS/MSD analyses with samples collected from this site. Sample results are evaluated based on LCS/LCSD results.

5. Laboratory Duplicates

   SDG XS61
   The laboratory duplicate relative percent differences (RPDs) for chromium, cobalt, copper, magnesium, and nickel were greater than the control limit of 20 percent in the laboratory duplicate performed with sample SWMY-13-2.5-3.0. With the exception of copper, all of the RPDs were below the alternative control limits suggested in the functional guidelines of 35 percent for non-homogenous soil samples. The copper results were previously qualified due to the MS recovery and aren’t qualified further. Primary and duplicate results that are not greater than five times the reporting limit are alternatively evaluated against the value of the absolute difference between the primary and duplicate sample being lower than the value of the RL. National functional guidelines suggest an alternative value of two times the RL for non-homogenous soil samples; using the alternative criteria, the cadmium RPD is acceptable.

6. Field Duplicates

   Field duplicates were not collected at this site during this sampling event.

7. Reporting Limits and Laboratory Flags – Acceptable.

OVERALL ASSESSMENT OF DATA

The table below summarizes the data review. The completeness of SDGs XS55, XS61, XS67, and XS70 is 100 percent. Evaluation of the usefulness of these data is based on EPA guidance documents referenced in the introduction to this report. Few problems were identified, and analytical performance was generally within specified limits. The data meet the project’s data quality objectives.

Sample ID	Analysis Method	Qualified Analyte	Qualified Result	Qualifier Reason
SWMY-13-4.0-8.0	SVOCs	benzyl alcohol	2.0 UJ	CCAL responses
SWMY-15-4.0-8.0	SVOCs	benzyl alcohol	2.0 UJ	CCAL responses
SWMY-9-8.0-12.0	SVOCs	benzyl alcohol	2.0 UJ	CCAL responses
Trip Blank		none		
SWMY-13-2.5-3.0	VOCs Metals	1,2,4-trichlorobenzene copper	4.6 UJ 61.8	LCS/LCSD recovery MS recovery

Sample ID	Analysis Method	Qualified Analyte	Qualified Result	Qualifier Reason
SWMY-13-4.6-6.0	VOCs	1,2,4-trichlorobenzene	5.5 UJ	LCS/LCSD recovery
	Metals	copper	29.9	MS recovery
SWMY-12-2.5-3.2	VOCs	1,2,4-trichlorobenzene	4.9 UJ	LCS/LCSD recovery
	Metals	copper	50.9 J	MS recovery
SWMY-15-4.0-5.0	VOCs	1,2,4-trichlorobenzene	4.7 UJ	LCS/LCSD recovery
	Metals	copper	37.5 J	MS recovery
SWMY-14-1.0-1.5	VOCs	1,2,4-trichlorobenzene	5.5 UJ	LCS/LCSD recovery
	Metals	copper	34.7 J	MS recovery
SWMY-14-4.0-6.0	VOCs	1,2,4-trichlorobenzene	5.1 UJ	LCS/LCSD recovery
	Metals	copper	39.6 J	MS recovery
SWMY-8-1.0-1.5	VOCs	1,2,4-trichlorobenzene	4.6 UJ	LCS/LCSD recovery
	Metals	copper	23.1 J	MS recovery
SWMY-9-1.0-1.5	VOCs	1,2,4-trichlorobenzene	4.6 UJ	LCS/LCSD recovery
	Metals	copper	16.1 J	MS recovery
SWMY-9-4.0-5.0	VOCs	1,2,4-trichlorobenzene	5.8 UJ	LCS/LCSD recovery
	Metals	copper	42.7 J	MS recovery
SWMY-4-1.0-1.5	VOCs	vinyl chloride	0.9 UJ	CCAL Response
	VOCs	carbon disulfide	0.9 UJ	CCAL Response
	VOCs	1,4-dichlorobenzene	0.9 UJ	CCAL Response
	VOCs	iodomethane	0.9 UJ	CCAL Response
	VOCs	hexachlorobutadiene	4.3 UJ	CCAL Response
	VOCs	n-butylbenzene	0.9 UJ	CCAL Response
	VOCs	1,2,4-trichlorobenzene	4.3 UJ	CCAL Response
	VOCs	1,2,3-trichlorobenzene	4.3 UJ	CCAL Response
	Metals	copper	43.0 J	MS recovery
SWMY-5-1.0-1.8	VOCs	vinyl chloride	0.8 UJ	CCAL Response
	VOCs	carbon disulfide	0.8 UJ	CCAL Response
	VOCs	1,4-dichlorobenzene	0.8 UJ	CCAL Response
	VOCs	iodomethane	0.8 UJ	CCAL Response
	VOCs	hexachlorobutadiene	4.2UJ	CCAL Response
	VOCs	n-butylbenzene	0.8 UJ	CCAL Response
	VOCs	1,2,4-trichlorobenzene	4.2 UJ	CCAL Response
	VOCs	1,2,3-trichlorobenzene	4.2 UJ	CCAL Response
	Metals	copper	25.5 J	MS recovery
SWMY-1-1.0-1.8	VOCs	vinyl chloride	0.9 UJ	CCAL Response
	VOCs	carbon disulfide	0.9 UJ	CCAL Response
	VOCs	1,4-dichlorobenzene	0.9 UJ	CCAL Response
	VOCs	iodomethane	0.9 UJ	CCAL Response
	VOCs	hexachlorobutadiene	4.3 UJ	CCAL Response
	VOCs	n-butylbenzene	0.9 UJ	CCAL Response
	VOCs	1,2,4-trichlorobenzene	4.3 UJ	CCAL Response
	VOCs	1,2,3-trichlorobenzene	4.3 UJ	CCAL Response
	Metals	copper	17.4 J	MS recovery

Sample ID	Analysis Method	Qualified Analyte	Qualified Result	Qualifier Reason
SWMY-2-1.0-1.5	VOCs	vinyl chloride	0.9 UJ	CCAL Response
	VOCs	carbon disulfide	0.9 UJ	CCAL Response
	VOCs	1,4-dichlorobenzene	0.9 UJ	CCAL Response
	VOCs	iodomethane	0.9 UJ	CCAL Response
	VOCs	hexachlorobutadiene	4.3 UJ	CCAL Response
	VOCs	n-butylbenzene	0.9 UJ	CCAL Response
	VOCs	1,2,4-trichlorobenzene	4.3 UJ	CCAL Response
	VOCs	1,2,3-trichlorobenzene	4.3 UJ	CCAL Response
	Metals	copper	15.1 J	MS recovery
SWMY-3-1.0-1.5	VOCs	vinyl chloride	0.9 UJ	CCAL Response
	VOCs	carbon disulfide	0.9 UJ	CCAL Response
	VOCs	1,4-dichlorobenzene	0.9 UJ	CCAL Response
	VOCs	iodomethane	0.9 UJ	CCAL Response
	VOCs	hexachlorobutadiene	4.4 UJ	CCAL Response
	VOCs	n-butylbenzene	0.9 UJ	CCAL Response
	VOCs	1,2,4-trichlorobenzene	4.4 UJ	CCAL Response
	VOCs	1,2,3-trichlorobenzene	4.4 UJ	CCAL Response
	Metals	copper	16.1 J	MS recovery
SWMY-6-1.0-1.8	VOCs	vinyl chloride	0.7 UJ	CCAL Response
	VOCs	carbon disulfide	1.4 J	CCAL Response
	VOCs	1,4-dichlorobenzene	0.7 UJ	CCAL Response
	VOCs	iodomethane	0.7 UJ	CCAL Response
	VOCs	hexachlorobutadiene	4.3 UJ	CCAL Response
	VOCs	n-butylbenzene	0.7 UJ	CCAL Response
	VOCs	1,2,4-trichlorobenzene	4.3 UJ	CCAL Response
	VOCs	1,2,3-trichlorobenzene	4.3 UJ	CCAL Response
	Metals	copper	40.1 J	MS recovery
SWMY-11-3.0-3.5	VOCs	vinyl chloride	1.0 UJ	CCAL Response
	VOCs	carbon disulfide	1.0 UJ	CCAL Response
	VOCs	1,4-dichlorobenzene	1.0 UJ	CCAL Response
	VOCs	iodomethane	1.0 UJ	CCAL Response
	VOCs	hexachlorobutadiene	5.0 UJ	CCAL Response
	VOCs	n-butylbenzene	1.0 UJ	CCAL Response
	VOCs	1,2,4-trichlorobenzene	5.0 UJ	CCAL Response
	VOCs	1,2,3-trichlorobenzene	5.0 UJ	CCAL Response
	Metals	copper	22.8 J	MS recovery
SWMY-7-1.0-1.5	VOCs	vinyl chloride	0.9 UJ	CCAL Response
	VOCs	carbon disulfide	0.9 UJ	CCAL Response
	VOCs	1,4-dichlorobenzene	0.9 UJ	CCAL Response
	VOCs	iodomethane	0.9 UJ	CCAL Response
	VOCs	hexachlorobutadiene	4.4 UJ	CCAL Response
	VOCs	n-butylbenzene	0.9 UJ	CCAL Response
	VOCs	1,2,4-trichlorobenzene	4.4 UJ	CCAL Response
	VOCs	1,2,3-trichlorobenzene	4.4 UJ	CCAL Response
	Metals	copper	19.3 J	MS recovery
Trip Blank		none		

Sample ID	Analysis Method	Qualified Analyte	Qualified Result	Qualifier Reason
SWMY-10-8.0-12.0		none		
Trip Blank		none		
SWMY-10-1.0-2.0	VOCs	vinyl chloride carbon disulfide 1,4-dichlorobenzene iodomethane hexachlorobutadiene n-butylbenzene 1,2,4-trichlorobenzene 1,2,3-trichlorobenzene	0.9 UJ 0.9 UJ 0.9 UJ 0.9 UJ 4.5 UJ 0.9 UJ 4.5 UJ 4.5 UJ	CCAL response LCS/LCSD recovery LCS/LCSD recovery LCS/LCSD recovery LCS/LCSD recovery CCAL response LCS/LCSD recovery LCS/LCSD recovery
SWMY-10-4.0-5.0	VOCs	vinyl chloride carbon disulfide 1,4-dichlorobenzene iodomethane hexachlorobutadiene n-butylbenzene 1,2,4-trichlorobenzene 1,2,3-trichlorobenzene	1.0 UJ 1.0 UJ 1.0 UJ 1.0 UJ 5.0 UJ 1.0 UJ 5.0 UJ 5.0 UJ	CCAL response LCS/LCSD recovery LCS/LCSD recovery LCS/LCSD recovery LCS/LCSD recovery CCAL response LCS/LCSD recovery LCS/LCSD recovery
Trip Blank				

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